



DISCUSSION PAPER SERIES

IZA DP No. 3788

North-South Trade Liberalization and Returns to Skill in the South: The Case of Mexico

Gautam Hazarika
Rafael Otero

October 2008

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

North-South Trade Liberalization and Returns to Skill in the South: The Case of Mexico

Gautam Hazarika

*University of Texas at Brownsville
and IZA*

Rafael Otero

University of Texas at Brownsville

Discussion Paper No. 3788
October 2008

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

Any opinions expressed here are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but the institute itself takes no institutional policy positions.

The Institute for the Study of Labor (IZA) in Bonn is a local and virtual international research center and a place of communication between science, politics and business. IZA is an independent nonprofit organization supported by Deutsche Post World Net. The center is associated with the University of Bonn and offers a stimulating research environment through its international network, workshops and conferences, data service, project support, research visits and doctoral program. IZA engages in (i) original and internationally competitive research in all fields of labor economics, (ii) development of policy concepts, and (iii) dissemination of research results and concepts to the interested public.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ABSTRACT

North-South Trade Liberalization and Returns to Skill in the South: The Case of Mexico

This study examines the effect of NAFTA, an instance of North-South trade liberalization, on returns to skill in Mexico. Mexico is abundant in low-skill workers relative to the US and Canada, and so, by the Heckscher-Ohlin-Samuelson trade model, NAFTA ought to have raised the relative earnings of low-skill workers, that is, lowered returns to skill in Mexico. Analysis of Mexican labor micro-data yields the finding that while returns to skill in industries producing tradeables have risen, *ceteris paribus*, since Mexico embarked upon trade liberalization by joining the GATT in 1986, this rise was less pronounced by 1999 in industries liberalized relatively rapidly by NAFTA, launched in 1994, than in industries liberalized relatively slowly by this phased trade treaty. This is considered evidence of NAFTA holding back rise in returns to skill, since it is plausible such a dampening would have been more marked in industries more rapidly exposed to trade with Mexico's skill abundant northern neighbors. Hence, this study suggests trade with developed nations may lower returns to skill in developing nations. It is speculated this may slow the pace of private human capital accumulation in developing nations, with negative consequences for their economic growth.

JEL Classification: F11, I21

Keywords: NAFTA, Heckscher-Ohlin model, human capital

Corresponding author:

Gautam Hazarika
Department of Business Administration
The University of Texas at Brownsville
80 Fort Brown
Brownsville, TX 78520
USA
E-mail: gautam.hazarika@utb.edu

I. Introduction

Neo-Classical theory contends international trade may alter returns to skill and, thereby, the distribution of earnings. Indeed, international trade is held by some to be the primary factor in widening earnings inequality in the U.S. (for example, Burtless 1995). The import from less developed countries, the South, of goods intensive in the use of low-skill workers has, it is argued, depressed these workers' earnings in developed countries, the North, thereby raising returns to skill and widening earnings inequality. By this argument, North-South trade ought to have raised the earnings of low-skill workers and, hence, reduced earnings inequality in the South. Consequently, this paper aims to contribute to the body of research examining the effect of the North American Free Trade Agreement (NAFTA), an instance of North-South trade liberalization, upon returns to skill in Mexico.

This is a worthy subject of study because it is distinctly possible that lowered returns to skill in the South upon the opening up of trade with the North shall hinder the South's ability to realize dynamic gains from trade, that is, international trade stimulated economic growth. Grossman and Helpman (1994) summarize the reasons why integration into the world economy is an important factor in national economic growth. First, a nation integrated into world markets enjoys access to a larger technical knowledge base than an autarky. Second, international competition forces domestic firms to be innovative rather than the merely imitative. Third, by expanding firms' customer base, economic integration raises the profitability of industrial research. It is likely these causal connections between international openness and economic growth hinge upon the availability of human capital, for a nation's ability to absorb new technologies from abroad increases in its stock of human capital (for example, Tybout 2000), and it is evident that industrial research and development is a human capital intensive endeavor. If rates of return to skill in developing countries were depressed upon the liberalization of trade with developed countries, developing countries would see a blunting of private incentives to accumulate human capital. With dampened private human capital accumulation, the capacities of developing countries to realize dynamic gains from trade may decline. As it is, the maximum dynamic gains attainable by developing nations are limited by the low-technology nature of the goods that static comparative advantage dictates they produce (for example, Young 1991). In addition, lowered private human capital accumulation may hold back national economic growth directly, that is, in ways unrelated to international trade (for example, Lucas 1988).

Trade liberalization in Mexico may be said to have begun in earnest upon the Nation's joining the General Agreement on Tariffs and Trade (GATT) in 1986. A second momentous event in Mexico's history of trade liberalization was the launch of NAFTA in 1994. As described by Robertson (2004), the periods 1986 – 1994 and 1994 – present are notably dissimilar in that the relative prices of skill-intensive goods in Mexico and, consequently, the relative earnings of skilled workers, rose between 1986 and 1994, but have fallen thereafter. The Heckscher-Ohlin-Samuelson model predicts that trade based on comparative advantage shall lead to increases in the relative prices of goods intensive in the use of a nation's abundant resource and, therefore, to a rise in the relative price of this resource. Since it is commonly believed Mexico is abundant in low-skill workers, rise in the relative earnings of skilled workers, that is, *fall* in the relative earnings of low-skill workers in the period of trade liberalization preceding NAFTA is puzzling. Hanson and Harrison (1999) and, more successfully, Robertson (2000) contend that Mexico is really abundant in skilled workers in relation to the poorer nations that make up much of the world, and so a general liberalization of trade under the terms of the GATT in 1986 led to rise in the relative earnings of skilled workers. These authors present evidence that, prior to trade liberalization, Mexico protected its low-skill industries more than it did its high-skill industries and that liberalization under the GATT then caused tariffs upon the imports of low-skill goods to fall more rapidly than those upon the imports of high-skill goods. As a result, the relative prices of low-skill goods declined, causing decreases in the relative earnings of low-skill workers and, thus, widening wage inequality. NAFTA, however, was different in that it liberalized trade between Mexico and the more skill abundant United States and Canada. Therefore, argues Robertson (2004), the relative-prices of high-skill goods in Mexico have fallen since 1994, as, hence, have the relative earnings of high-skill workers. In sum, previous research indicates NAFTA lowered returns to skill in Mexico. It is the objective of this study to uncover, by means different, additional evidence of lowered returns to skill in the South upon the liberalization of its trade with the North. The principal differences between this study and previous such research are that it employs labor micro-data rather than data aggregated at the level of firms or industries, and, next, that its empirical strategy exploits the fact that NAFTA liberalized trade in some goods faster than trade in others.

The remainder of the paper is organized as follows. Section II discusses the empirical strategy. Section III describes the data, and presents and interprets the empirical findings. Section IV summarizes these findings and presents the study's conclusions.

II. Empirical Strategy

NAFTA began liberalizing trade between Mexico and its northern neighbors in 1994. This liberalization was a phased process in that some industries experienced a more rapid reduction in import tariffs than others. For example, tariffs on some goods were eliminated immediately, that is, in 1994, whereas imports of other goods were to become duty-free only by 1998 or later. In addition, some industries were unaffected by NAFTA, or largely so. Industries producing non-tradeables were naturally beyond the scope of NAFTA, those producing such supply-managed goods¹ as milk, poultry, and eggs, were deliberately excluded from NAFTA, and this Preferential Trading Arrangement may have had little effect on Mexico's *maquiladora* industry.

The Mexican government founded a border industrialization program in 1965 in order to combat unemployment in the border region resulting from the US's termination of the *bracero* program² in 1964. This industrialization program allowed the unrestricted entry of foreign capital into the border region. Manufactured goods were to be assembled by cheap Mexican labor from components originating in the United States, for re-export to the United States. Raw materials imported into Mexico were exempted from import duties and U.S. tariffs upon the import of the finished goods were to be levied only on Mexican value added. This policy resulted in the proliferation, by means of mostly U.S. capital, of export oriented manufacturing units, called *maquiladoras*³, along Mexico's 2,000-mile northern border. Since U.S. import tariffs were levied only upon the Mexican value-added portion of the output of *maquiladoras*, consisting often of the modest value-added by mere assembly of U.S. components, tariffs upon these goods were low to begin with, and so NAFTA is unlikely to have significantly eased U.S. imports of *maquiladora* output. Indeed, even though tariff reduction under NAFTA was extended to *maquiladoras*, the phased nature of tariff reduction implied U.S. import tariffs in the *maquiladora* program may, in the beginning, have been lower than under NAFTA (Gruben 2001).

In sum, it is possible to distinguish between four sectors of the Mexican economy: the sector producing non-tradeables and the few supply-managed tradeables excluded from NAFTA, untouched by this Preferential Trading Arrangement, the *maquiladora* sector, perhaps only marginally affected by NAFTA, the sector producing goods the imports of which were liberalized relatively slowly under NAFTA, and the sector producing items the imports of which were liberalized relatively rapidly. It is plausible the first two sectors

¹ goods whose domestic supply is restricted so as to raise their prices, ostensibly to benefit their producers

² The *bracero* program was instituted on August 4, 1942, to alleviate a manual labor shortage in the U.S. on account of the war.

³ The term derives from the Spanish verb *maquilar*, which means 'to put together or assemble'.

were largely unaffected as well by Mexico's joining the GATT in 1986, since the first produces mainly non-tradeables, NAFTA's exclusions being few, and the GATT resulted mainly in sharp reductions in Mexican import duties whereas the *maquiladora* sector, using raw materials imported duty-free, is entirely export-oriented. Might differences between these sectors' time-trends in rates of return to schooling enable identification of the effect of NAFTA, an instance of North-South trade liberalization, upon returns to skill in Mexico?

Liberalized North-South trade shall bring about rise in the relative prices of low-skill goods in the South, expansion of the South's low-skill industries, a rise in demand for low-skill workers, and, hence, depression in returns to skill, holds Neo-Classical theory. Might this occur faster in the sectors of Southern economies more rapidly exposed to trade with the North? Note that differences between sectors in time-trends in returns to skill may make for inter-sectoral differences, inconsistent with Neo-Classical theory, in the compensation of identical workers at a point in time. However, such differences become plausible in a world of industry rents.

Protected industries enjoy rents (Revenge 1997), and so, prior to NAFTA, high-skill industries in Mexico enjoyed rents in relation to these industries in the U.S. and Canada, whereas low-skill industries in the U.S. and Canada enjoyed rents compared with these industries in Mexico. Such rents may be passed on to workers (Revenge 1997). It is conceivable that rents shall make up a larger share of the compensation of a skilled worker than of the compensation of a low-skill worker in high-skill industries, since their superior numbers in these industries may endow skilled workers with greater bargaining power over the division of rents. Similarly, it is plausible that rents shall constitute a larger share of the compensation of a low-skill worker than of the compensation of a skilled worker in low-skill industries. Consequently, the whittling down of rents in Mexico's high-skill industries by the import competition effected by NAFTA would have hurt Mexican high-skill workers more than low-skill workers. Similarly, the capture by Mexico's low-skill industries of part of the rents of the U.S.'s and Canada's low-skill industries, facilitated by NAFTA, would have benefited Mexico's low-skill workers more than its high-skill workers. A fall in measured returns to skill would have resulted. Now, consider, for simplicity, two sectors of the Mexican economy, each consisting of a mix of high and low skill industries. Say, one was more rapidly exposed to trade with the U.S. and Canada under NAFTA's phased tariff elimination than the other. It is conceivable that the process described above whereby returns to

skill are depressed would occur faster in the more speedily liberalized sector. This logic is the basis of this study's empirical strategy.

Recall that it is possible to distinguish between four sectors of the Mexican economy: the sector producing non-tradeables and goods excluded from NAFTA, untouched by this tripartite treaty, the *maquiladora* sector, perhaps only slightly affected by NAFTA, the sector producing goods the imports of which were liberalized relatively slowly under NAFTA, and the sector producing items the imports of which were liberalized relatively rapidly. Consider the two years 1987 and 1999. The former marks the beginnings of Mexican trade liberalization under the GATT but precedes the launch of NAFTA by some 7 years. The latter marks the complete elimination of tariffs under NAFTA for some, though not all industries. Imports of goods exempted from duties by 1999 under the terms of NAFTA may be considered relatively rapidly liberalized by this Preferential Trading Arrangement, whereas imports of goods yet subject to tariffs by 1999 may be deemed relatively slowly liberalized. Consider, now, the Mincer earnings function, fitted to labor micro-data from the years 1987 and 1999,

$$\begin{aligned}
 (1) \quad \ln(\text{monthly earnings}) &= \mathbf{a} + X'\mathbf{b} \\
 &+ \sum_j \mathbf{c}_{1j} \cdot (\text{years of schooling} \times \text{industry } j) + \sum_j \mathbf{c}_{2j} \cdot (\text{years of schooling} \times \text{industry } j \times \text{year 1999}) \\
 &+ \mathbf{d}_1 \cdot (\text{years of schooling} \times \text{maquila}) + \mathbf{d}_2 \cdot (\text{years of schooling} \times \text{maquila} \times \text{year 1999}) \\
 &+ \mathbf{e}_1 \cdot (\text{years of schooling} \times \text{fastlib}) + \mathbf{e}_2 \cdot (\text{years of schooling} \times \text{fastlib} \times \text{year 1999}) \\
 &+ \mathbf{f}_1 \cdot (\text{years of schooling} \times \text{slowlib}) + \mathbf{f}_2 \cdot (\text{years of schooling} \times \text{slowlib} \times \text{year 1999}) + u
 \end{aligned}$$

where X represents a vector of influences, including personal and environmental characteristics, upon a worker's monthly earnings, *industry j* signifies employment in industrial class j (farm, manufacturing, commerce, etc.), *maquila* denotes employment in the *maquiladora* sub-sector of manufacturing, *fastlib* indicates employment in industries producing goods exempted from tariffs by 1999 under the terms of NAFTA, *slowlib* indicates employment in industries producing goods yet subject to tariffs by 1999, and u signifies unobserved random influences upon the worker's log monthly earnings. As is well known, the coefficient of *years of schooling* in a Mincer earnings function measures the rate of return to schooling, that is, the percentage increase in earnings from an additional year of schooling, a common metric of returns to skill.

This specification of the Mincer earnings function permits rates of return to schooling in 1987 as well as changes in these between 1987 and 1999 to differ between broad industrial classes. Industries within these classes that produce tradeables, with the exception of the few excluded from NAFTA, are indicated by the

variables *fastlib* and *slowlib*⁴, and so changes in rates of return to schooling between 1987 and 1999 measured by the coefficients \mathbf{e}_2 and \mathbf{f}_2 may be considered to originate in Mexican trade liberalization. These are, clearly, changes in addition to those measured by the coefficients \mathbf{e}_{2j} which may, hence, be considered largely secular, that is, unrelated to trade liberalization, originating, for example, in skill-biased technical progress.

The coefficient \mathbf{d}_2 measures change between 1987 and 1999, in addition to that measured by the particular \mathbf{e}_{2j} relevant to the industrial class of manufacturing, in the rate of return to schooling of *maquiladora* workers. As argued, it is likely Mexican trade liberalization under both the GATT and NAFTA had little bearing on the prospects of *maquiladoras* since U.S. import tariffs on the output of *maquiladoras* were low even prior to NAFTA and the principal effect of Mexico's joining the GATT was greatly lowered Mexican import duties whereas *maquiladoras*, using raw materials imported duty-free, are entirely export-oriented. Thus, it is plausible that the change measured by \mathbf{d}_2 resulted mainly from factors other than trade liberalization, such as skill-biased technical progress. Note that *maquiladoras* embody foreign direct investment and there is evidence such investment facilitates the transfer of technology across borders (Zhiqiang 2008). Further, there is evidence that firms producing for export markets embrace new technologies faster than firms focused on domestic markets (Robertson 2000). Thus, skill-biased technical progress in the *maquiladora* sector may have been more rapid than in the rest of manufacturing, and so it is conceivable that $\mathbf{d}_2 > 0$.

As argued, changes in rates of return to schooling between 1987 and 1999 measured by the coefficients \mathbf{e}_2 and \mathbf{f}_2 may be taken to originate in the liberalization of trade. If the GATT eased imports into Mexico of low-skill goods from less developed nations more abundant in low-skill workers, and so hurt Mexico's low-skill industries more than its skill-intensive industries with the result that returns to skill were elevated, this trade treaty will have resulted in both \mathbf{e}_2 and \mathbf{f}_2 taking positive values. However, if NAFTA, liberalizing trade between Mexico and the more skill-abundant U.S. and Canada, has reversed these earlier increases in returns to skill (Robertson 2004), this reversal, by the logic set forth in this study, will have been more pronounced by 1999 in the sector, *fastlib*, producing goods the imports of which were liberalized relatively rapidly under NAFTA, than in the sector, *slowlib*, producing goods the imports of which were liberalized relatively slowly, leading to $\mathbf{e}_2 < \mathbf{f}_2$. If the decline in returns to skill owing to NAFTA has more than offset the

⁴ While the labels *fastlib* and *slowlib* pertain to NAFTA, they really mark all tradeables but for the few excluded from the provisions of this tripartite treaty, and so the industries thus labeled would've been affected by both the GATT and NAFTA.

rise in returns to skill brought about by GATT even in the more slowly liberalized sector, it would be that $e_2 < f_2 < 0$.

In sum, whether NAFTA, an instance of North-South trade liberalization, has depressed returns to skill in Mexico may be ascertained via a statistical test of the hypothesis $e_2 < f_2$. It may be seen that this paper differs in two ways from previous studies of the impact of trade liberalization upon returns to skill in Mexico such as by Hanson and Harrison (1999), Robertson (2000), Robertson (2004), and Mollick (2008): it bases identification upon the phased nature of NAFTA, that is, the fact that this trade treaty liberalized trade in some goods faster than trade in others, and it employs labor micro-data⁵ rather than data aggregated at the level of firms or industries.

III. The Data and Empirical Findings

The Encuesta Nacional de Empleo Urbano (ENEU), or National Urban Employment Survey, from the years 1987 and 1999 furnishes the data upon which this study's empirical analysis is based. As discussed, 1987 marks the beginnings of Mexican trade liberalization under the GATT but precedes the launch of NAFTA by some 7 years, whereas 1999 marks the complete elimination of tariffs under NAFTA for some, though not all industries. The ENEU supplies a quarterly data series rich in socio-economic information. In order to avoid excessively large, unwieldy sample sizes, the study uses data from but the 2nd quarters of the 1987 and 1999 ENEU. The ENEU samples from about 60% of the nation's urban population including about 90% of the population in areas with 100,000 or more inhabitants, and so the data are representative of urban Mexico. A sample of 203,550 workers is yielded.

Table 1 presents the full definitions of the variables included in the analysis. Table 2 presents the sample mean values of these variables. Sample mean monthly earnings are approximately 1,564 ($e^{7.355}$) pesos whereas mean weekly hours worked are about 41 ($e^{3.718}$) hours. Approximately 38% of these workers were female. Since the geographical scope of this survey has greatly increased over time, it is not surprising that substantially more of these workers are drawn from the 1999 than from the 1987 ENEU. Sample mean years of schooling are a little over 9. About 3.4% of these 203,550 workers are employed in the *maquiladora* sub-sector of manufacturing, about 2.6% in the sector producing goods the imports of which were liberalized relatively rapidly by NAFTA, and about 10.9% in the sector producing goods the imports of which were

⁵ Robertson (2000, 2004) too uses labor micro-data, though for the purposes of basic illustration.

liberalized relatively slowly by the terms of this Preferential Trading Arrangement, with the remainder engaged in sectors producing non-tradeables and the few supply-managed goods excluded from NAFTA.

Table 3 presents OLS estimates of the Mincer earnings function (1). As expected, log monthly earning increases in weekly hours worked. In keeping with human capital theory, log monthly earning significantly increases in years of work experience. *Ceteris paribus*, women earn less than men. Married workers, entrepreneurs, and those employed in the formal sector of the economy earn significantly more than others. It appears workers in *micro* (1 – 5 employees) firms earn less than the solitary self-employed, whereas those in *small* (6 – 50 employees), *medium* (51 – 250 employees), and *large* (more than 250 employees) firms earn more. It is indicated that workers in the border (with the US) region and in the northern region excluding the border region earn more, whereas workers in the nation's southern region earn less, than workers in the central region. By these estimates, the rate of return to schooling in the services sector, one producing non-tradeables, was 2.4% in 1987.

It may be noted that despite the concentration of foreign direct investment in *maquiladoras* and these firms' export-orientation, factors credited with speeding the rate of skill-biased technical progress, the statistical insignificance of the interaction $schooling \times maquila \times year\ 1999$ suggests that increase between 1987 and 1999 in the rate of return to schooling in *maquiladoras* was not greater than in the rest of manufacturing.

That the estimated coefficients of $schooling \times fastlib \times year\ 1999$ and $schooling \times slowlib \times year\ 1999$ are positive with the variables significant is consistent with previous findings (for example, Hanson and Harrison, 1999, and Robertson, 2000) of a positive effect upon returns to skill of Mexico's joining the GATT in 1986. It may be noted, however, that rise in returns to skill is less pronounced in industries producing tradeables the imports of which were liberalized more rapidly by NAFTA than in industries producing goods the imports of which were liberalized relatively slowly: the estimated coefficient of $schooling \times fastlib \times year\ 1999$ is smaller than that of $schooling \times slowlib \times year\ 1999$ with the difference significant at the 1% level. As argued, the above may be taken as indicative of a reversal, owing to NAFTA, of the GATT induced rise in returns to skill, a reversal more marked in the sector more rapidly liberalized by this phased trade treaty. In other words, this finding supports the view (e.g., Robertson, 2004) that NAFTA has lowered rates of return to skill in Mexico. North-South trade liberalization may, then, lower rates of return to skill in the South. Finally, since the rate of return to schooling appears to have risen in net even in the more slowly liberalized sector, it does not appear that NAFTA has offset the rise in returns to skill from Mexico's joining the GATT.

IV. Conclusion

This study exploits the phased nature of tariff reductions under NAFTA to attempt identification of the effect of this instance of North-South trade liberalization upon returns to skill, measured as rates of return to schooling, in Mexico. It is held that Mexico's joining the GATT in 1986 raised its workers' returns to skill whereas NAFTA has reversed this trend (for example, Robertson 2004). This study uncovers evidence from Mexican labor micro-data consistent with this view. It is found that while returns to skill in industries producing tradeables have risen, *ceteris paribus*, since Mexico embarked upon trade liberalization by joining the GATT in 1986, rise in returns to skill was less pronounced by 1999 in industries producing goods the imports of which were liberalized relatively rapidly by NAFTA, launched in 1994, than in industries producing goods the imports of which were liberalized relatively slowly by this phased tripartite treaty. This is taken to be due to NAFTA reversing the preceding increase in returns to skill from Mexico's joining GATT, since it is plausible this reversal was of greater magnitude in the sector producing goods the imports of which were liberalized relatively rapidly by NAFTA. Hence, this study suggests trade with developed nations may lower returns to skill in developing nations. It is speculated this may slow the pace of private human capital accumulation in developing nations, with negative consequences for their economic growth.

TABLE 1 Definitions of Variables

Variable	Definition
<i>log earnings</i>	natural log of monthly earnings in 1999 pesos
<i>log hours</i>	natural log of hours worked during week prior to interview
<i>experience</i>	years of work experience (age – schooling – 6)
<i>female</i>	= 1 if female
<i>married</i>	= 1 if married
<i>formal</i>	= 1 if employed in formal sector
<i>owner</i>	=1 if entrepreneur
<i>year 1999</i>	=1 if drawn from the 1999 ENEU
<i>micro</i> (firm size; omitted category is ‘self-employed with no employees’)	= 1 if employed in a firm with 1 – 5 employees
<i>small</i> (firm size)	=1 if employed in a firm with 6 – 50 employees
<i>medium</i> (firm size)	=1 if employed in a firm with 51 – 250 employees
<i>large</i> (firm size)	=1 if employed in a firm with more than 250 employees
<i>border</i> (region; omitted category is ‘central region’)	=1 if lives on the Mexico – US border
<i>north</i> (region)	=1 if lives in a northern state of Mexico not bordering the US
<i>south</i> (region)	=1 if lives in a southern state of Mexico
<i>professional</i> (occupation; omitted category is ‘laborer’)	=1 if a professional
<i>technical</i> (occupation)	=1 if a technician
<i>managerial</i> (occupation)	=1 if a manager
<i>farm</i> (industrial class; omitted category is ‘services’)	= 1 if employed in agricultural sector, including agro-based industry
<i>mine or electric</i> (industrial class)	= 1 if employed in mining or power sectors
<i>manufacturing</i> (industrial class)	= 1 if employed in the manufacturing sector
<i>construction</i> (industrial class)	= 1 if employed in the construction sector
<i>commerce</i> (industrial class)	= 1 if employed in the commerce sector
<i>maquila</i>	= 1 if employed in the <i>maquiladora</i> sub-sector of manufacturing
<i>fastlib</i>	=1 if employed in a sector, excluding the <i>maquiladora</i> sub-sector, with 100% tariff reduction by 1999 under NAFTA
<i>slowlib</i>	=1 if employed in a sector, excluding the <i>maquiladora</i> sub-sector, with less than a 100% tariff reduction by 1999 under NAFTA
<i>farm</i> × <i>year 1999</i>	interaction of <i>farm</i> and <i>year 1999</i>
<i>mine or electric</i> × <i>year 1999</i>	interaction of <i>mine or electric</i> and <i>year 1999</i>
<i>manufacturing</i> × <i>year 1999</i>	interaction of <i>manufacturing</i> and <i>year 1999</i>
<i>construction</i> × <i>year 1999</i>	interaction of <i>construction</i> and <i>year 1999</i>
<i>commerce</i> × <i>year 1999</i>	interaction of <i>commerce</i> and <i>year 1999</i>
<i>maquila</i> × <i>year 1999</i>	interaction of <i>maquila</i> and <i>year 1999</i>
<i>fastlib</i> × <i>year 1999</i>	interaction of <i>fastlib</i> and <i>year 1999</i>
<i>slowlib</i> × <i>year 1999</i>	interaction of <i>slowlib</i> and <i>year 1999</i>
<i>schooling</i>	years of formal education
<i>schooling</i> × <i>farm</i>	interaction of <i>schooling</i> and <i>farm</i>
<i>schooling</i> × <i>mine or electric</i>	interaction of <i>schooling</i> and <i>mine or electric</i>
<i>schooling</i> × <i>manufacturing</i>	interaction of <i>schooling</i> and <i>manufacturing</i>
<i>schooling</i> × <i>construction</i>	interaction of <i>schooling</i> and <i>construction</i>

TABLE 1 Definitions of Variables (continued)

<i>schooling</i> × <i>commerce</i>	interaction of <i>schooling</i> and <i>commerce</i>
<i>schooling</i> × <i>maquila</i>	interaction of <i>schooling</i> and <i>maquila</i>
<i>schooling</i> × <i>fastlib</i>	interaction of <i>schooling</i> and <i>fastlib</i>
<i>schooling</i> × <i>slowlib</i>	interaction of <i>schooling</i> and <i>slowlib</i>
<i>schooling</i> × <i>year 1999</i>	interaction of <i>schooling</i> and <i>year 1999</i>
<i>schooling</i> × <i>farm</i> × <i>year 1999</i>	interaction of <i>schooling</i> , <i>farm</i> , and <i>year 1999</i>
<i>schooling</i> × <i>mine or electric</i> × <i>year 1999</i>	interaction of <i>schooling</i> , <i>mine or electric</i> , and <i>year 1999</i>
<i>schooling</i> × <i>manufacturing</i> × <i>year 1999</i>	interaction of <i>schooling</i> , <i>manufacturing</i> , and <i>year 1999</i>
<i>schooling</i> × <i>construction</i> × <i>year 1999</i>	interaction of <i>schooling</i> , <i>construction</i> , and <i>year 1999</i>
<i>schooling</i> × <i>commerce</i> × <i>year 1999</i>	interaction of <i>schooling</i> , <i>commerce</i> , and <i>year 1999</i>
<i>schooling</i> × <i>maquila</i> × <i>year 1999</i>	interaction of <i>schooling</i> , <i>maquila</i> , and <i>year 1999</i>
<i>schooling</i> × <i>fastlib</i> × <i>year 1999</i>	interaction of <i>schooling</i> , <i>fastlib</i> , and <i>year 1999</i>
<i>schooling</i> × <i>slowlib</i> × <i>year 1999</i>	interaction of <i>schooling</i> , <i>slowlib</i> , and <i>year 1999</i>

TABLE 2 Sample Statistics

(n = 203,550)

Variable	Mean	S.D.
<i>log earnings</i>	7.355	1.684
<i>log hours</i>	3.718	0.422
<i>experience</i>	18.229	13.248
<i>female</i>	0.375	0.484
<i>married</i>	0.600	0.490
<i>formal</i>	0.791	0.407
<i>owner</i>	0.257	0.437
<i>year 1999</i>	0.793	0.405
<i>micro</i> (firm size)	0.250	0.433
<i>small</i> (firm size)	0.177	0.382
<i>medium</i> (firm size)	0.070	0.255
<i>large</i> (firm size)	0.354	0.478
<i>border</i> (region)	0.124	0.329
<i>north</i> (region)	0.399	0.490
<i>south</i> (region)	0.141	0.348
<i>professional</i> (occupation)	0.096	0.294
<i>technical</i> (occupation)	0.042	0.200
<i>managerial</i> (occupation)	0.115	0.319
<i>farm</i> (industrial class)	0.016	0.126
<i>mine or electric</i> (industrial class)	0.013	0.115
<i>manufacturing</i> (industrial class)	0.227	0.419
<i>construction</i> (industrial class)	0.058	0.233
<i>commerce</i> (industrial class)	0.200	0.400
<i>maquila</i>	0.034	0.182
<i>fastlib</i>	0.026	0.160
<i>slowlib</i>	0.109	0.312
<i>farm</i> × <i>year 1999</i>	0.013	0.112
<i>mine or electric</i> × <i>year 1999</i>	0.010	0.100
<i>manufacturing</i> × <i>year 1999</i>	0.171	0.377
<i>construction</i> × <i>year 1999</i>	0.046	0.209
<i>commerce</i> × <i>year 1999</i>	0.161	0.367
<i>maquila</i> × <i>year 1999</i>	0.025	0.157
<i>fastlib</i> × <i>year 1999</i>	0.146	0.353
<i>slowlib</i> × <i>year 1999</i>	0.361	0.480
<i>schooling</i>	9.340	4.446
<i>schooling</i> × <i>farm</i>	0.119	1.078
<i>schooling</i> × <i>mine or electric</i>	0.150	1.391
<i>schooling</i> × <i>manufacturing</i>	1.985	4.084
<i>schooling</i> × <i>construction</i>	0.430	2.017
<i>schooling</i> × <i>commerce</i>	1.802	4.025
<i>schooling</i> × <i>maquila</i>	0.297	1.713
<i>schooling</i> × <i>fastlib</i>	2.215	5.051
<i>schooling</i> × <i>slowlib</i>	4.084	5.340

TABLE 2 Sample Statistics (continued)
(n = 203,550)

<i>schooling</i> × <i>year 1999</i>	7.567	5.567
<i>schooling</i> × <i>farm</i> × <i>year 1999</i>	0.096	0.979
<i>schooling</i> × <i>mine or electric</i> × <i>year 1999</i>	0.116	1.240
<i>schooling</i> × <i>manufacturing</i> × <i>year 1999</i>	1.536	3.730
<i>schooling</i> × <i>construction</i> × <i>year 1999</i>	0.351	1.847
<i>schooling</i> × <i>commerce</i> × <i>year 1999</i>	1.481	3.748
<i>schooling</i> × <i>maquila</i> × <i>year 1999</i>	0.225	1.515
Key Variables		
<i>schooling</i> × <i>fastlib</i> × <i>year 1999</i>	1.746	4.633
<i>schooling</i> × <i>slowlib</i> × <i>year 1999</i>	3.348	5.149

TABLE 3 Determinants of Log Monthly Earnings
Dependent Variable = *log earnings*, OLS Estimates

Variable	Coefficient	T-Ratio
<i>constant</i>	2.632***	67.29
<i>log hours</i>	1.027***	133.02
<i>experience</i>	0.005***	16.27
<i>female</i>	-0.311***	-45.9
<i>married</i>	0.066***	9.78
<i>formal</i>	0.068***	6.47
<i>owner</i>	1.095***	113.25
<i>year 1999</i>	-0.195***	-6.99
<i>micro</i> (firm size)	-0.444***	-37.41
<i>small</i> (firm size)	0.815***	55.32
<i>medium</i> (firm size)	1.035***	58.11
<i>large</i> (firm size)	1.207***	81.2
<i>border</i> (region)	0.383***	32.8
<i>north</i> (region)	0.153***	21.18
<i>south</i> (region)	-0.065***	-7.04
<i>professional</i> (occupation)	0.586***	43.81
<i>technical</i> (occupation)	0.289***	18.55
<i>managerial</i> (occupation)	0.593***	55.36
<i>farm</i> (industrial class)	-0.946***	-9.71
<i>mine or electric</i> (industrial class)	-0.194	-1.46
<i>manufacturing</i> (industrial class)	-0.060	-1.44
<i>construction</i> (industrial class)	0.273***	4.72
<i>commerce</i> (industrial class)	-1.016***	-23
<i>maquila</i>	-0.494***	-5.43
<i>fastlib</i>	-0.152***	-7.05
<i>slowlib</i>	-0.165***	-11.92
<i>farm</i> × <i>year 1999</i>	-0.574***	-5.13
<i>mine or electric</i> × <i>year 1999</i>	0.019	0.12
<i>manufacturing</i> × <i>year 1999</i>	-0.229***	-4.89
<i>construction</i> × <i>year 1999</i>	0.183***	2.76
<i>commerce</i> × <i>year 1999</i>	0.253***	4.91
<i>maquila</i> × <i>year 1999</i>	0.023	0.22
<i>fastlib</i> × <i>year 1999</i>	-0.146***	-5.66
<i>slowlib</i> × <i>year 1999</i>	-0.304***	-13.62
<i>schooling</i>	0.024***	8.32
<i>schooling</i> × <i>farm</i>	-0.020	-1.58
<i>schooling</i> × <i>mine or electric</i>	0.023*	1.93
<i>schooling</i> × <i>manufacturing</i>	0.003	0.77
<i>schooling</i> × <i>construction</i>	-0.009	-1.2
<i>schooling</i> × <i>commerce</i>	0.068***	13.74
<i>schooling</i> × <i>maquila</i>	0.004	0.42
<i>schooling</i> × <i>fastlib</i>	-0.010***	-4.81
<i>schooling</i> × <i>slowlib</i>	-0.029***	-13.79

TABLE 3 Determinants of Log Monthly Earnings (continued)

Variable	Coefficient	T-Ratio
<i>schooling</i> × <i>year 1999</i>	-0.007**	-2.15
<i>schooling</i> × <i>farm</i> × <i>year 1999</i>	0.049***	3.52
<i>schooling</i> × <i>mine or electric</i> × <i>year 1999</i>	0.012	0.89
<i>schooling</i> × <i>manufacturing</i> × <i>year 1999</i>	0.013***	2.69
<i>schooling</i> × <i>construction</i> × <i>year 1999</i>	-0.018**	-2.18
<i>schooling</i> × <i>commerce</i> × <i>year 1999</i>	-0.049***	-8.8
<i>schooling</i> × <i>maquila</i> × <i>year 1999</i>	0.010	0.89
Key Variables		
<i>schooling</i> × <i>fastlib</i> × <i>year 1999</i>	0.031***	10.52
<i>schooling</i> × <i>slowlib</i> × <i>year 1999</i>	0.048***	15.91
R ² =	0.3614	
n =	203,550	

*, **, and *** denote significance at, respectively, the 10%, 5%, and 1% levels

References

- Burtless, G. 1995. International trade and the rise in earnings inequality. *Journal of Economic Literature* 33, no. 2: 800 – 816.
- Grossman, G.M. and E. Helpman. 1994. Endogenous innovation in the theory of growth. *Journal of Economic Perspectives* 8, no. 1: 23 – 44.
- Gruben, W.C. 2001. Was NAFTA behind Mexico's high maquiladora growth? *Economic and Financial Review*, Federal Reserve Bank of Dallas, Third Quarter: 11 – 21.
- Hanson, G.H. and A. Harrison. 1999. Trade liberalization and wage inequality in Mexico. *Industrial and Labor Relations Review* 52, no. 2: 271 – 88.
- Lucas, R.E. 1988. On the mechanics of economic development. *Journal of Monetary Economics* 22, no. 1: 3 – 42.
- Mollick, A.V. 2008. Relative wages, labor supplies and trade in Mexican manufacturing: evidence from two samples. *The Journal of International Trade & Economic Development*, forthcoming.
- Reventa, A. 1997. Employment and Wage Effects of Trade Liberalization. *Journal of Labor Economics* 15, no. 3: S20 – S43.
- Robertson, R. 2000. Trade liberalization and wage inequality: lessons from the Mexican experience. *World Economy* 23, no. 6: 827 – 49.
- Robertson, R. 2004. Relative prices and wage inequality: evidence from Mexico. *Journal of International Economics* 64, no. 2: 387 – 409.
- Tybout, J.R. 2000. Manufacturing firms in developing countries: how well they do, and why? *Journal of Economic Literature* 38, no. 1: 11 – 44.
- Young, A. 1991. Learning by doing and the dynamic effects of international trade. *Quarterly Journal of Economics* 106, no. 2: 369 – 405.
- Zhiqiang, L. 2008. Foreign direct investment and technology spillovers: theory and evidence. *Journal of Development Economics* 85, no. 2: 176-93