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Globalization, Labor Income, and Poverty in Mexico

Gordon H. Hanson

10.1 Introduction

There is now an immense body of literature on how globalization affects labor markets. Early research centered on the United States (Freeman 1995; Richardson 1995), motivated in part by an interest in understanding what caused marked changes in the U.S. wage structure during the 1980s and 1990s (Katz and Autor 1999). A common theme in this work is that globalization—especially in the form of global outsourcing—has modestly but significantly contributed to increases in wage differentials between more- and less-skilled workers (Feenstra and Hanson 1999, 2003). A small effect for international trade is perhaps unsurprising, given the large size of the U.S. economy and the still limited role that trade plays in U.S. production and consumption (Feenstra 1998; Freeman 2003). Later research shifted attention to other countries and to the developing world in particular, which in the 1980s began to lower barriers to trade and capital flows aggressively. The tendency for rising wage inequality to follow globalization is not limited to the United States or other rich countries. Expanding trade and capital flows have been associated with increases in the relative demand for skilled labor in many economies, including Chile (Pavcnik 2003), Colombia (Attanasio, Goldberg, and Pavcnik 2004), Hong Kong (Hsieh and Woo 2005), Mexico (Feenstra and Hanson 1997),

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and Morocco (Currie and Harrison 1997), to list just a few recent examples.[1]

In most research to date, the focus has been on the relationship between globalization and earnings inequality. Fewer studies have examined how globalization affects income levels. This comes as something of a surprise, given the long-standing interest of developing-country research in how changes in policy affect the well-being of the poor. The relative lack of attention on the impact of globalization on poverty is perhaps partly attributable to methodology. The most established empirical techniques for identifying the effects of economic shocks, such as globalization or technological change, on earnings relate to estimating changes in the relative demand for labor of different skill types (Katz and Autor 1999). The lack of attention may also reflect a U.S. bias in the type of questions being asked. The strong emphasis in U.S. literature on why earnings inequality has increased may have spilled over into research on other countries, partially crowding out other issues.

In this paper, I examine how the distribution of income changed in Mexico during the country's decade of globalization in the 1990s. Taking the income distribution as the unit of analysis makes it possible to examine changes both in the nature of inequality—reflected in the shape of the distribution—and in the level of income—reflected in the position of the distribution. Mexico is worthy of study because over the last two decades the country has aggressively opened its economy to the rest of the world. This process began with a unilateral liberalization of trade in 1985, continued with the elimination of many restrictions on foreign capital in 1989, and culminated with the North American Free Trade Agreement (NAFTA) in 1994 (Hanson 2004).[2]

There is relatively little work on the impact of trade liberalization on poverty in Mexico. One notable exception is Nicita (2004), who applies data from the Mexico's National Survey of Household Income and Expenditure to techniques developed by Deaton and Muellbauer (1980) and Porto (2003) to construct an estimate of how tariff reductions have affected household welfare. This exercise involves estimating the impact of tariff changes on domestic goods' prices, the impact of changes in goods' prices on the wages of different skill groups, and income and price elasticities of demand for different goods, and then combining these estimates to form an estimate of the change in real income due to tariffs. During the 1990s, tariff

1. See Winters, McCulloch, and McKay (2004) and Goldberg and Pavcnik (2004) for surveys of the literature on globalization and income in developing countries.

2. See Chiquiar (2003) for a discussion of recent policy changes in Mexico. For other work on the labor market implications of globalization in Mexico, see Ariola and Juhn (2003), Cragg and Epelbaum (1996), Fairris (2003), Feliciano (2001), Revenga (1997), Hanson and Harrison (1999), and Robertson (2004). See Hanson (2004) for a review of this literature. For work on trade reform and wage inequality in Latin America, see Behrman, Birdsall, and Szekely (2003).

changes appeared to raise disposable income for all households, with richer households enjoying a 6 percent increase and poorer households enjoying a 2 percent increase. These income gains imply a 3 percent reduction in the number of households in poverty. Income gains are larger in regions that are close to the United States, where tariff-induced price changes are larger.

The approach in Nicita (2004) exploits cross-time variation in tariff levels to estimate how tariff changes are passed along into prices. The advantage of this approach is that it produces estimates of how changes in trade policy affect the *level* of real household income. One disadvantage is that it ignores other contemporaneous shocks that are also related to globalization, such as greater foreign investment and expanding global production networks in Mexico. The existence of other shocks reflects a common problem in evaluating the impact of trade liberalization. Trade reform is not a random event, but instead typically results as part of a government reaction to economic pressures that force it to abandon a preexisting set of policies. In Mexico, as in many other countries, when the government lowered import tariffs it also eliminated nontariff barriers, eased restrictions on foreign investment, deregulated industries, and privatized state-owned enterprises and agricultural cooperatives. Problematically, industries subject to larger reductions in tariffs may also have been subject to larger changes in other policies. Unless one carefully controls for these other policy changes—which is difficult to do given that many of the policy instruments being changed are either unobserved (e.g., the bureaucratic process for approving foreign direct investment) or hard to measure (e.g., nontariff barriers)—then one may misattribute income changes to import tariffs that are in fact associated with other policy shocks.

In this paper, I compare changes in the distribution of labor income in the 1990s between Mexican regions that were more or less exposed to globalization. As section 10.2 discusses, geographic variations in proximity to the United States and in natural resource supplies have helped make some Mexican regions much more exposed to foreign trade and investment than others. I take states with high exposure to globalization to be the treatment group and states with low exposure to globalization to be the control group (leaving states with intermediate exposure out of the analysis). I then apply a difference-in-difference strategy by comparing the change in the income distribution for high-exposure states to the change in income distribution for low-exposure states.[3] By comparing changes in the lower tail of the distributions across regions, I am able to measure the differential change in poverty across regions during Mexico's globalization decade

3. Implicit in the analysis is the assumption is that labor is sufficiently immobile across regions of Mexico for region-specific labor-demand shocks to affect regional differentials in labor income.

(subject to a common national shock in both regions). To provide a benchmark for comparing poverty levels, I define the poverty threshold as the labor income needed to sustain a family of four at minimum consumption levels.[4]

The advantage of my approach relative to Nicita (2004), Porto (2003), and other work in the tradition of Deaton and Muellbauer (1980) is that I am able to consider a broader set of shocks related to globalization. The disadvantage of my approach is that I can only make statements about the *relative* regional change in poverty associated with globalization. Given the severe estimation problems in identifying the impact of trade reform on household income, no single approach is likely to be entirely satisfactory. My approach and that of Nicita (2004) should thus be seen as complementary.

The analysis is complicated by several issues, three of which stand out. One is that income distributions change both because the characteristics of the underlying population of individuals change and because the returns to these characteristics change. To identify the effects of globalization, I would like to examine changes in returns to characteristics (in my case, interregional differences in these changes) while holding the distribution of characteristics constant. To perform this exercise, I apply nonparametric techniques from DiNardo, Fortin, and Lemieux (1996) and Leibbrandt, Levinsohn, and McCrary (2005), which I describe in section 10.3. I also compare results from this approach to results from a more standard parametric approach, both of which are presented in section 10.4. A second issue is that other shocks in the 1990s may also have had differential effects on regions with high versus low exposure to globalization. The potential for these shocks to contaminate the analysis is an important concern, which I address by way of discussing qualifications to my results in section 10.5.

A third issue has to do with measurement. There are many components to income, including labor earnings, capital returns, rental income, government transfers, gifts, and remittances from family members abroad. Surveys that measure each of these components carefully, such as Mexico's National Survey of Household Income and Expenditure, are not representative across the regions of the country (Cortés et al. 2003), which makes it impossible to apply my estimation strategy to these data. Surveys that are representative across Mexico's regions, such as the Census of Population and Housing, measure labor income with relatively high precision, but lack complete data on other income categories. To ensure that my data are regionally representative, I use the Mexican census, and to minimize the impact of measurement error, I focus the analysis on labor income. Excluding other sources of income has the obvious drawback of

4. Since I estimate the shape of the entire distribution, other thresholds are straightforward to consider.

limiting the analysis to labor earnings rather than to the full distribution of income.[5]

To preview the results, states with high exposure to globalization began the 1990s with higher incomes than low-exposure states, even after controlling for regional differences in the observable characteristics of individuals. During the 1990s, low-exposure states had slower growth in labor income than high-exposure states. This took the form of a leftward shift in the income distribution of low-exposure states relative to high-exposure states. The results of this income shift were (1) a decrease in average labor earnings of 10 percent for individuals from states with low exposure to globalization relative to individuals from states with high exposure to globalization, and (2) an increase in the incidence of wage poverty (the fraction of wage earners whose labor income would not sustain a family of four at above-poverty consumption levels) in low-exposure states of 7 percent relative to that in high-exposure states.

10.2 Regional Exposure to Globalization

10.2.1 Data Sources

Data for the analysis come from two sources. In 1990, I use the 1 percent microsample of the XII Censo General de Poblacion y Vivienda, 1990, and in 2000 I use a 10 percent random sample of the 10 percent microsample of the XIII Censo General de Poblacion y Vivienda, 2000. The sample is working-age men with positive labor earnings. I focus on men, since labor force participation rates for women are low and vary considerably over time, ranging from 21 percent in 1990 to 32 percent in 2000. This creates issues of sample selection associated with who supplies labor outside the home. Compounding the problem, many women who report zero labor earnings may work in the family business or on the family farm. For men, problems of sample selection and measurement error also exist, but they appear to be less severe. Their labor force participation rates vary less over time, rising modestly from 73 percent in 1990 to 74 percent in 2000. Still, differences in labor force participation over time and across regions could affect the results reported in section 10.4. In section 10.3, I discuss strategies to correct for self-selection into the labor force.

10.2.2 The Opening of Mexico's Economy

In Mexico, the last two decades have not been a quiet period. Since 1980, the country has had three currency crises, bouts of high inflation, and sev-

5. One interesting extension to the analysis in this paper would be to use Mexico's National Survey of Household Income and Expenditure to estimate the empirical relationship between labor income and poverty. One could then use this mapping to evaluate how the changes in labor income that I estimate (using data from the Census of Population and Housing) may have affected poverty.

Table 10.1 **Percent of Mexico's population with per capita income below threshold needed to achieve minimum caloric intake**

Area	1992	1994	1996	1998	2000
Urban households	10.2	7.2	20.1	16.4	9.8
Rural households	29.5	30	43.3	43.8	34.1

Source: Cortés et al. (2003).

eral severe macroeconomic contractions, the most recent of which occurred in 1995 following a large devaluation of the peso that precipitated the country's conversion from a fixed to a floating exchange rate. The liberalization of the country's trade and investment policies has been, in part, a response to this turmoil. Mexico's currency crises and ensuing contractions have had very negative consequences on the country's poor. Table 10.1 shows that poverty rates rose sharply after the 1995 peso crisis.

Mexico's economic opening began in 1982, when the government responded to a severe balance-of-payments crisis by easing restrictions on export assembly plants known as *maquiladoras.* In 1985, Mexico joined the General Agreement on Tariffs and Trade (GATT), which entailed cutting tariffs and eliminating many nontariff barriers. In 1989, Mexico eased restrictions on the rights of foreigners to own assets in the country. In 1994, NAFTA consolidated and extended these reforms. Partly as a result of these policy changes, the share of international trade in Mexico's gross domestic product (GDP) has nearly tripled, rising from 11 percent in 1980 to 32 percent in 2002. Mexico is now as closely tied to the U.S. economy as it has been at any point in its history. In 2002, the country sent 89 percent of its exports to and bought 73 percent of its imports from the United States.[6]

Mexico's maquiladoras, shown in figure 10.1, have been instrumental in the country's export conversion. Between 1983 and 2002, real value added in maquiladoras grew at an average annual rate of 11 percent, making it the most dynamic sector in the country. In 2002, these export assembly plants accounted for 45 percent of Mexico's manufacturing exports and 28 percent of the country's manufacturing employment (up from 4 percent in 1980). Their concentration in northern Mexico accounts in part for the differential regional impact of globalization in the country. A brief history of Mexico's trade policy reveals the origins of northern Mexico's advantage in export production.

In the 1940s, Mexico adopted a strategy of import substitution industrialization. To import most manufacturing products, firms had to obtain a license from the government and pay moderate to high tariffs. In 1965,

6. Concomitant with its economic opening, Mexico privatized state-owned enterprises, deregulated entry restrictions in many industries, and used wage and price restraints to combat inflation.

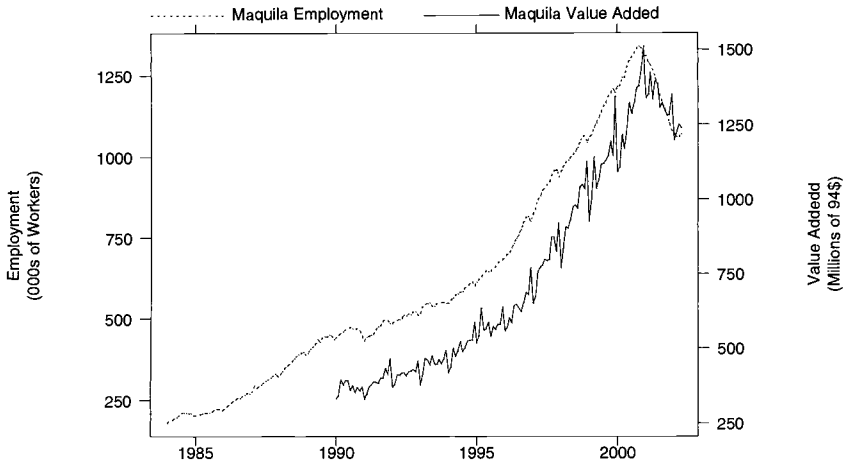

Fig. 10.1 Employment and value added in Mexico's maquiladoras

Mexico softened its import substitution strategy by allowing the creation of maquiladoras (Hansen 1981).[7] Firms could import free of duty the inputs, machinery, and parts needed for export assembly operations, as long as they exported all output. To ensure that firms abided by this rule, they were required to buy a bond equal to the value of their imports that would be returned to them once they had exported all their imported inputs in the form of final goods (hence the term *in-bond assembly plants*). In contrast to other firms in the country, maquiladoras could be 100 percent foreign owned. Bureaucratic restrictions on maquiladoras kept the sector small until 1982, when the government streamlined regulation of the plants.

Initially, maquiladoras were required to locate within twenty miles of an international border or coastline. In 1972, the government relaxed these rules and allowed maquiladoras to locate throughout the country. However, the plants continued to concentrate near the United States. As seen in figure 10.2, 83 percent of maquiladora employment is still located in states on the U.S. border. Proximity to the U.S. market is motivated in part by a desire to be near U.S. consumers, to whom maquiladoras export most of their production, and in part by a desire to be near U.S. firms, who often manage Mexican maquiladoras out of offices based in U.S. border cities.

U.S. trade policies initially gave maquiladoras an advantage over other Mexican producers in exporting to the U.S. market. Prior to NAFTA, a

7. The original motivation for this program was to create employment opportunities for Mexican workers returning to the country after working in the United States as temporary farm laborers under the Bracero Program. The U.S. government ended the Bracero Program in 1964, and the Mexican government was concerned that the returning workers would raise unemployment in border states.

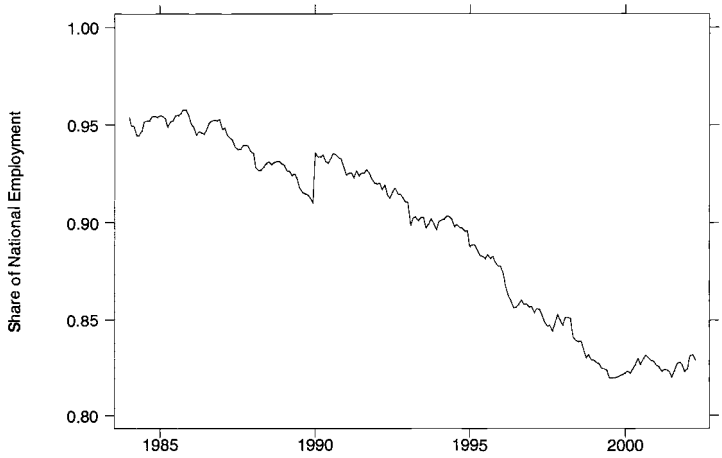

Fig. 10.2 Share of maquiladora employment in border states

U.S. firm that made components, shipped them to a plant in Mexico for assembly, and then reimported the finished good only paid U.S. import duties on the value of Mexican labor and raw materials used in assembly. NAFTA ended this special status for maquiladoras by giving all Mexican firms duty-free access to the U.S. market.[8] Yet, as seen in figure 10.1, NAFTA did little to stunt the growth of maquiladoras. In a purely legalistic sense, NAFTA did mean the end of the maquiladora regime; it eliminated the in-bond arrangement under which maquiladoras operated. However, Mexico's low wages continue to give the country a comparative advantage in the assembly of manufactured goods for the U.S. economy.

10.2.3 Regional Exposure to Globalization

Mexico's trade and investment reforms have dramatically increased the openness of its economy. These policies appear to have affected some parts of the country much more than others. Figure 10.3 plots the share of state GDP accounted for by value added in maquiladoras during the 1990s against distance to the United States. For three of the six states that border the United States (Baja California, Chihuahua, Tamaulipas), the maquiladora share of GDP is over 18 percent. For two of the three others (Coahuila, Sonora) it is over 8 percent. In the rest of the country, the maquiladora share of GDP is below 5 percent.

While maquiladoras are a large part of Mexico's exports, they are by no

8. With NAFTA, all firms in Mexico obtained duty-free access to the U.S. market as long as they comply with NAFTA rules of origin. NAFTA also exposes maquiladoras to rules of origin (from which they had been exempt previously), but now it also allows the plants to sell goods on the Mexican market.

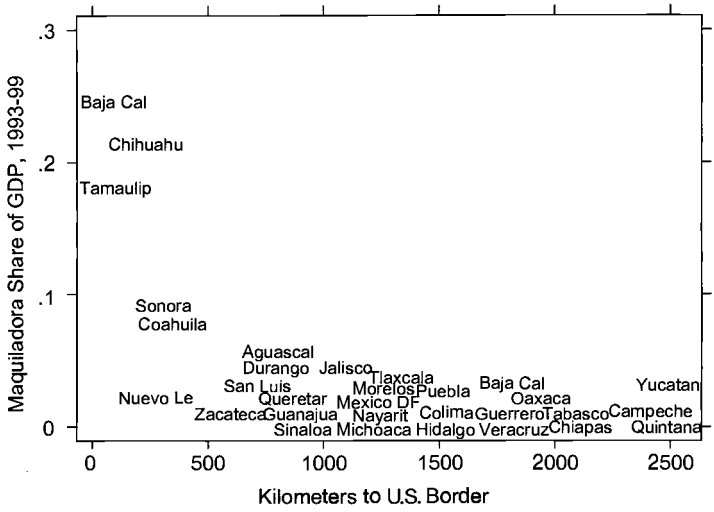

Fig. 10.3 Maquiladora activity in Mexico and distance to the United States

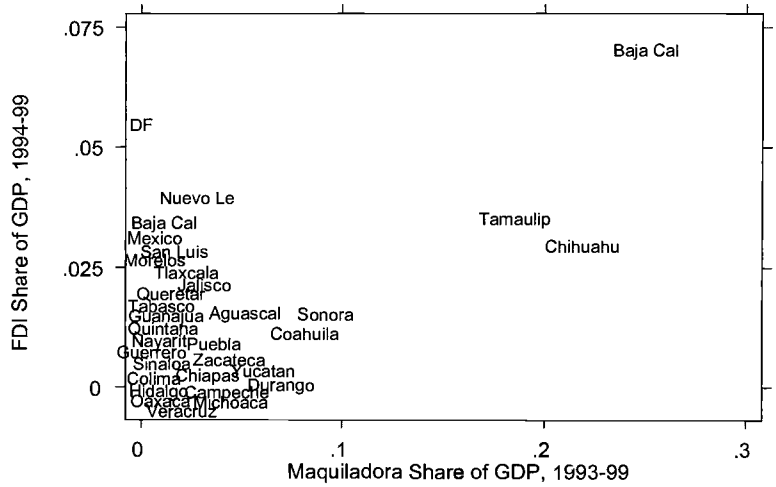

Fig. 10.4 Maquiladora activity and FDI in Mexico

means the whole story. Export production also occurs in states with relatively large supplies of skilled labor, which have attracted multinational auto companies (as in Aguascalientes) and electronics producers (as in Jalisco). Figure 10.4 plots the share of foreign direct investment (FDI) in state GDP against the share of maquiladora value added in state GDP, both averaged over the 1990s. While border states show up as high in both categories, other states have attracted FDI in forms besides maquiladoras.

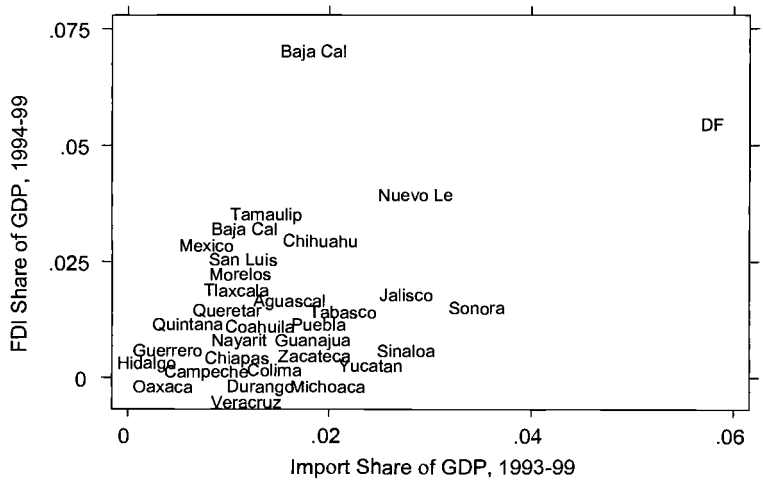

Fig. 10.5 FDI and imports in Mexico

These include states in which Mexico's most important industrial cities are located (Mexico City, Federal District; Monterrey, Nuevo Leon; Guadalajara, Jalisco).

Beyond FDI and maquiladoras, some states are exposed to globalization by virtue of having ports and being large importers. This is seen in figure 10.5, which plots FDI as a share of state GDP against imports as a share of state GDP.[9] A few states, such as Yucatan and Sinaloa, have high imports while attracting little in the way of FDI.

To categorize states as having high or low exposure to globalization, I use the three measures described in figures 10.3–10.5: the share of maquiladora value added in state GDP, the share of FDI in state GDP, and the share of imports in state GDP (each averaged over the period 1993–99). Using all three measures is important, since with the exception of FDI and imports they are relatively weakly correlated across states, as reported in table 10.2. Table 10.3 reports the globalization measures for Mexico's thirty-two states, where states are sorted according to their average rank across the three measures. I select as states with high exposure to globalization those whose average rank across the three measures is in the top third (and that have at least one individual rank in the top third), and I select as states with low exposure to globalization those whose average rank is in the bottom third (and that have no single rank in the top third).

Of the seven states with high exposure to globalization, five share a border with the United States; of the ten states with low exposure to global-

9. In Mexico, there are no data on exports at the state level (other than data on maquiladora exports).

Table 10.2 **Correlation matrix for measures of exposure to globalization across Mexican states in the 1990s**

	Maquiladora value added/ state GDP	Foreign direct investment/ state GDP	Imports/ state GDP	Share of state population migrating to U.S., 1995–2000
Maquiladora value added/state GDP				
Foreign direct investment/state GDP	0.381			
Imports/state GDP	–0.008	0.582		
Share of state population migrating to U.S., 1995–2000	–0.129	–0.371	–0.257	

Notes: Shares of state GDP (maquiladora value added, foreign direct investment, imports) are averages over the period 1993–99. Correlations are weighted by state share of the national population (averaged over 1990 to 2000).

ization, five are in southern Mexico. Historically, Mexico's north—with its more abundant mineral deposits, lower population densities, and closer proximity to the United States—has been relatively rich, while Mexico's south—with its higher population densities and larger indigenous community—has been relatively poor. It is well known that since Mexico's economic opening the border region has enjoyed relatively high wage growth, widening regional wage differentials in the country (Hanson 2004). However, the recent success of the border region follows a period in which Mexico's poorer regions had been catching up. Chiquiar (2005) finds that from 1970 to 1985, the fifteen years preceding Mexico's entry into the GATT, there was convergence in per capita GDP levels across Mexican states, and that after 1985 this process broke down. For the period 1985–2001, there is strong divergence in state per capita GDP levels. Chiquiar's results are reproduced in figure 10.6. Mexico's globalization decade thus follows a period during which income differences between high-exposure states and low-exposure states had been closing.

Finally, it is important to note that exposure to globalization is not simply a proxy for the opportunity to migrate to the United States. Contrary to popular belief, migration to the United States is not especially common among residents of Mexican states on the U.S. border. Mexico's high migration states are in agricultural regions in central and western Mexico, which have dominated migration to the United States for most of the last century (Durand, Massey, and Zenteno 2001). Most of these states have low exposure to FDI or to trade, as seen in figures 10.7 and 10.8, which plot the fraction of the state population migrating to the United States over the period 1995–2000 against the share of FDI in state GDP or the share of imports in state GDP. This suggests that high exposure to globalization does not indicate high exposure to emigration.

Proximity to the United States explains part of regional differences in

Table 10.3 Categorizing Mexican states by exposure to globalization in the 1990s

State	Average rank	Share of state GDP		
		FDI	Imports	Maquiladoras
High exposure to globalization				
Baja California	30	0.070	0.018	0.246
Chihuahua	28	0.030	0.018	0.214
Nuevo Leon	28	0.039	0.027	0.023
Sonora	27	0.015	0.034	0.088
Jalisco	25	0.018	0.027	0.029
Tamaulipas	25	0.035	0.013	0.181
Aguascalientes	25	0.015	0.014	0.046
Intermediate states				
Federal District	22	0.055	0.058	0.000
Coahuila	22	0.011	0.014	0.077
Yucatan	21	0.005	0.023	0.031
Puebla	19	0.009	0.015	0.015
Baja California Star	19	0.032	0.011	0.008
San Luis Potosi	18	0.028	0.011	0.013
Guanajuato	18	0.009	0.014	0.008
Sinaloa	17	0.005	0.027	0.001
Tlaxcala	17	0.019	0.010	0.020
Queretaro	16	0.013	0.011	0.011
Durango	16	0.001	0.012	0.035
Tabasco	16	0.010	0.017	0.000
Morelos	15	0.024	0.010	0.005
Mexico	15	0.031	0.008	0.004
Michoacan	15	0.000	0.016	0.000
Low exposure to globalization				
Zacatecas	15	0.003	0.013	0.008
Quintana Roo	12	0.006	0.011	0.000
Nayarit	10	0.006	0.011	0.000
Colima	9	0.002	0.014	0.000
Guerrero	9	0.004	0.007	0.002
Veracruz	8	–0.004	0.012	0.000
Chiapas	6	0.000	0.011	0.000
Campeche	5	0.001	0.008	0.000
Hildalgo	4	0.000	0.007	0.000
Oaxaca	2	0.000	0.005	0.000

Note: Shares of state GDP (foreign direct investment, imports, maquiladora value added) are averages over the period 1993–99.

exposure to globalization, but it is clearly not the whole story. Other states have become more integrated into the global economy by virtue of having more skilled workers, better transportation infrastructure, or larger markets. These features, while present before globalization took hold in Mexico, are not exogenous. They reflect the ability of these states to develop economically, which may in turn reflect the quality of their legal or political institutions or other historical factors. This suggests that my measure

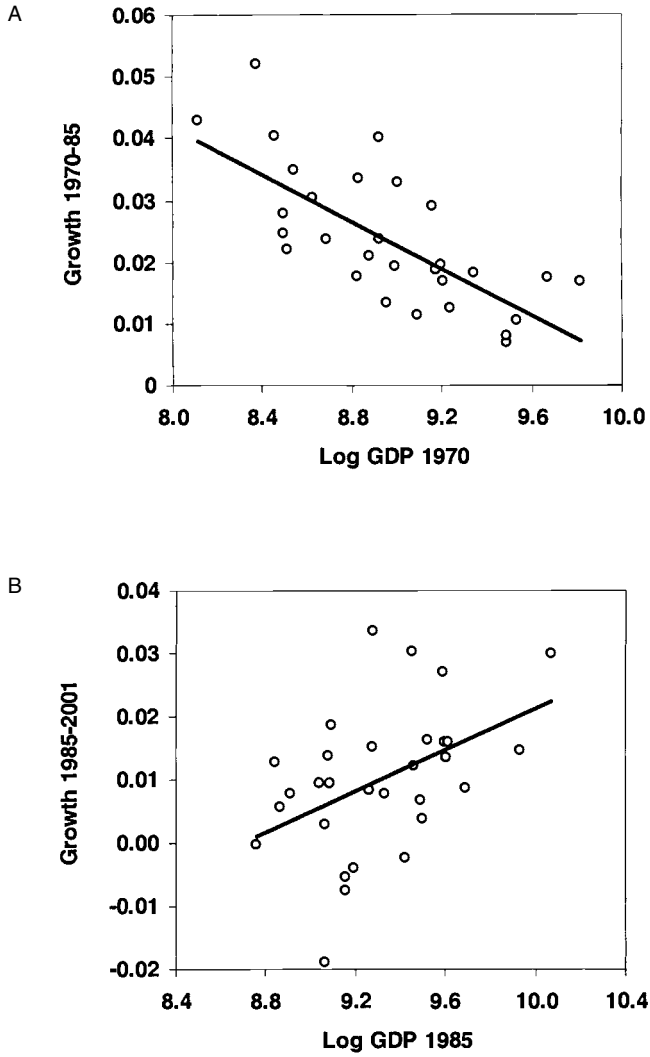

Fig. 10.6 Growth in log GDP across Mexican states, 1970–2001: *A*, annual growth 1970–85 versus initial GDP; *B*, annual growth 1985–2001 versus initial GDP

of exposure to globalization may proxy for institutional quality or other regional characteristics. Identifying the factors that determine regional variation in exposure to global markets, while beyond the scope of this paper, is important. Without this mapping, one cannot make policy recommendations. My findings will suggest that in Mexico regions more exposed to

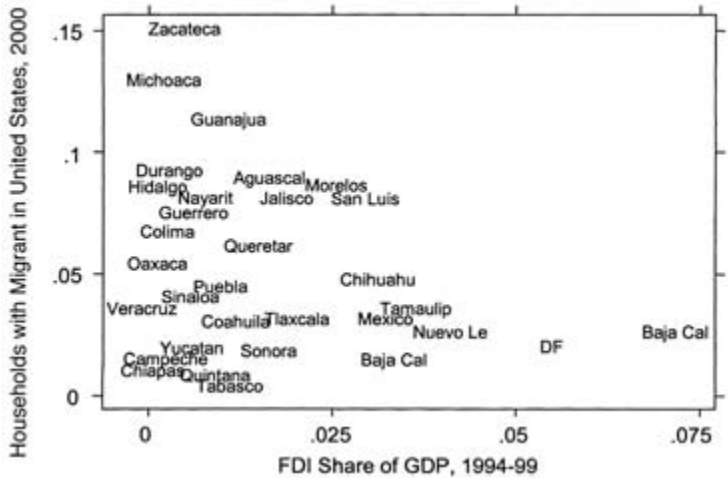

Fig. 10.7 International migration and FDI in Mexico

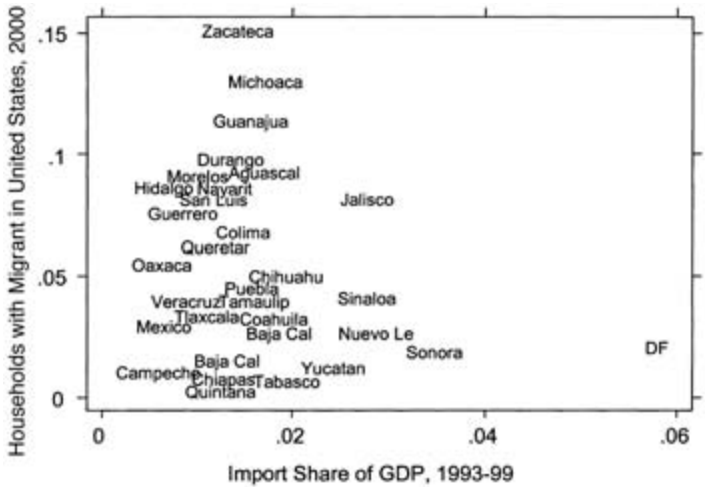

Fig. 10.8 International migration and imports in Mexico

globalization have done better in terms of income growth. But the policy implications of this result are unclear, as I leave unanswered the question of how one goes about increasing regional exposure.

10.3 Empirical Methodology

The empirical analysis involves comparing changes in income distribution during Mexico's globalization decade between two groups of states:

states with high exposure to globalization and states with low exposure to globalization. In this section, I describe nonparametric and parametric approaches for making these comparisons.

10.3.1 Estimating Counterfactual Income Densities

Let $f(w \mid x, i, t)$ be the density of labor income, w, conditional on a set of observed characteristics, x, in region i and time t. Define $h(x \mid i, t)$ as the density of observed characteristics among income earners in region i and time t. For regions, $i = H$ indicates high exposure to globalization and $i = L$ indicates low exposure to globalization; for time periods, $t = 00$ indicates the year 2000 and $t = 90$ indicates the year 1990. The observed density of labor income for individuals in i at t is

$$g(w \mid i, t) = \int f(w \mid x, i, t) h(x \mid i, t) dx. \tag{1}$$

Differences in $f(w \mid x, H, t)$ and $f(w \mid x, L, t)$ capture differences in returns to observable characteristics in regions with high versus low exposure to globalization; differences in $h(x \mid H, t)$ and $h(x \mid L, t)$ capture differences in the distribution of observed characteristics in high- versus low-exposure regions.

To evaluate the change in income distributions across time and across regions, I would like to compare changes in $f(w \mid x, H, t)$ and $f(w \mid x, L, t)$, while holding the distribution of x constant. However, in the data I do not observe these conditional densities, but the only marginal densities, $g(w \mid x, H, t)$ and $g(w \mid x, L, t)$. To evaluate these densities, I apply techniques from DiNardo, Fortin, and Lemieux (1996). First, consider the cross-time change in income distribution in the high-exposure region that is due to changes in returns to observable characteristics, which can be written as

$$\int f(w \mid x, H, 00) h(x \mid H, 90) dx - \int f(w \mid x, H, 90) h(x \mid H, 90) dx. \tag{2}$$

Equation (2) evaluates the change in income distribution in high-exposure regions between 1990 and 2000, fixing the marginal density of observables to be that in high-exposure regions in 1990. Rewrite equation (2) as

$$\int (\theta^{H,90 \to H,00} - 1) f(w \mid x, H, 90) h(x \mid H, 90) dx, \tag{3}$$

where

$$\theta^{H,90 \to H,00} = \frac{f(w \mid x, H, 00)}{f(w \mid x, H, 90)}. \tag{4}$$

Equation (3) is simply the observed marginal income density in high-exposure regions in 1990, adjusted by a weighting function. Given an estimate of the weighting function in equation (4), it would be straightforward to apply a standard kernel density estimator to equation (3). The key, then, to estimating the change in income distribution that is due to changes in returns to observables is estimating the weighting function in equation (4).

Before turning to the weighting functions, consider the analog to equation (2) for regions with low exposure to globalization. The change in income distribution in low-exposure regions that is due to changes in returns to observables is

$$(5) \qquad \int f(w \mid x, L, 00)h(x \mid H, 90)dx - \int f(w \mid x, L, 90)h(x \mid H, 90)dx.$$

Equation (5) evaluates the change in income distribution in regions with low exposure to globalization between 1990 and 2000, again fixing the marginal density of observables to be that in high-exposure regions in 1990. To rewrite equation (5) in terms of the marginal density of income in high-exposure regions in 1990, apply the weights

$$(6) \qquad \theta^{H,90\to L,00} = \frac{f(w \mid x, L, 00)}{f(w \mid x, H, 90)} \quad \text{and} \quad \theta^{H,90\to L,90} = \frac{f(w \mid x, L, 90)}{f(w \mid x, H, 90)},$$

which yields

$$(7) \qquad \int [\theta^{H,90\to L,00} - \theta^{H,90\to L,90}] f(w \mid x, H, 90)h(x \mid H, 90)dx.$$

As in estimating equation (3), estimating equation (7) comes down to applying the appropriate weighting function to a standard kernel density estimator.

The changes in conditional income densities in equations (2) and (5) reflect in part the impact of globalization and in part the impact of other aggregate shocks to the Mexican economy. The *difference* between these changes amounts to a difference-in-difference estimator, which evaluates the change in returns to observables in regions with high exposure to globalization relative to the change in returns observables in regions with low exposure to globalization. Putting equations (3) and (7) together, we get the following:

$$\begin{aligned}(8) \qquad & \left[\int f(w \mid x, H, 00)h(x \mid H, 90)dx - \int f(w \mid x, H, 90)h(x \mid H, 90)dx\right] \\ & - \left[\int f(w \mid x, L, 00)h(x \mid H, 90)dx - \int f(w \mid x, L, 90)h(x \mid H, 90)dx\right] \\ & = \int [(\theta^{H,90\to H,00} - 1) - (\theta^{H,90\to L,90} - \theta^{H,90\to L,90})] f(w \mid x, H, 90) \\ & \quad \cdot h(x \mid H, 90)dx\end{aligned}$$

Equation (8) shows the 1990-to-2000 change in income distribution in high-exposure regions relative to low-exposure regions, holding the distribution of observables constant. I use equation (8) to evaluate the impact of globalization on income distribution in Mexico. The choice of the high-exposure region in 1990 as the base case is purely arbitrary and should not affect the density difference. To check the robustness of the results, I will discuss estimates using other base cases.

To estimate the weighting functions in equations (4) and (6), I use Leibbrandt, Levinsohn, and McCrary's (2005) extension of the DiNardo, Fortin, and Lemieux (1996) paper. Applying the Bayes axiom to the weighting equations yields

$$(9)\qquad \theta^{H,90\to H,00} = \frac{f(w \mid x, H, 00)}{f(w \mid x, H, 90)} = \frac{\Pr(t = 00, i = H) \mid w, x)}{1 - \Pr(t = 00, i = H) \mid w, x)} \cdot \frac{1 - \Pr(t = 00, i = H) \mid x)}{\Pr(t = 00, i = H) \mid x)}$$

$$\theta^{H,90\to L,00} = \frac{f(w \mid x, L, 00)}{f(w \mid x, H, 90)} = \frac{\Pr(t = 00, i = L) \mid w, x)}{1 - \Pr(t = 00, i = L) \mid w, x)} \cdot \frac{1 - \Pr(t = 00, i = L) \mid x)}{\Pr(t = 00, i = L) \mid x)}$$

$$\theta^{H,90\to L,90} = \frac{f(w \mid x, L, 90)}{f(w \mid x, H, 90)} = \frac{\Pr(t = 90, i = L) \mid w, x)}{1 - \Pr(t = 90, i = L) \mid w, x)} \cdot \frac{1 - \Pr(t = 90, i = L) \mid x)}{\Pr(t = 90, i = L) \mid x)}$$

Each weighting function is the product of odds ratios. Consider the first weight. The first ratio is the odds an individual is from a high-exposure region in 2000 (based on a sample of individuals from high-exposure regions in 1990 and 2000), conditional on observables, x, and labor income, w. The second ratio is the (inverse) odds that an individual is from a high-exposure region in 2000 (again, based on a sample of individuals from high-exposure regions in 1990 and 2000), conditional just on x. I can estimate the odds ratios by estimating two logit models. In each case, the dependent variable is a 0–1 variable on the outcome $i = H$ and $t = 00$ (based on a sample of $i = H$ and $t = 90$ or 00). For the first logit model, the regressors are x and w; for the second, the regressor is x, alone. The other weights can be estimated analogously.

After estimating the weights, I apply them to a standard kernel density estimator to obtain estimates for the densities described by equations (3), (7), and (9). These estimates are for the *difference* in income densities, in the case of equations (3) and (7), and for the *double difference* in income densities, in the case of equation (9).

10.3.2 A Parametric Analog

The advantage of the approach described in subsection 10.3.1 is that it characterizes the difference in income across time periods and/or regions at all points in the distribution. The disadvantage is that there are no standard errors for these density differences. To examine the statistical significance of the results, I estimate a parametric analog to equation (8), which is simply a difference-in-difference wage equation.

I pool data on working age men in 1990 and 2000 from states with either

high exposure or low exposure to globalization and then estimate the following regression,

$$\ln w_{hst} = \alpha_s + \mathbf{X}_{hst}(\beta_1 + \beta_2 \text{Y2000}_{ht} + \beta_3 \text{High}_{hs}) + \phi \cdot \text{Y2000}_{ht} \cdot \text{High}_{hs} + \varepsilon_{hst}, \tag{10}$$

where w is labor market earnings, $\mathbf{X}$ is a vector of observed characteristics, Y2000 is a dummy variable for the year 2000, and High is a dummy variable for high-exposure states. The regression includes controls for state fixed effects and allows returns to observable characteristics to vary across regions and across time. The coefficient, ϕ, captures the differential change in earnings from 1990 to 2000 between states with high exposure and low exposure to globalization.

Equation (10) is a standard difference-in-difference specification, which implies that I estimate the mean differential in wage growth between low-exposure and high-exposure states. This approach ignores the possibility that the wage effect of being in a state with high exposure to globalization may not be uniform throughout the wage distribution. The results presented in the next section will provide evidence consistent with this possibility. A more elegant approach would be to estimate the regional differential in wage changes nonparametrically, as in the framework derived by Athey and Imbens (2003).

10.3.3 Estimation Issues

Several estimation issues merit attention. First, individuals self-select into regions. Individuals who have chosen to live in a state with high exposure to globalization may have relatively high drive or ambition and may have moved to the state to take advantage of the opportunities globalization offers. Similarly, individuals who have chosen not to leave states with low exposure to globalization may have relatively low drive or ambition. Given this pattern of selection, unobserved components of labor income would tend to be positive for individuals in high-exposure states and negative for individuals in low-exposure states. The estimation exercises in equations (9) and (10) would then be polluted by systematic differences in unobserved characteristics between regions. To avoid this problem, I categorize individuals by birth state and not by state of residence. In this way, I pick up earnings differences in where people live based on where they were born—a factor out of their control—and not on where they have chosen to reside—a factor in their control. Consistent with expectations, in 1990 83 percent of those born in high-exposure states still lived in those states, compared to only 73 percent of those born in low-exposure states. In 2000, the figures were 82 percent and 70 percent.

A second estimation issue is that individuals self-select into the labor force. This is partly due to age. Over time, young workers enter the labor

force and older workers exit. To control for these movements, I limit the sample to the cohort of men who were twenty-five to fifty-five years old in 1990 (and thirty-five to sixty-five years old in 2000). Relatedly, if over the 1990s labor market conditions improved by more in high-exposure states than in low-exposure states, high-exposure states may have registered a larger increase in the fraction of low-ability individuals participating in the labor force. Given this pattern of selection, unobserved components of labor income may have increased by less in high-exposure states than in low-exposure states.[10] To control for selection into the labor force, I follow Lee (2004) and trim low-wage earners across the four samples (i.e., for $i = H, L$ and $t = 90,00$) such that the fraction included in the estimation is the same for each group.

A third estimation issue is that shocks other than globalization may have had differential impacts on regions with high versus low exposure to globalization. One such shock is the peso crisis of 1995. After a bungled devaluation of the peso in 1994, Mexico chose to float its currency, which proceeded to plummet in value relative to the dollar. The ensuing increase in the peso value of dollar-denominated liabilities contributed to a banking collapse and a severe macroeconomic contraction. It is hard to gauge whether the peso crisis would have hurt states with high exposure to globalization more or less than states with low exposure. On the one hand, high-exposure states are more specialized in the production of exports, and the devaluation of the peso would have increased demand for their output. On the other hand, high-exposure states are better integrated into Mexico's financial markets and the banking collapse may have hurt them more. Other important shocks in the 1990s included a reform of Mexico's land tenure system in 1992, the ongoing privatization of state-owned enterprises and deregulation of industries, and the ruling party's loss of majority control in Mexico's congress in 1997. Again, it is hard to say whether these shocks would have helped or hurt high-exposure states more. The existence of these other shocks leaves the results subject to the caveat that factors other than globalization may have accounted for any differential change in income distribution across regions of the country. I return to this issue in section 10.5.

10.4 Empirical Results

The sample for the analysis is men aged twenty-five to fifty-five in 1990 or thirty-five to sixty-five in 2000 who were born in one of the seven Mexican states with high exposure to globalization or in one of the ten Mexican states with low exposure to globalization. The dependent variable is log av-

10. This suggests that selection into the labor force would work against selection into regions, in terms of the impact on unobserved components of earnings.

Table 10.4 **Summary statistics**

	High exposure to globalization		Low exposure to globalization	
	Mean	Standard deviation	Mean	Standard deviation
	High grade of schooling completed, 1990			
Age	33.6	5.9	33.9	5.9
0	0.055	0.229	0.132	0.338
1 to 5	0.185	0.388	0.285	0.452
6 to 8	0.273	0.445	0.255	0.436
9 to 11	0.208	0.406	0.141	0.348
12 to 15	0.139	0.346	0.100	0.300
16+	0.140	0.347	0.087	0.282
Wage	2.590	2.610	1.781	2.073
No. of observations	13,771		19,351	
	High grade of schooling completed, 2000			
Age	43.0	5.7	43.2	5.8
0	0.036	0.187	0.093	0.290
1 to 5	0.178	0.383	0.255	0.436
6 to 8	0.259	0.438	0.259	0.438
9 to 11	0.207	0.405	0.157	0.364
12 to 15	0.142	0.349	0.109	0.312
16+	0.177	0.382	0.128	0.334
Wage	2.656	2.798	1.674	1.965
No. of observations	11,807		17,967	

Notes: Sample is men with positive labor earnings aged twenty-five to fifty-five in 1990 or thirty-five to sixty-five in 2000 born in states with either high exposure to globalization or low exposure to globalization. Wages are average hourly levels in 2000 U.S. dollars.

erage hourly labor earnings.[11] I also discuss results using log total labor income as the dependent variable. Summary statistics are in table 10.4.

10.4.1 Raw Income Distributions

To provide a starting point for the analysis, consider the raw distributions of labor income in states with either high exposure or low exposure to globalization. Figure 10.9 shows kernel density estimates for hourly labor earnings in 1990 and 2000. In both years, the density for high-exposure states is shifted to the right compared to low-exposure states. Between 1990 and 2000, the difference between the wage densities in the two groups of

11. For Mexico, average hourly wages are calculated as monthly labor income ÷ (4.5 × hours worked last week); for the United States, average hourly wages are calculated as annual labor income ÷ (weeks worked last year × usual hours worked per week). Assuming individuals work all weeks of a month could bias wage estimates downward. To avoid measurement error associated with implausibly low wage values or with top coding of earnings, I restrict the sample to be individuals with hourly wages between $0.05 and $20 (in 2000 dollars). This restriction is nearly identical to dropping the largest and smallest 0.5 percent of wage values.

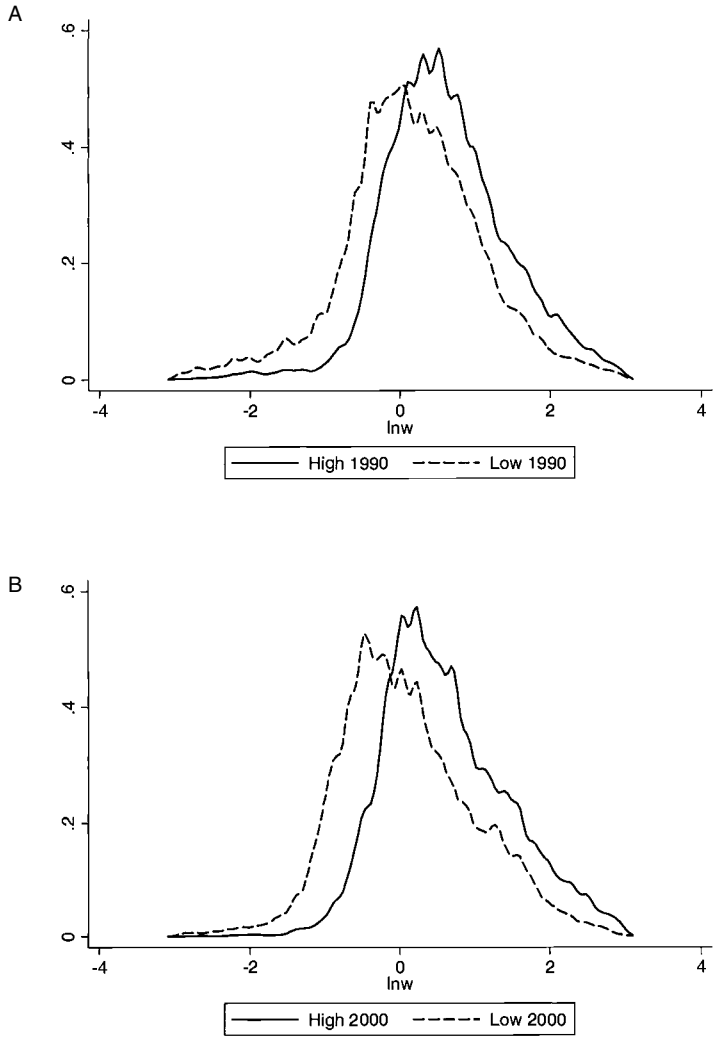

Fig. 10.9 Density of hourly labor income in states with high exposure and low exposure to globalization: *A,* 1990; *B,* 2000

states appears to widen. Higher wages in high-exposure states reflect in part the fact these states have a more highly educated labor force, as indicated by table 10.4. Higher wages in high-exposure states may also reflect differences in the returns to observable characteristics across states in Mexico.

To see what these distributional differences imply about differences in the incidence of poverty between regions, figure 10.10 shows the cumulative distribution for wages in high-exposure and low-exposure states in the two years. The vertical line in each graph shows the hourly wage needed to

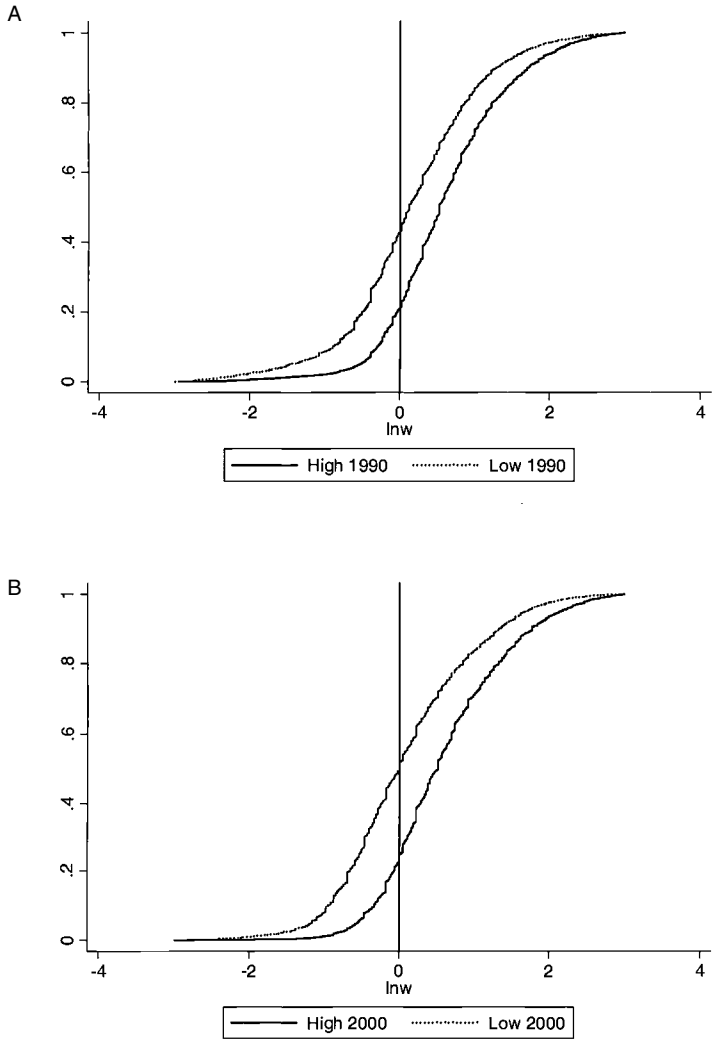

Fig. 10.10 Cumulative distribution of hourly labor income in states with high exposure and low exposure to globalization: *A*, 1990; *B*, 2000

provide the minimum caloric intake for a family of four with one wage earner working the mean number of annual labor hours in that year.[12] The

12. In 1990, the implied poverty cutoff for the hourly wage was $1.16 in low-exposure regions and $1.25 in high-exposure regions (in 2000 U.S. dollars), and in 2000, it was $1.13 in low-exposure regions and $1.22 in high-exposure regions. The poverty wage is lower in low-exposure regions because rural areas have lower prices for goods and because a higher fraction of the population in low-exposure regions lives in rural areas. The line shown in figure 10.9 is that for the log poverty wage in low-exposure regions (in log terms the poverty wage in high-exposure and low-exposure regions is nearly the same).

peso value for the minimum caloric intake is from Cortés et al. (2003). The poverty wage line in figure 10.10 is not meant to provide an accurate indicator of the fraction of individuals living in poverty. By focusing on labor income, I ignore other sources of household earnings. Government transfers, rental income, loans, in-kind receipts, and remittances also supplement family income, suggesting that the implied poverty wage threshold in figure 10.10 is set too high—some families below this threshold will receive enough income from other sources to allow them to afford a consumption level that is above the poverty cutoff. Still, the poverty wage is a useful benchmark for gauging the potential for a worker to sustain a family at above-poverty consumption levels on labor income alone (which is two-thirds of total income in Mexico).

In 1990, the fraction of workers earning less than the poverty cutoff wage in low-exposure regions (0.42) was twice that in high-exposure regions (0.21). In 2000, the difference was even larger, with the fraction of workers below the poverty wage at 0.49 in low-exposure regions and 0.22 in high-exposure regions. While it appears that poverty increased more rapidly in low-exposure regions, the results in figure 10.10 are inconclusive. Since both the price of labor and the composition of labor are changing across regions and over time, we do not know whether the apparent increase in the relative incidence of poverty in low-exposure regions is due to a deterioration in the returns to observable characteristics or to change in the relative composition of the labor force. To separate these effects, I construct counterfactual income densities.

10.4.2 Counterfactual Income Distributions

To control for regional differences in the distribution of observable characteristics, I apply the weights in equation (9) to the kernel density for high-exposure states in 1990. This produces the two sets of densities in figure 10.11. Panel A shows the actual income density in 1990 for high-exposure states and a counterfactual density that would obtain were workers in high-exposure states in 1990 paid according to the returns to observable characteristics in low-exposure states in 1990, or

$$\int f(w \mid x, L, 90)h(x \mid H, 90)dx = \int \theta^{H,90\to L,90} f(w \mid x, H, 90)h(x \mid H, 90)dx.$$

Since the distribution of observable characteristics is the same in the actual and counterfactual densities, comparing the two makes it possible to isolate the regional differences in income densities that are attributable to regional differences in returns to characteristics. In figure 10.11, the density for high-exposure states in 1990 is again right-shifted relative to low-exposure states, although the regional difference in incomes is smaller than in figure 10.9. Thus, even before Mexico's globalization decade, incomes were higher across the distribution in high-exposure states. These income differences may be due to high-exposure states historically having better infrastructure, being more specialized in the high-wage manufacturing sec-

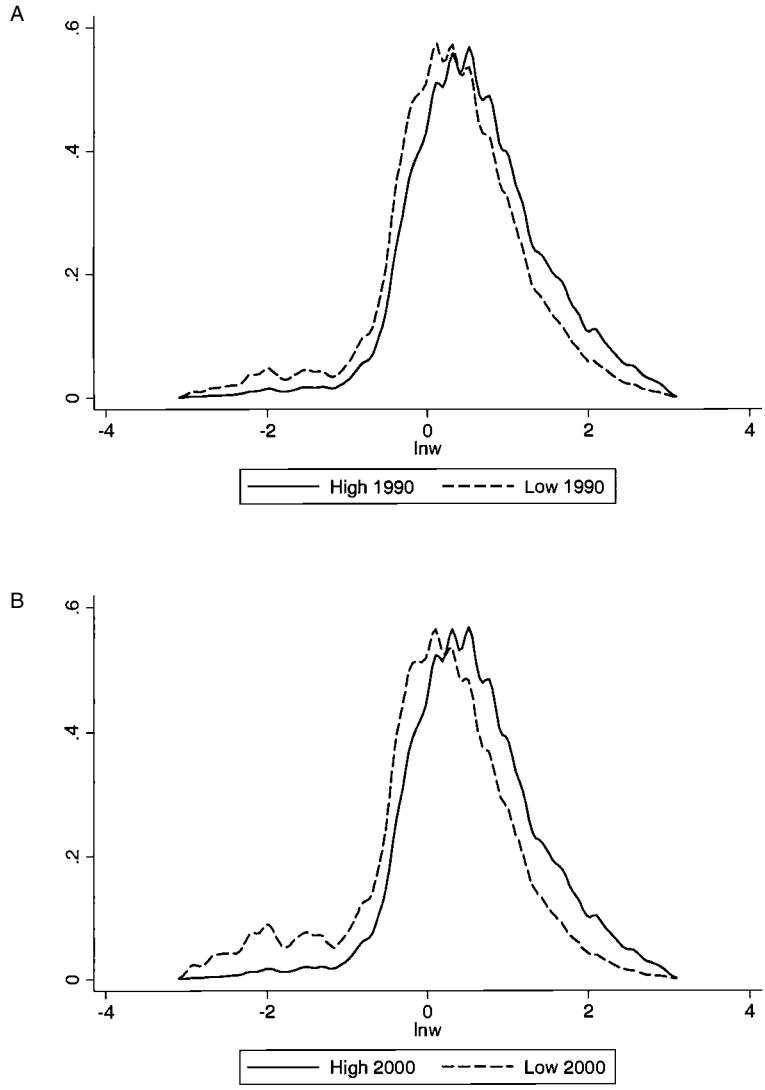

Fig. 10.11 Counterfactual income densities, high- and low-exposure states: *A*, 1990; *B*, 2000

tor, or being less specialized in the low-wage agricultural sector, among other factors (see Chiquiar 2003 for a more complete discussion). This highlights the importance of controlling for initial income differences between states when examining changes in income distributions over time.

Panel B of figure 10.11 shows income densities in 2000, evaluated based on the distribution of observable characteristics in high-exposure states in

1990. For high-exposure states, the resulting counterfactual density is what workers in high-exposure states in 2000 would earn were they to have the observable characteristics of workers in high-exposure states in 1990, or

$$\int f(w \mid x, H, 00)h(x \mid H, 90)dx = \int \theta^{H,90\rightarrow H,00} f(w \mid x, H, 90)h(x \mid H, 90)dx.$$

For low-exposure states, the counterfactual is what workers in low-exposure states in 2000 would earn had they the characteristics of high-exposure states in 1990, or

$$\int f(w \mid x, L, 00)h(x \mid H, 90)dx = \int \theta^{H,90\rightarrow L,00} f(w \mid x, H, 90)h(x \mid H, 90)dx.$$

Comparing these counterfactuals isolates regional differences in income densities that are due to differences in returns to characteristics rather than to the distribution of observables. As in 1990, the density for high-exposure states in 2000 is right-shifted relative to low-exposure states. Comparing the two years, it appears that differences in income densities between high-exposure and low-exposure states have increased over time, suggesting that relative incomes have risen in the former.

To relate the counterfactual wage densities to poverty, figure 10.12 shows the cumulative distribution analogs to the counterfactual wage kernels in figure 10.11. Panel A of figure 10.12 thus shows the cumulative density for wages in high-exposure and low-exposure states in 1990, based on the characteristics of workers in high-exposure regions in 1990. Comparing this graph to panel A of figure 10.10, we again see that the fraction of workers below the poverty wage is higher in low-exposure states (0.32) than in high-exposure states (0.21). However, the difference in the incidence of wage poverty between the two groups of states in figure 10.12 (0.32 – 0.21 = 0.11) is considerably lower than in figure 10.10 (0.42 – 0.21 = 0.21). Holding constant the distribution of observable characteristics leaves the difference in cumulative distributions due to differences in returns to observables. Again, the apparent higher initial incidence of poverty in low-exposure states highlights the importance of controlling for initial conditions when comparing changes in income distributions.

Panel B of figure 10.12 shows the cumulative density for wages in high-exposure and low-exposure states in 2000, based on the characteristics of workers in high-exposure regions in 1990. The fraction of workers earning less than the poverty wage is 0.40 in low-exposure states and 0.22 in high-exposure states, which again is a smaller difference (0.40 – 0.22 = 0.18) than that for the actual wage distributions in figure 10.10 (0.49 – 0.22 = 0.27). Putting the 1990-to-2000 change in the incidence of wage poverty for low-exposure versus high-exposure states together yields a difference-in-difference estimate of (0.40 – 0.32) – (0.22 – 0.21) = 0.07. During Mexico's globalization decade of the 1990s, the incidence of wage poverty in low-exposure states appeared to increase relative to that in high-exposure states by approximately 7 percent.

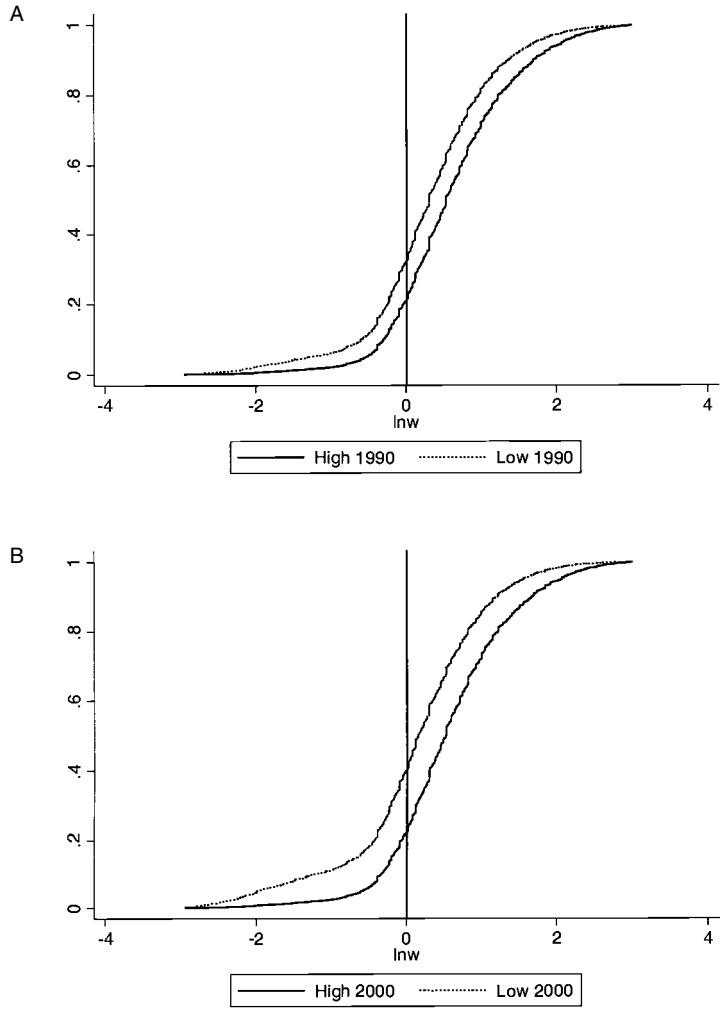

Fig. 10.12 Counterfactual cumulative income distributions, high- and low-exposure states: *A*, 1990; *B*, 2000

To explore these distributional changes in more detail, figure 10.13 shows estimates of equation (2)—the 1990-to-2000 change in income densities in high-exposure states—and of equation (5)—the 1990-to-2000 change in income densities in low-exposure states—where all densities are evaluated based on the distribution of observables in high-exposure states in 1990 (as shown in equations [3] and [7]). In low-exposure states, there was a pronounced shift in mass from the upper half of the distribution to the lower half of the distribution. In high-exposure states, there was a mod-

Fig. 10.13 Estimated change in labor income densities, 1990 to 2000

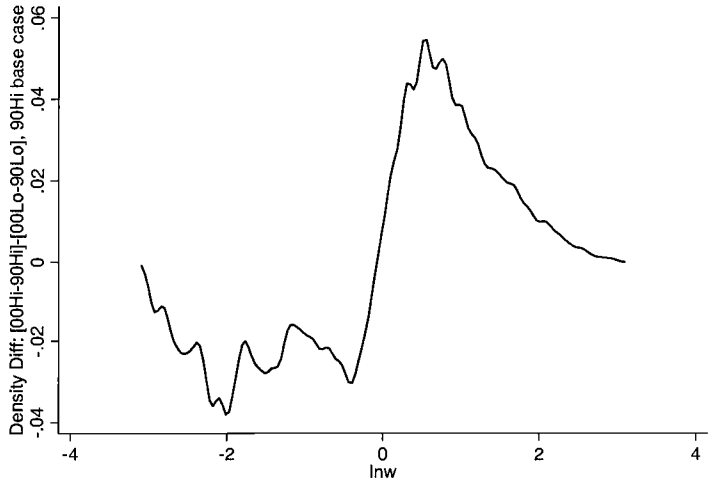

Fig. 10.14 Double difference in labor income densities

est shift in mass from the upper part of the distribution to the middle of the distribution. While labor incomes in the 1990s deteriorated in both regions, caused in part by Mexico's peso crisis in 1995, the deterioration was much less severe in states with high exposure to globalization.

The change in regional relative incomes is seen more clearly in figure 10.14, which shows an estimate of equation (8), the change in income density in high-exposure states relative to the change in income density in low-

exposure states (evaluated for the distribution of observable characteristics in high-exposure states in 1990). It is clear that the income of high-exposure states has increased relative to the income of low-exposure states. This appears as shift in mass in the double density difference from the lower half of the distribution to the upper half of the distribution. During Mexico's globalization decade, individuals born in states with high exposure to globalization appear to have done much better than individuals born in states with low exposure to globalization. These results appear to be robust to changing the sample of states with either high exposure or low exposure to globalization. In unreported results, I experimented with dropping high-exposure states one at a time from the sample and reestimating the income densities and with dropping low-exposure states one at a time and reestimating the densities. Both sets of results are very similar to those reported.

10.4.3 Additional Results

Throughout the analysis, we have evaluated labor income densities fixing the distribution of observable characteristics to be those in states with high exposure to globalization in 1990. This choice of the base case is arbitrary and should not affect the results. To examine the robustness of the findings, figure 10.15 reestimates the double difference in income densities in equation (8), evaluating all densities based on the distribution of observables in low-exposure states in 1990. Figure 10.15 is very similar to figure 10.14, confirming that the choice of base case does not matter for the results.

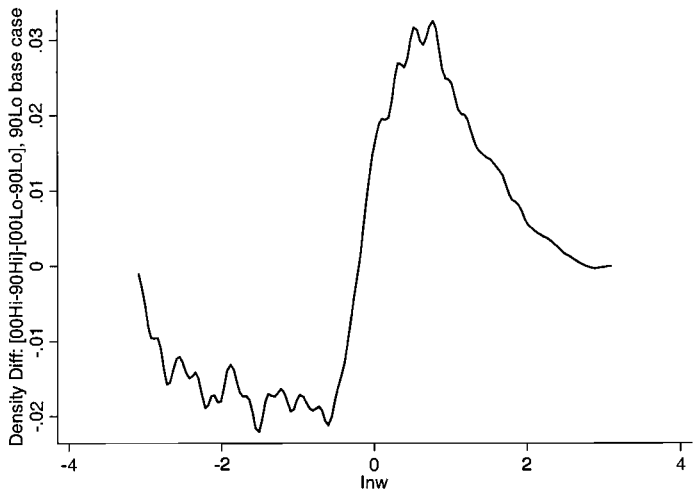

Fig. 10.15 Double difference in labor income densities (alternative base case)

The income densities shown so far are for average hourly labor earnings. If changes in wages affect individual labor supply, changes in hourly labor earnings may understate changes in total labor income. To see if this might be the case, figure 10.16 estimates the double density difference in equation (8), evaluated in terms of total labor income rather than average hourly labor income. Figure 10.16 is similar to figure 10.14, suggesting that regional changes in the distribution of total labor income mirror regional changes in the distribution of hourly labor income.

In the results so far, I have included the full sample of workers from low-exposure and high-exposure states in 1990 and 2000. One concern is that the nature of self-selection into work varies across states or across time. If labor force participation differs between low-exposure and high-exposure states, then cross-section comparisons in wage distributions may be contaminated by sample selection. If these differences are stable over time, they may not pose a problem for comparing changes in wage distributions. However, if labor force participation changes differentially over time between low-exposure and high-exposure states, then sample selection may also contaminate the difference-in-difference analysis. For males with nine or more years of education, labor force participation rates are very similar in low-exposure and high-exposure states. For low-education males, labor force participation rates are higher in high-exposure states, and these differences appear to increase over time. This suggests the data are missing more low-wage workers in low-exposure states than in high-exposure states, which would tend to compress the estimated difference in wage distributions for the two groups of states. Further, since the relative fraction

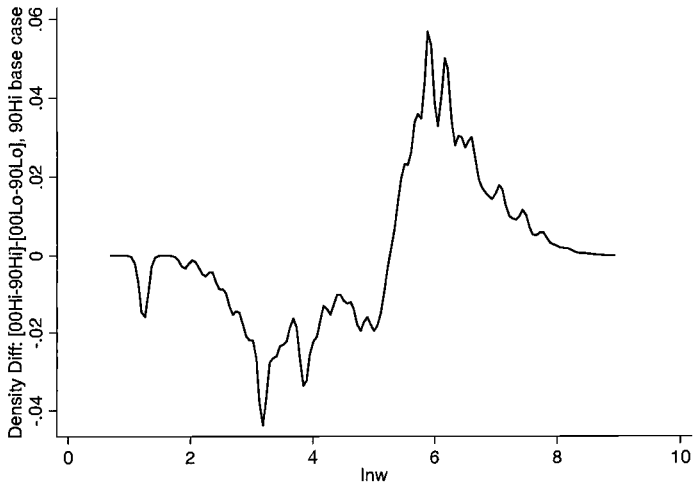

Fig. 10.16 Double difference in total labor income densities

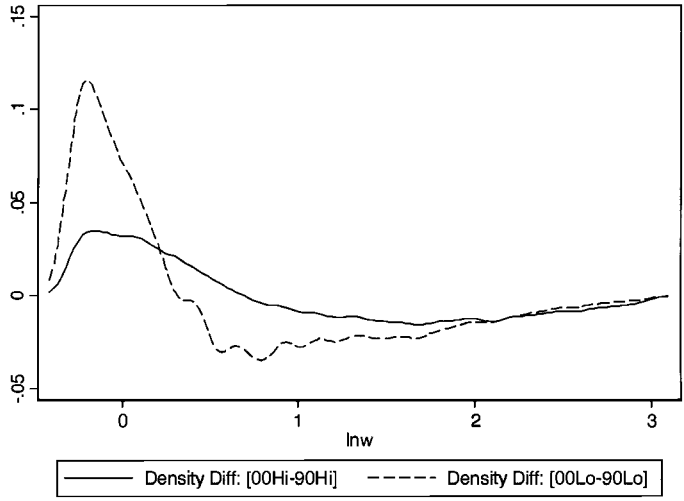

Fig. 10.17 Estimated change in labor income densities, 1990 to 2000, with observations trimmed to account for selection into work

of missing low-wage workers in low-exposure states rises over time, my estimates would tend to understate the full extent of the change in relative wages between the two groups of states over time.

To deal with sample selection associated with labor force participation, I apply Lee's (2005) technique for trimming observations to make them comparable across samples (which may vary by region, time, or some other dimension). The idea is that if both wages and labor force participation are monotonically increasing in the unobserved component of wages, then it is possible to make two samples comparable in terms of the distribution of unobservables by trimming low-wage observations in the group that has higher labor force participation. We cannot add low-wage workers who do not work into the sample in the low-labor-force-participation group, but we can drop from the sample low-wage workers in the high-labor-force-participation group (who presumably would not work if they were to be placed in the other group). I trim low-wage workers from the high-labor-force-participation group until I obtain two samples that are identical in terms of the fraction of wage earners included. Figures 10.17 and 10.18 redo figures 10.13 and 10.14 applying Lee's trimming procedure. It remains the case that wages deteriorate by more in low-exposure states. Income in high-exposure states increases relative to income in low-exposure states, which appears as a shift in mass in the double density difference from the lower half of the distribution to the upper half of the distribution. This is further evidence that during Mexico's globalization decade individuals

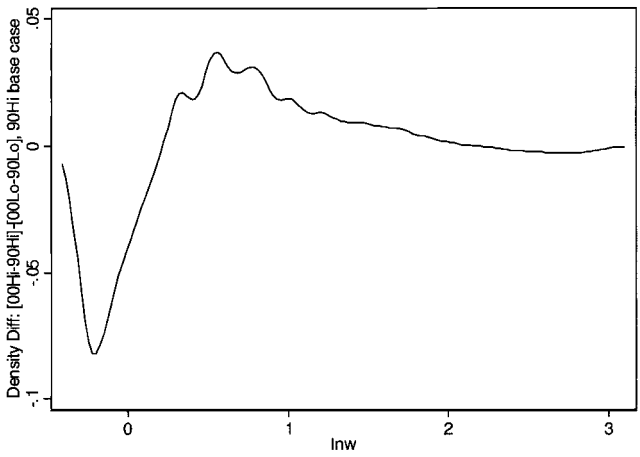

Fig. 10.18 Double difference in labor income densities, with observations trimmed to account for selection into work

born in states with high exposure to globalization did relatively well in terms of their labor earnings.

10.4.4 Parametric Results

While the nonparametric results show a strong increase in relative incomes in states with high exposure to globalization, they give no sense of the statistical precision of these estimates. As a check on the statistical significance of the results, table 10.5 shows estimation results for equation (10). The dependent variable is log average hourly labor earnings. The regressors are dummy variables for educational attainment, a quadratic in age, a dummy variable for the year 2000 and its interaction with the age and education variables, a dummy variable for having been born in a state with high exposure to globalization and its interaction with the age and education variables, dummy variables for the state, and the interaction of the year 2000 and high-exposure-to-globalization dummy variables. This last variable captures the differential change in wage growth in high-exposure states relative to low-exposure states. Standard errors are adjusted for correlation across observations within the same state.

Panel A of table 10.5 shows that during the 1990s the cohort of individuals born in states with high exposure to globalization enjoyed labor earnings growth that was 7.9 to 9.2 log points higher than earnings growth for individuals born in low-exposure states. These coefficients are precisely estimated. This is consistent with the counterfactual density estimates and again suggests that individuals in high-exposure states enjoyed higher growth in labor income that individuals in low-exposure states. The second

Table 10.5 **Regression results**

	All workers (1)	Workers with 20- to 80-hour work week (2)	All workers (3)	Workers with 20- to 80-hour work week (4)
	A. Full sample of workers			
Year 2000 · high exposure	0.092	0.079	0.115	0.116
	(0.039)	(0.033)	(0.053)	(0.050)
Year 2000 · high exposure · secondary education			–0.050	–0.079
			(0.042)	(0.046)
R^2	0.337	0.373	0.337	0.373
No. of observations	45,012	42,298	45,012	42,298
	B. Trimmed sample to account for sample selection			
Year 2000 · high exposure	0.109	0.090	0.159	0.153
	(0.029)	(0.025)	(0.040)	(0.039)
Year 2000 · high exposure · secondary education			–0.106	–0.130
			(0.031)	(0.034)
R^2	0.380	0.417	0.380	0.418
No. of observations	42,711	40,224	42,711	40,224

Notes: The dependent variable is log average hourly labor earnings. In columns (1) and (3), the sample is non-self-employed males born in states with high exposure to globalization or states with low exposure to globalization; in columns (2) and (4), the sample includes only the non-self-employed who report working twenty to eighty hours a week. Other regressors (quadratic in age, dummies for year of education, and their interactions with year 2000 dummy and with high exposure dummy; year 2000 dummy variable; state dummy variables) are not shown. Standard errors are in parentheses and are adjusted for correlation across observations within birth states. In panel A, the sample is working males in all states and time periods; in panel B, I trim low-wage workers in high-labor-force-participation state/year groups until the fraction of wage earners is the same in low-exposure and high-exposure states and in the two years.

two columns of table 10.5 show results where the year 2000/high-exposure interaction is interacted with a dummy variable for an individual having completed a secondary education. This term allows relative earnings growth to be larger for more-educated workers. The interaction term is negative, but imprecisely estimated.

Panel B of table 10.5 redoes the estimation, trimming observations across the samples to account for possible self-selection into work. Estimated relative wage growth for high-exposure states is higher using this estimation method, with individuals born in high-exposure states enjoying labor earnings growth 9.0 to 10.9 log points higher than that of individuals born in low-exposure states. In the second two columns, the interaction between the year 2000/high-exposure interaction and the dummy variable for secondary education is negative, precisely estimated, and similar in absolute value to the main effect (the year 2000/high-exposure interaction). This suggests that on average most of the relative wage growth for individuals born in high-exposure states went to individuals with low levels of

schooling. The income gains in moving from low-exposure to high-exposure states appear to be largest for low-wage workers.

10.5 Conclusion

In this paper, I examine the change in the distribution of labor income across regions of Mexico during the country's decade of globalization, the 1990s. I focus the analysis on men born either in states with high exposure to globalization or in states with low exposure to globalization, as measured by the share of FDI, imports, and export assembly in state GDP during the 1990s. Mexican states with high exposure to globalization are located along the U.S. border and in the relatively skill-abundant center-west region of the country; states with low exposure to globalization are primarily located in more rural southern Mexico. I exclude from the analysis individuals born in states with intermediate exposure to globalization.

Controlling for regional differences in the distribution of observable characteristics and for initial differences in regional incomes, the distribution of labor income in high-exposure states shifted to the right relative to the distribution of income in low-exposure states. This change in regional relative incomes was the result of a shift in mass in the income distribution of low-exposure states from upper-middle income earners to lower income earners. Labor income in low-exposure states fell relative to high-exposure states by 8–12 percent, and the incidence of wage poverty (the fraction of wage earners whose labor income would not sustain a family of four at above-poverty consumption levels) increased in low-exposure states relative to high-exposure states by 7 percent.

There are several possible interpretations of these results. One is that trade and investment liberalization raised incomes in states with high exposure to the global economy relative to states with low exposure to the global economy. However, trade and investment reforms were by no means the only shocks to the Mexican economy during the 1990s. The Mexican peso crisis in 1995 was another important event. The results are also consistent with the greater ability of states that were more integrated into the global markets to weather the large devaluation of the peso, the banking crisis, and the contraction in economic activity that occurred in Mexico during the mid-1990s. High-exposure states are relatively specialized in export production and would potentially benefit from a depreciation of the currency.

Other policy changes, such as the privatization and deregulation of Mexican industry or the reform of Mexico's land-tenure system, may also have had differential regional impacts in Mexico. Privatization and deregulation appeared to weaken Mexico's unions and lower wage premiums enjoyed by workers in these sectors (Fairris 2003). Since more heavily unionized in-

dustries are concentrated in Mexico's north and center, and relatively absent in Mexico's south (Chiquiar 2003), we might expect a loss in union power to lower relative incomes in states with higher exposure to globalization, contrary to what we observe in the data. The reform of Mexico's land-tenure system allowed individuals to sell agricultural land previously held in cooperative ownership. In principle we might expect this opportunity to raise relative incomes in rural southern Mexico, where agriculture accounts for a relatively high share of employment and output. Again, this is contrary to what we observe in the data.

Another possibility is that income growth in high-exposure states merely reflects continuing trends unrelated to globalization. This also does not appear to be the case. As seen in figure 10.6, poorer states, which include seven of the ten states with low exposure to globalization, had faster growth in per capita income than richer states, which include six of the seven high-exposure states. The process of income convergence in Mexico came to a halt in 1985, coinciding with the onset of trade liberalization. Since 1985, regional incomes have diverged in the country. The pattern of income growth I uncover does not appear to have been evident in the early 1980s or before.

A brief review of Mexico's other policy reforms during the 1990s does not suggest any obvious reason why they should account for the observed increase in relative incomes in states with high exposure to globalization. Still, it is important to be cautious about ascribing shifts in regional relative incomes to specific policy changes. In the end, we can only say that I find suggestive evidence that globalization has increased relative incomes in Mexican states that are more exposed to global markets.

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Comment

Esther Duflo

Relative to the abundant number of papers on the impact of globalization on inequality, only a few papers (several of them in this volume) try to investigate its effects on poverty. This is unfortunate, since the effects on poverty are at the heart of the debate between proglobalization and antiglobalization camps, with each employing theoretical reasoning and anecdotal evidence to argue that globalization is good (or bad) for the poor.

The present paper is part of a most welcome change in this state of affairs. Hanson examines the impact of globalization on the shape of wage distribution in Mexico and, in particular, on the number of people whose wages would place them below the poverty line if they were to subsist on these wages. While this is not the whole story on poverty (some of the poor may be unemployed or self-employed, for example), this is clearly an essential ingredient. Moreover, data on wages are available from a large sample and are representative at the regional level, which is not the case for consumption data. In future work, it may be possible to use these data to attempt to say something about poverty, using the strategy developed by

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Elbers, Lanjouw, and Lanjouw (2003), for instance. Their strategy involves using a smaller data set containing both wages and consumption information to predict the relationship between poverty, wages, and other variables observed in the larger data set. Using this strategy as a foundation, one could construct an estimate of poverty at the regional level using the representative data set, and then use this as the dependent variable in the analysis.

Hanson's approach is to compare the evolution of wage distribution during the "decade of globalization" (1990–2000) in regions that were most exposed to globalization to that of regions that were less exposed to globalization. (Globalization is defined as a composite index, reflecting exposure to FDI and foreign trades.) He shows that the distribution of wages shifted to the right in exposed states between 1990 and 2000, relative to the distribution in unexposed states. The states with higher exposure were already richer in 1990, but they were even richer by 2000. In particular, the number of wage-poor in states with high exposure declined by 10 percent relative to the number in unexposed states. Globalization appears to have benefited more the states that were exposed to it most.

Hanson takes great care to ensure the robustness of these findings: he defines a person's region as his state of birth, in order to ensure that he is not picking up the effect of migration by high-ability migrants to the regions with more opportunities. He shows that before 1990, there tended to be a convergence between Mexican states, so that the effect found between 1990 and 2000 is not *prima facie* likely to be due to the continuation of a divergence trend. Some uncertainty is bound to remain: the convergence trend is established over a long period, and so is the result found in this paper. It is possible that the richer states would have started to diverge anyway, and that this is what is reflected in these results. Several serious shocks affected Mexico during this decade, and they could have had differential effects on different regions, varying systematically with their exposure to foreign investment and trade. It is difficult to assess in which direction these effects would have gone. The results are therefore far from definitive, but they should certainly affect our priors that the globalization in Mexico reduced poverty more (or increased poverty less) in regions that were more exposed to foreign investment and foreign trade.

One must be cautious in interpreting the results as saying that globalization was good for Mexico's poor, however. The strategy involves a comparison between regions and would not pick up any macroeconomic effect affecting Mexico as a whole. Mexico is an integrated economy, and the regions share a number of characteristics. These effects could go in either direction. For example, some may argue that the peso crisis was a consequence of globalization. If it made everyone poorer, this would not be picked up by the approach. This strategy can only tell us whether some regions pick up more of the benefits (or less of the burden) of globalization

than others, and whether this is related to how much more they were exposed to trade. This is an important question, and it has the advantage over the more general question (what was the impact of globalization on poverty in Mexico) in that it can be answered.

It is important to note that if the Mexican labor market was fully integrated, migration would operate to equalize factor prices, and there would be no differential impact of globalization on different regions. Hanson's paper therefore tells us that labor is relatively immobile across regions. In contrast, within regions, it seems to be mobile across sectors (employment in the maquiladoras, for example). A comparison between this paper and two other contributions in this volume (chap. 7, by Topalova, on India, and chap. 6, by Goldberg and Pavcnik, on Colombia) suggests that the extent of labor mobility may be at the heart of the impact of globalization on poverty, within and across regions. The chapters by Topalova and by Goldberg and Pavcnik both show that trade liberalization increased poverty in the regions (Topalova) and sectors (Goldberg and Pavcnik) it directly affected, relative to those that were less affected.[1] In both cases, in contrast to what Hanson finds in this paper, the mobility of labor seems to have been very limited, both across sectors and across regions. In turn, the mobility of labor may have been hindered by the absence of reallocation of capital across sectors.

These papers taken together seem to suggest that factor mobility may be at the heart of the impact of trade on poverty. A generation of new models (notably Banerjee and Newman 2004) focuses on developing the theory of trade with imperfect factor mobility. We can hope that these models will be followed by a new wave of empirical work explicitly testing some of these hypotheses.

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1. All three papers use the same type of difference-in-differences strategies, which allow them to make only comparative statements.

III

Capital Flows and Poverty Outcomes