

Inequality and Mexico's labor market after trade reform

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October 2000

The author is grateful to James Albrecht, Susan Collins, and Susan Vroman for useful comments and to Jose Montes for excellent research assistance. Any errors are the responsibility of the author. This paper does not necessarily reflect the opinions of the Inter-American Development Bank.

Labor income inequality rose substantially in Mexico after trade reform and liberalization of the balance of payments in 1985. As measured by the Gini coefficient, between 1984 and 1994 individual labor income inequality rose about 9 percentage points and per capita household labor income inequality rose 7 points (table 1). These increases, offset slightly by a decrease in the inequality of nonlabor income, resulted in an increase in per capita household income inequality of around 6 points.

Table 1
Inequality in Mexico: the Gini coefficient in 1984 and 1994

	1984	1994	Change	
			Points	Percent
Individual labor income	46.53	55.27	8.74	18.8
Per capita household income	47.62	53.51	5.89	12.4
Per capita household labor income	52.19	58.72	6.53	12.5
Per capita household nonlabor income	65.15	62.94	-2.21	-3.4

Source: Author's calculations based on Mexican household surveys.

As discussed below, the increase in inequality was accompanied by important changes in the labor market. Among these were changes in labor force participation and unemployment rates across different types of workers, changes in the allocation of workers across sectors, and changes in education and sector returns. That these changes occurred in the same period as the rise in inequality suggests that they may have been related.

The main purpose of this paper is to measure the contributions of the changes in the labor market to the increase in inequality experienced by Mexico after the 1985 trade and financial liberalization. To do so, the paper uses data from Mexican household surveys (*Encuesta*

Nacional de Ingreso Gasto de los Hogares de México) produced by the Mexican Institute for Statistics, Geography and Informatics (*Instituto Nacional de Estadística, Geografía e Informática*) for 1984 and 1994. The paper applies a counterfactual methodology to measure the effects on inequality of changes in labor force participation, unemployment, structure of employment, and mean labor income by economic sector and education level.

The literature on the distribution of income in Mexico has found that an increase in inequality is associated with increases in skill premiums. Some studies link the increase in skill premiums to the trade reform, arguing that it caused skill-biased technical change by cheapening imported physical capital, intensive in skilled labor, or that protection had been biased in favor of low-skill labor (Meza, 1997; Cragg and Epelbaum, 1996; Robbins, 1996; Hanson and Harrison, 1999a and 1999b). Although this paper does not explicitly model the effects of trade reform on income inequality, it identifies the main changes observed in the labor market between 1984 and 1994.

The simulation shows that changes in mean income across groups of workers—as defined by gender, education level, and economic sector—explain most of the increase in inequality experienced by Mexico after trade reform. Taken together, changes in labor force participation, unemployment, and the structure of employment were equalizing after the reform. But their combined effect was small relative to the increase in inequality due to changes in mean income.

Mexico's 1985 trade reform

Two main events influenced the evolution of the Mexican labor market between 1984 and 1994. One was the liberalization of trade and the financial sector that started in 1984. The second was the North American Free Trade Agreement (NAFTA), which went into effect in January 1994.¹

Trade liberalization started slowly in 1984 but intensified in 1985 and 1987. The 1985 liberalization focused on capital and intermediate goods. Import permits were reduced from covering 100 percent of capital and intermediate goods in 1982 to 38 percent in 1985. The average tariff, weighted by import volume, fell from 16 percent in 1982 to 13 percent in 1986.

In 1987 trade liberalization went even further. Import permits were also reduced for consumption goods, and by 1988 import permits covered just 20 percent of all imported goods. Tariffs were also cut and homogenized (to just five rates—0, 5, 10, 15, and 20 percent). The average tariff, weighted by import volume, fell to 6 percent. A few agricultural products and manufactured products (particularly automobiles) remained protected after the liberalization, accounting for 25 percent of tradable production.²

Because more than two-thirds of Mexico's external trade is with the United States, NAFTA implied almost free trade for Mexico. The only sectors not completely liberalized were some agricultural products, automobiles, and oil. Imports expanded significantly after the liberalization, while exports decreased slightly as a share of GDP. Imports grew from 9.6 percent of GDP in 1984 to 21.7 percent in 1994; exports fell from 17.4 to 16.8 percent of GDP in the same period.

¹ The description of these processes that follows was taken from Ros (1999).

² For more on Mexican trade liberalization, see Ros (1999) and Lustig (1998).

Restrictions on foreign investment were also eased starting in 1984. Although the 1973 foreign investment law was not changed until 1993, the government started to interpret the law less strictly beginning in 1984. Financial opening started in 1988, when the government liberalized reserve requirements, interest rate ceilings, and exchange rate markets. During 1989-90 the government opened the money market and the stock market to foreign investors. As a result capital inflows jumped from \$3.5 billion in 1989 to \$33.3 billion in 1993—the year before the balance of payments crisis. About 85 percent of this was portfolio investment; foreign direct investment accounted for a small share of the total. Trade and financial liberalization was combined with a macroeconomic policy that used the exchange rate as a nominal anchor to fight inflation. As a result of this policy the peso appreciated more than 40 percent in real terms between 1988 and 1993.

Appreciation of the currency, along with trade liberalization, lowered the relative price of tradable goods and made the production of these goods far less profitable. According to Ros (1999), reduced profitability in these sectors mainly benefited highly skilled labor and hurt unskilled labor. The share of profits and interest revenue in tradable goods activities fell from an average of 34 percent of national income in 1982-87 to 14 percent in 1993. Profits and interest revenue from nontradable goods grew from 20 percent of national income in 1982-87 to 36 percent in 1993 (Ros, 1999, table 2).

Data and methodology

The purpose of this paper is to simulate Mexican income under the assumption that labor market conditions remained the same in 1994 as in 1984, the year before trade reform began. This is

done using a counterfactual methodology developed by the United Nations Development Programme (UNDP) for a study on the impacts of trade liberalization on poverty and inequality in Latin America. The methodology imposes the 1984 structure of the labor market (a counterfactual scenario that reflects economic conditions before trade reform) on 1994 data to generate a new income distribution. The data and methodology are described below.

Data

As noted, the findings of this paper are based on data from Mexican household surveys for 1984 and 1994. The surveys have national coverage, with a sample of 4,735 households for 1984 and 12,815 households for 1994.

The 1984 survey was chosen because it is the most recent survey available before trade reform started in 1985. Although there are surveys available for 1989 and 1992, the 1994 survey was chosen because macroeconomic conditions in that year were the most similar to those in 1984. Thus the changes in the labor market between 1984 and 1994 do not reflect major changes in macroeconomic conditions other than those related to trade reform and economic liberalization.

Methodology

The methodology assumes that the variables L_j , U_j , S_{kj} , and w_{kj} define the labor market structure in the base year (1994). L_j is the percentage of the economically active population in cluster j that participates in the labor force. U_j is the percentage of labor force participants in cluster j who are unemployed. S_{kj} is the percentage of individuals in cluster j employed in sector k , and w_{kj} is the average wage in sector k for individuals in cluster j . The paper considers six clusters and six

economic sectors. The clusters are defined by education level and gender. Workers are grouped in three education levels: low (primary education or less), intermediate (more than primary education but less than college education), and high (college education or more). The economic sectors are defined by production sectors (agriculture, manufacturing and mining, and services) and by activity (wage and nonwage earners).

The variables L_j^c , U_j^c , S_{kj}^c , and w_{kj}^c define the labor market structure in the counterfactual year (1984). Inequality measures can be calculated with the observed data of the base year, $I(L, U, S, w)$, and for the data of the base year once the labor force structure of the counterfactual has been imposed $I(L^c, U^c, S^c, w^c)$. The difference between these two measures reflects the change in inequality due to changes in the structure of the labor market. Though it would be useful to do the same exercise using 1984 as the base year and 1994 as the counterfactual year, the size of the 1984 survey (one-third the 1994 one) prevents us from doing so. Other studies that do this with methodologies more suitable for the exercise show results consistent with those found in this paper (Legovini, Bouillon, and Lustig 2000).

It is possible to estimate the effect on inequality of each change in the labor market. The total change in inequality due to changes in the labor market is given by:

$$?I(L, U, S, w) = I(L, U, S, w) - I(L^c, U^c, S^c, w^c).$$

The change in inequality due to changes in labor force participation is given by:

$$?I(L) = I(L, U, S, w) - I(L^c, U, S, w).$$

The change in inequality due to changes in unemployment is given by:

$$\Delta I(U) = I(L, U, S, w) - I(L, U^c, S, w).$$

The change in inequality due to changes in the structure of employment is given by:

$$\Delta I(S) = I(L, U, S, w) - I(L, U, S^c, w).$$

Finally, the change in inequality due to changes in the relative incomes of different groups of workers is given by:

$$\Delta I(w) = I(L, U, S, w) - I(L, U, S, w^c).$$

For the simulation, inequality measures are calculated for earners' individual income as well as for per capita household income. The simulation is done for each individual effect, as well as in a cumulative way to check for the robustness of the individual simulation. The cumulative simulation is path dependent, and a specific path was chosen for the paper (first labor force participation, then labor force participation and unemployment, then labor force participation, unemployment, and economic sector of employment, and finally all the effects). To impose the labor structure of the counterfactual year on the base year, the methodology proceeds as follows.

Labor force participation. For cluster j , if $L_j > L_j^c$ ($L_j < L_j^c$), participating (nonparticipating) individuals in the base year will be randomly taken out from (put in) the labor

force until the percentage of participating individuals is equal to L_j^c . Individuals taken out from (put in) the participating group will be taken out from (put in) the employed and unemployed segments of the cluster to keep unchanged the percentage of unemployed individuals in the active population of the cluster (U_j).

If $L_j < L_j^c$, some individuals without earnings will be included in the labor force. To assign them an income, first, using a random number, a percentile is assigned to all individuals in the cluster not working. Second, percentiles of income and the average incomes corresponding to those percentiles are calculated for individuals in the cluster working. If an inactive individual is chosen to be employed, the average income of the working population percentile corresponding to her randomly assigned percentile will be imputed to her.

Unemployment. For individuals participating in the labor force in cluster j , if $U_j < U_j^c$ ($U_j > U_j^c$), employed (unemployed) individuals in the base year will be randomly taken out from (put in) employment until the percentage of unemployment is equal to U_j^c . If $U_j > U_j^c$, some unemployed individuals without earnings will be included in the labor force. To assign them an income, the procedure described above will be repeated.

Sector of employment. For employed individuals in cluster j , if $S_{jk} > S_{jk}^c$ ($S_{jk} < S_{jk}^c$), employed workers in sector k in the base year will be randomly taken out from (put in) sector k and put in (taken out from) sector q until the percentage of employed workers in sector k is equal to S_{jk}^c and the percentage of employed workers in sector q is equal to S_{jq}^c . When a worker is moved from sector k to sector q , a new income has to be assigned to her. To do so, income percentiles for workers in each cluster j and each economic sector k are computed, as is the

average income for each percentile. When a worker in cluster j is moved from sector k to sector q , the average income of the percentile in cluster j and sector q corresponding to her original percentile in cluster j and sector k will be imputed to her.

Average wage by economic sector. For each employed individual i in cluster j , her income w_{jki} will be replaced by the following simulated income:

$$w_{jki}^c = \frac{w_{jki} \cdot \bar{w}^c}{\bar{w}_{jk} \cdot \bar{w}}$$

where \bar{w} is the average wage for all workers in the base year, \bar{w}^c is the average wage for all workers in the counterfactual year, \bar{w}_{jk} is the average wage for individuals in cluster j employed in sector k in the base year, and \bar{w}_{jk}^c is the average wage for individuals in cluster j employed in sector k in the counterfactual year.

For the cumulative simulation, the procedure to simulate the change in the structure of the labor market is similar to the one described above but with the changes made simultaneously. When a worker is moved from one sector to another or from not working to working, an income is assigned using percentiles generated on the basis of her observed income or a random number.

The methodology described above measures the effect on labor income inequality of changes in labor force participation, unemployment, structure of employment by economic sector, and mean income by group of workers. Household surveys make it possible to calculate

the effects mentioned above on individual earnings inequality as well as household income inequality.

Structure of Mexico's labor market before and after trade reform

Tables 2-6 show features of Mexico's labor market before (1984) and after (1994) trade reform began in 1985. One of the most important findings of these tables is that in the manufacturing sector the adjustment to reform came mainly through changes in wages and earnings rather than through changes in employment.

Changes in labor force participation and unemployment

One variable that showed an important change between 1984 and 1994 was the labor force participation rate, which rose for both men and women (see table 2). The increase in participation increased with the worker's education level. Poorly educated women increased their participation rates by just 5 percentage points, while highly educated women did so by 15 percentage points. Similarly, only men with intermediate and high education raised their labor force participation rates. The biggest increase was among intermediate educated men, whose participation rates rose by 16 percentage points.

Table 2
Labor force participation rates and unemployment rates by gender and education level, 1984 and 1994
(percent)

	Education level							
	Total		Low		Intermediate		High	
	1984	1994	1984	1994	1984	1994	1984	1994
Male								
Participation rate	69.67	74.56	77.96	77.79	51.76	67.36	72.72	82.94
Unemployment rate	4.22	4.69	3.19	4.36	6.80	5.97	5.88	2.71
Female								
Participation rate	22.57	30.47	20.35	25.28	25.85	33.87	43.73	58.66
Unemployment rate	3.59	3.38	1.57	1.62	8.36	4.90	1.92	5.18

Source: Author's calculations based on Mexican household surveys.

Total unemployment rates varied by less than half a percentage point for both men and women between 1984 and 1994 (see table 2). For men, unemployment was almost unchanged for those with poor and intermediate educations (1 and -1 percentage points). But unemployment fell by more than 3 percentage points for highly educated men. For women, there was a slight reduction in unemployment, mainly caused by a 3.5 percentage point reduction in the unemployment of women with an intermediate education. Highly educated women saw unemployment increase by more than 3 percentage points.

Changes in the structure of employment and income by economic sector

Changes in the structure of employment by sector are presented in table 3. Manufacturing and mining experienced small increases in employment share after trade reform. These results are controversial because one would expect employment to have shifted out of manufacturing sectors that compete with imports. But while the employment comparisons between 1984 and

1994 using household surveys show an increase in employment in manufacturing and mining, wage and nonwage, and a large drop in male nonwage agricultural employment, comparisons using urban employment surveys for 1988 and 1993 show a decrease in manufacturing and mining employment and an increase in agricultural employment (Ros 1999).

This discrepancy in employment trends between household surveys and urban employment surveys suggests caution for drawing conclusions from household survey data. But the modest effect of trade reform on employment has been documented in many previous studies using other data sources. As reported by Harrison and Hanson (1999b), studies for Mexico that analyze the effects of trade reform on the labor market show a small effect on employment (see Revenga, 1994. Mexico's labor market remained highly regulated after the reform, which could explain the lack of flexibility in employment. Harrison and Hanson find extremely low correlations between output and employment levels (0.9 in the short run and 0.13 in the long run) for Mexican industries. They find neither positive nor negative correlations between changes in output or employment and changes in tariffs or quotas.

Table 3
Employment structure by gender and education level, 1984 and 1994
(percent)

	Education							
	Total		Low		Intermediate		High	
	1984	1994	1984	1994	1984	1994	1984	1994
Male								
Wage								
Agriculture	14.5	12.8	18.6	19.8	6.3	5.2	0.4	0.6
Manufacturing and mining	14.5	16.4	11.6	12.8	22.6	23.8	18.1	13.0
Services	38.2	43.1	28.8	32.4	57.3	52.8	67.6	67.2
Nonwage								
Agriculture	19.5	10.6	27.1	17.1	1.7	2.6	1.2	1.3
Manufacturing and mining	2.3	2.8	2.7	3.6	1.4	1.8	1.4	1.9
Services	11.1	14.3	11.2	14.2	10.8	13.7	11.3	16.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Female								
Wage								
Agriculture	3.1	1.7	4.3	3.3	0.8	0.3	0.7	0.2
Manufacturing and mining	12.1	13.8	12.5	11.7	12.2	18.1	7.9	7.4
Services	53.5	52.5	37.4	32.7	81.8	67.3	90.8	84.1
Nonwage								
Agriculture	8.2	8.8	12.6	17.7	0.2	0.8	-	-
Manufacturing and mining	3.2	5.2	4.3	8.6	1.2	2.5	0.5	0.4
Services	20.0	18.0	29.0	26.1	3.9	11.1	0.2	7.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Author's calculations based on Mexican household surveys.

Household survey data show that among men only highly educated manufacturing and mining wage workers reduced their participation in total employment after trade reform. This group of workers moved to the nonwage service sector. It is possible that these workers, due to their high education, were employed in managerial positions and had more labor flexibility than less educated and unionized workers. Finally, the employment share of medium-educated

manufacturing and mining female wage workers rose substantially between 1984 and 1994. This phenomenon could be linked to the rise in *maquiladora* industries.

The small increase in employment in manufacturing and mining was accompanied by almost no growth in real wages, resulting in an important reduction in the premium in that sector. While the mean income across sectors rose about 17 percent between 1984 and 1994, manufacturing and mining wage income stayed almost constant (see table 4). This result could be explained first by the reduction in the share of highly educated workers in the sector—and second, by the decrease in the wages of medium and poorly educated workers (see tables 5 and 6). Trade reform generated a big adjustment in real wages for less educated workers in the sector, partly imposed by the lack of employment flexibility of workers protected by labor legislation (see Hanson and Harrison, 1999b).

Table 4
Average income by economic sector, 1984 and 1994

	1984	1994
1994 real pesos		
Wage		
Agriculture	480.0	478.3
Manufacturing and mining	1,238.9	1,236.2
Services	1,169.2	1,447.0
Nonwage		
Agriculture	905.1	501.6
Manufacturing and mining	995.2	1,143.0
Services	1,039.8	1,419.6
Total	1,034.6	1,213.5
1984=100		
Wage		
Agriculture	100.0	99.6
Manufacturing and mining	100.0	99.8
Services	100.0	123.8
Nonwage		
Agriculture	100.0	55.4
Manufacturing and mining	100.0	114.9
Services	100.0	136.5
Total	100.0	117.3
Total=100		
Wage		
Agriculture	46.4	39.4
Manufacturing and mining	119.7	101.9
Services	113.0	119.2
Nonwage		
Agriculture	87.5	41.3
Manufacturing and mining	96.2	94.2
Services	100.5	117.0
Total	100.0	100.0

Source: Author's calculations based on Mexican household surveys.

Table 5
Average income by gender and education level, 1984
and 1994

	1984	1994
1994 real pesos		
Male		
High education	2,535.0	4,056.5
Intermediate education	1,315.5	1,326.2
Low education	907.3	826.2
Female		
High education	1,535.9	2,240.5
Intermediate education	1,101.1	1,043.8
Low education	554.4	415.1
Total	1,034.6	1,213.5
1984=100		
Male		
High education	100.0	160.0
Intermediate education	100.0	100.8
Low education	100.0	91.1
Female		
High education	100.0	145.9
Intermediate education	100.0	94.8
Low education	100.0	74.9
Total	100.0	117.3
Total =100		
Male		
High education	245.0	334.3
Intermediate education	127.1	109.3
Low education	87.7	68.1
Female		
High education	148.4	184.6
Intermediate education	106.4	86.0
Low education	53.6	34.2
Total	100.0	100.0

Source: Author's calculations based on Mexican household surveys.

Table 6
Average income by gender, education level, and economic sector, 1984 and 1994
(1994 real pesos unless otherwise specified)

	Male			Female		
	1984	1994	Percentage change	1984	1994	Percentage change
High education						
Wage						
Agriculture	1,702.5	4,784.9	181.0	1,733.9	3,073.9	77.3
Manufacturing and mining	2,643.8	4,343.0	64.3	1,845.4	2,145.9	16.3
Services	2,366.1	3,925.4	65.9	1,509.4	2,260.0	49.7
Nonwage						
Agriculture	7,586.9	4,123.6	-45.6	n.a.	n.a.	n.a.
Manufacturing and mining	3,547.2	3,674.3	3.6	1,532.5	179.6	-88.3
Services	2,730.8	4,388.0	60.7	353.3	2,212.4	526.2
Intermediate education						
Wage						
Agriculture	546.1	480.8	-11.9	269.6	205.5	-23.8
Manufacturing and mining	1,371.7	1,337.6	-2.5	932.9	838.0	-10.2
Services	1,306.9	1,255.4	-3.9	1,151.6	1,131.9	-1.7
Nonwage						
Agriculture	2,195.2	1,146.5	-47.8	258.8	129.6	-49.9
Manufacturing and mining	1,631.7	1,437.2	-11.9	463.3	388.1	-16.2
Services	1,514.1	1,920.7	26.8	967.0	1,077.5	11.4
Low education						
Wage						
Agriculture	484.7	463.1	-4.5	283.5	304.7	7.5
Manufacturing and mining	1,088.3	849.2	-22.0	816.5	545.0	-33.3
Services	958.3	935.3	-2.4	639.9	518.0	-19.1
Nonwage						
Agriculture	937.4	551.7	-41.1	314.8	113.6	-63.9
Manufacturing and mining	1,127.2	1,767.1	56.8	336.3	278.3	-17.3
Services	1,166.4	1,154.8	-1.0	507.4	491.2	-3.2

Source: Author's calculations based on Mexican household surveys.

Reventa (1994), Venables and Wijnbergen (1993), and Hanson and Harrison (1999a) describe the adjustment through wages in manufacturing. Venables and Wijnbergen, cited by Hanson and Harrison, show that trade reform led to important reductions in the cost-price ratios in manufacturing.

Revenga, also cited by Hanson and Harrison, emphasizes that the adjustment in manufacturing mainly came through lower wages in previously protected sectors with high unionization. She finds that workers share the rents in protected sectors and that on average, a 20 percent tariff reduction resulted in a 5-6 percent reduction in wages. According to Revenga, the adjustment came more through wages than through changes in employment. Hanson and Harrison argue that firms in Mexico adjusted to the reform through changes in productivity and reductions in profits and wages rather than through adjustments in output or employment.

One of the sectors that suffered the most after reform was agriculture, especially small nonwage male farmers. According to household surveys, the biggest change occurred among poorly educated nonwage male farmers, whose share of employment fell from 27 to 17 percent (see table 3). The participation rate of nonwage male farmers with higher education remained stable, as did the employment of wage workers in the sector.

The movement of nonwage workers outside agriculture was motivated by a nearly 45 percent drop in their income (see table 4). Although trade reform initially tried to protect agriculture (see Ros, 1999), small farmers were hit hard by movements in the international prices of their most important crops. Lustig and Székely (1999) found a substantial increase in poverty among rural workers in south and southeast Mexico between 1989 and 1994. The authors identified three causes for the drop in farmers' income: the collapse of price guarantees for crops, high interest rates, and the elimination of agricultural subsidies (see also de Janvry, Gordillo, and Sadoulet, 1997). This notorious reduction in government support, combined with a more than 70 percent drop in international coffee and cacao prices between 1984 and 1992, harmed small farmers and indigenous communities.

For male workers, the service sector was one of the main generators of employment between 1984 and 1994. For females, employment in the sector fell slightly. Male employment in wage services rose mainly for workers with little education and fell for workers with intermediate education (see table 3). Employment for male nonwage workers in the sector rose for all three levels of education, especially for highly educated workers, absorbing the drop in employment in manufacturing and mining. Similar developments occurred for female nonwage workers in the sector, though employment fell for the poorly educated. Among female wage workers in the sector, the share of total employment fell for all levels of education—especially intermediate education. Manufacturing and mining and nonwage services absorbed these workers.

The absorption of male labor in the service sector was motivated by an above average increase in the sector's mean real income between 1984 and 1994. The average income of wage workers in the sector grew 24 percent and that of nonwage workers, 37 percent (see table 4). This simultaneous increase in employment and income reveals an important increase in the demand for labor at all education levels in service activities. Growth in such activities started in the 1970s but intensified during 1984-94. Between 1991 and 1993, 89 percent of new jobs created were in the service sector. These new jobs are not homogeneous, and they include less productive jobs in the informal sector. But they also include jobs generated by the liberalization and modernization of the economy in wholesale trade, retail, tourism, and transport and communications (see OECD, 1997).

Changes in returns to education

The most important change in Mexico's labor market since trade reform has been the sharp increase in returns to well-educated workers. Between 1984 and 1994 the average real income of highly educated male workers rose 60 percent and that of highly educated female workers rose 46 percent (see table 5). The income of male workers with intermediate education did not change, while that of comparable female workers fell around 5 percent. Poorly educated workers suffered the most after reform: their real incomes fell by 9 percent for men and 25 percent for women.

The drop in returns to lower education has been documented by many studies for Mexico and other Latin American countries. For Mexico see Bouillon, Legovini, and Lustig (1999); Legovini, Bouillon, and Lustig (2000); Hanson and Harrison (1999a, 1999b); Meza (1997); Cragg and Epelbaum (1996); and Robbins (1996). For other Latin American countries see Robbins (1996).

The increase in returns to highly educated workers can be explained by trade-induced factors or by domestic factors. The literature argues that there are two ways in which trade liberalization may have raised the income of better-educated workers. The first argument, based on the Stolper-Samuelson theorem, asserts that trade reform cut tariffs in sectors that relied on low-skill labor or that were competing with more labor-intensive countries, such as China. Under this framework the reform process changed relative prices in the "wrong" way—that is, in favor of sectors that relied on skilled labor (Ros, 1999).

The second argument is that trade reform drastically cut the cost of imported physical capital, which relies on the use of skilled labor. Reform also eased restrictions on foreign

investment, allowing the adoption of foreign production processes and technologies also intensive in skilled labor. Both effects created a trade-induced, skill-biased technical change in countries that liberalized trade and foreign investment in the early 1990s.

Hanson and Harrison (1999a, 1999b) present evidence for both arguments. The authors show that in Mexico, tariff protection favored industries that relied on unskilled labor, which would support the Stolper-Samuelson effects of reform. These effects caused big drops in wages, more than in employment. Constrained by rigidities in employment, firms responded to increased competition from abroad by lowering wages. Hanson and Harrison also find that the deregulation of foreign direct investment caused a big increase in such investment, especially in the maquiladora industry. Citing Feenstra and Hanson (1997), the authors point out that the demand for skilled labor is correlated with the number of maquiladoras—indicating that foreign direct investment could have contributed to the higher demand for skilled labor.

Domestic factors may also explain the increase in the income of better-educated workers. Domestic changes in production processes or skill-biased technical change inspired by domestic innovation could have increased the demand for highly educated workers. It has also been argued that the stabilization of the Mexican economy after the 1987 recession was driven by wage controls for low-skilled workers.

This section has shown the damage that trade reform did to the wages of poorly educated manufacturing and mining workers. On average, manufacturing and mining workers did not see their income fall after reform (see table 4)—but the average income for poorly educated wage workers in the sector did fall (see table 6). Male workers saw real wages fall by 22 percent, while female workers saw a drop of 33 percent. Across sectors, only self-employed agricultural workers experienced bigger decreases in average income.

Effects on inequality of changes in the labor market

Estimates of the effects on inequality of the changes in the labor market described above are shown in tables 7 and 8. Results are shown for individual earnings as well as for household per capita income. The tables report the Gini coefficient in 1994 (the base year) and the Gini that would have occurred if the counterfactual labor market structure (in 1984) were imposed on the base year economy. When the simulation included random components, it was repeated 50 times to check the robustness of the estimates. The maximum and minimum values of the simulated Gini are also presented for these cases. Table 7 presents the individual effects of the simulation, while table 8 presents the results of the cumulative simulation.

The most important result of both simulations is the strong impact on inequality of changes in the average incomes of different groups of workers. These changes caused inequality to increase by about 5 percentage points (10 percent) in the 1994 Gini for individual earners and 4 points (8 percent) in the 1994 Gini for per capita household income (see table 7).

Table 7
Counterfactual simulation: Gini coefficients for individual effects

	Base Gini (1994) ¹	Simulated Gini (with 1984 labor market structure) ²	Change in the Gini due to changes in labor market structure ³					
			Points			Percentage		
			Mean	Max	Min	Mean	Max	Min
Individual labor income								
Participation rate	55.27	55.46	0.19	0.51	-0.43	0.35	0.92	-0.78
Unemployment rate	55.27	55.18	-0.09	0.07	-0.25	-0.16	0.12	-0.45
Structure of employment	55.27	55.25	-0.02	-0.48	0.23	-0.03	-0.88	0.42
Change in average income by economic sector	55.27	49.91	-5.36	-	-	-9.70	-	-
Per capita household income								
Participation rate	53.51	54.12	0.61	1.03	0.16	1.14	1.93	0.30
Unemployment rate	53.51	53.32	-0.19	-0.08	-0.35	-0.35	-0.15	-0.66
Structure of employment	53.51	53.62	0.11	-0.17	0.30	0.21	-0.31	0.56
Change in average income by economic sector	53.51	49.43	-4.08	-	-	-7.63	-	-

Notes: 1) This column shows the Gini coefficient obtained with the data from the 1994 household survey.

2) This column shows the Gini coefficient obtained when the 1984 labor market structure is imposed on the 1994 economy. Because parts of the simulation are based on random numbers, the results presented in this column are the average of the simulation repeated 50 times.

3) These columns show the changes in the Gini coefficient due to changes in the labor market structure (column 2 minus column 1). The results show the mean changes in the Gini coefficient and the minimum and maximum values of the simulation.

Source: Author's calculations based on Mexican household surveys.

Table 8
Counterfactual simulation: Gini coefficients for cumulative effects

	Base Gini (1994) ¹	Simulated Gini (with 1984 labor market structure) ²	Change in the Gini due to changes in Labor Market Structure ³					
			Points			Percentage		
			Mean	Max	Min	Mean	Max	Min
Individual labor income								
Participation rate	55.27	55.46	0.19	0.51	-0.43	0.35	0.92	-0.78
Participation rate + unemployment rate	55.27	55.32	0.05	-0.59	0.50	0.09	-1.07	0.91
Participation rate + unemployment rate + structure of employment	55.27	55.53	0.26	-0.26	0.73	0.47	-0.48	1.33
Participation rate + unemployment rate + structure of employment + changes in average income by economic sector	55.27	50.06	-5.21	-5.76	-4.81	-9.43	-10.42	-8.70
Per capita household income								
Participation rate	53.51	54.12	0.61	1.03	0.16	1.14	1.93	0.30
Participation rate + unemployment rate	53.51	53.89	0.38	-0.16	0.79	0.71	-0.30	1.48
Participation rate + unemployment rate + structure of employment	53.51	54.09	0.58	0.17	1.10	1.08	0.33	2.06
Participation rate + unemployment rate + structure of employment + changes in average income by economic sector	53.51	50.27	-3.24	-3.65	-2.69	-6.06	-6.82	-5.03

Notes: See the notes to table 7. For this table the simulation is done in a cumulative way: the cumulative simulation is path dependent, and a particular path was chosen. This is done to check for the robustness of the effects estimated in table 7; in a general equilibrium model all the changes depicted in this table occur simultaneously.

Source: Author's calculations based on Mexican household surveys.

Changes in labor force participation, unemployment, and the structure of employment had much less effect on the increase in inequality. Of these, the change in labor force participation was the most important, with an equalizing effect of 0.19 in the Gini for individuals and 0.61 in the Gini for per capita household income.

Although as a group the three changes had an equalizing effect, that effect is small relative to the opposite effect of changes in the average income of different groups of workers (see table 8). The following sections analyze each effect in detail.

Effects of changes in labor force participation, unemployment, and structure of employment

The changes in labor force participation that followed trade reform mainly resulted from changes in demographic variables (such as the number of children in the household and the age composition of household members), as well as from changes in cultural characteristics. The biggest increases in participation occurred among better-educated individuals (see table 2). Economic liberalization and modernization or skill-biased technical change motivated by domestic factors may have increased the demand for such workers, increasing their participation.

In this case the equalizing effects arise from the increase in participation among workers with an intermediate education, both male and female, and from the increase in participation among poorly educated women. The effects of these changes are stronger at the household level—possibly indicating that these changes are endogenous at the household level, responding in most cases to falls in household income. Legovini, Bouillon, and Lustig (2000) also found these type of effects using the Bourguignon, Fournier, and Gurgand (1998) methodology.

Changes in unemployment after trade reform contributed to the increase in inequality, but in small amounts. The effect is smaller at the individual earner level than at the household level. As noted, after economic liberalization and modernization there was a jump in the demand for highly educated male workers, especially in the service sector. This generated a substantial decline in unemployment among these workers (see table 2). The high incomes of these workers explain the negative effect on equality of the decrease in unemployment after 1984.

Changes in the structure of employment had almost no effect on inequality at the individual level (see table 7). At the household level the effect was slightly equalizing. The results at the individual level likely reflect a combination of equity-enhancing and equity-reducing changes in the structure of employment after 1984. The most important equity-enhancing changes were reduced participation by poorly educated male workers in nonwage agriculture and increased participation by these workers in wage and nonwage services (see table 3). Incomes in the service sector are almost twice those in nonwage agriculture. Reduced male participation in nonwage agriculture was offset by increased female participation in the sector, constituting the most equity-reducing force in the period.

Male workers with an intermediate education also increased their participation in nonwage and wage services. This effect could have been slightly equity reducing because the nonwage service sector has a higher average income than other sectors. Female workers with an intermediate education saw employment fall in wage services while increasing in manufacturing and mining and nonwage services. There is no apparent relationship between changes in female participation and changes in their average income across sectors.

Although employment among highly educated workers shifted from wage manufacturing and mining to nonwage services, this shift should not have had distributive effects because the

average income across sectors for highly educated workers became homogeneous after trade reform (see table 6). Highly educated female workers saw employment fall in wage services and increase in nonwage services. This shift also should not have had distributive effects because both sectors have similar incomes.

Effects of changes in average incomes

As noted, changes in average incomes across groups and sectors did the most to increase inequality (see tables 7 and 8). There are three main reasons. The first is the large increase in the income of highly educated workers. The second is the deterioration in the real income of poorly educated wage workers in manufacturing and mining and the stagnation in the real income of moderately educated wage workers in the same. The third reason is the big drop in the income of independent agricultural workers, especially small farmers.

After trade reform Mexico's labor market saw an increase in the returns to education—an increase that was uniform across sectors.³ Previous studies attribute this increase to the trade-induced, skilled-biased technical change discussed above (Ros 1999; Hanson and Harrison, 1999b; Robbins, 1996; Cragg and Epelbaum, 1996). The higher returns could also have been generated by skill-biased technical change induced by domestic factors.

That both the employment and wages of educated service workers rose suggests that changes in demand in this sector played an important role in the increased returns to highly educated workers. Manufacturing and mining, by contrast, saw their share of employment fall

³ Table 6 shows extreme changes for highly educated female workers in nonwage activities; this is caused by the small number of cases in the sample for those sectors.

after the reform. Is this development in the service sector related to economic reform and liberalization or to domestic factors?

As noted, the increased demand for highly educated workers in nontradable sectors could be interpreted as evidence of skill-biased technical change induced by domestic factors. But some of the new service jobs were generated in activities related to economic opening and modernization. Some could be linked to capital account liberalization and financial sector opening. After trade reform, Mexico experienced a big increase in income in sectors involving nontradable goods—especially the service sector (see table 3 and OECD, 1997). Trade reform and capital account liberalization could have caused the growth of the more modern activities in the service sector.

Bouillon, Legovini, and Lustig (1999) and Legovini, Bouillon, and Lustig (2000) identify the higher returns to education after Mexico's trade reform. Bouillon (2000) finds the same result for male wage workers. All three papers use national household surveys and the methodology proposed by Bourguignon, Fournier, and Gurgand (1998). They find that the higher returns after trade reform explain about one-quarter of the increase in inequality between 1984 and 1994.

One of the effects of trade reform that may have done the most to increase inequality was the reduction in real income of manufacturing and mining workers with low and intermediate education. As noted, these workers had shared the rents generated by protection, especially in unionized industries. After reform the adjustment to foreign competition came through changes in wages and profits rather than through changes in employment. This translated into a 22 percent drop in the real income of poorly educated male wage workers, a 33 percent drop for poorly educated female wage workers, a 2.5 percent drop for male wage workers with

intermediate education, and a 10 percent drop for female wage workers with intermediate education (see table 6).

The third factor contributing to higher inequality after trade reform was the deterioration in the average income of independent farmers. These farmers' income fell by more than 40 percent at all education levels (see table 6). The inequality-increasing effects of lower farmers' income has been documented by Bouillon, Legovini, and Lustig (1999) and Legovini, Bouillon, and Lustig (2000). Those authors found that deteriorating conditions in rural areas, especially in southern Mexico, accounted for about 20 percent of the increase in inequality.

Conclusion

This paper has estimated the effects on inequality of changes in Mexico's labor market after trade reform in the mid-1980s. The most important changes in the labor market, either by their magnitude or by their effect on the inequality of labor income and household income, were the changes in the income of different groups of workers (distinguished by gender, education level, and sector of employment).

Three factors explain the inequality-increasing effect of changes in the structure of average income. The first is the large increase in the income of highly educated workers. This increase occurred in all sectors—especially nontradable sectors, where highly educated workers accounted for a growing share of employment. Second, foreign competition lowered the average income of manufacturing and mining wage workers with low and intermediate education. Third, independent farmers, who are generally poorly educated, saw a significant drop in their average

income because of lower international prices for their major crops and because state aid was eliminated.

The counterfactual simulation shows that changes in labor force participation, unemployment, and structure of employment had limited effects on inequality for individual earners and for per capita household income. Household surveys show that after the reform, low and moderately educated workers in manufacturing and mining saw small changes in employment. Changes in unemployment were also small. The adjustment in manufacturing and mining in the face of increased foreign competition mainly came through changes in wages.

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