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Economic Integration across Latin America

Evidence from Labor Markets, 1990–2013

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Abstract

Combining macroeconomic and microeconomic data and three indicators of international market integration, this paper assesses the degree to which Latin American labor markets are integrated. The results suggest that relative to East Asia, Latin American labor markets are somewhat more integrated, but considerable differences across countries persist. In addition, the evidence indicates that the degree of labor market integration across Latin American borders is significantly less than that of labor markets within Mexico and within the United States in two of the three indicators. These differences may suggest opportunities for efficiency gains from further labor market integration.

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Economic Integration across Latin America: Evidence from Labor Markets, 1990-2013

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I. Introduction

Possibly motivated by empirical findings suggesting a strong positive link between trade and growth (Frankel and Romer 1999, Norguer and Sisquart 2005), governments have invested considerable resources over the last quarter-century to deepen economic integration. Trade and capital flows, two often-cited bellwethers of economic integration, have increased over the same time period. While it is clear that trade and financial flows have increased, there is considerable debate about the extent of actual economic integration that has followed. One dimension that is particularly debated is how rising trade and capital flows have affected workers generally and whether or not labor markets have become more integrated. While there is a voluminous literature on the relationship between globalization and wages, relatively little attention has been directed towards understanding the degree of labor market integration.

Labor market integration matters for at least three reasons. First, the core of the trade and growth literature (e.g. Frankel and Romer 1999) is based on the premise that increased economic integration leads to higher GDP per capita and, by implication, higher wages. It is a small step to this conclusion from the neoclassical trade models, such as the Heckscher-Ohlin theorem, which predicts that economic integration leads to wage convergence between high-wage and low-wage countries. Some papers suggest that reducing barriers to trade leads to Heckscher-Ohlin-Samuelson (HOS) effects. Michaels (2008) finds evidence of HOS effects within the United States after trade costs were reduced by the U.S. highway system. Ben-David (1993) analyzes the relationship between the income differentials within the European Economic Community and trade liberalization. The author focuses on six original members of the European Economic Community. By comparing the income differentials before and after they removed the trade barriers, he finds that EEC incomes began to converge.

Other papers (Maskus and Nishioka (2006), Clemens et al. (2008), Kiyota (2012), and Gandolfi et al. (2015)) suggest that integration does not reduce the "place premium" characterizing wage differences across countries. One possible reason for the persistence of the place premium is that trade agreements may reduce barriers to trade and foreign investment, but eliminating barriers to labor mobility is conspicuously absent from most recent agreements.

From a trade-theoretic point of view, however, labor mobility is not necessary for labor market integration. The exchange of goods, and the resulting convergence in output prices, should raise wages in low-wage countries and contribute to wage convergence. This idea is commonly known as the factor-price equalization theorem. The lack of evidence supporting factor-price equalization, however, raises the question of how much economic integration leads to labor market integration.

The second reason why labor market integration matters is that the lack of labor market integration may suggest a lack of allocative efficiency. One of the goals of economic integration is to take advantage of differences in prices across borders. Indeed, price differences across borders are what give rise to gains from trade. As people take advantage of price differences across borders, these price differences would diminish and perhaps even gradually disappear. Labor market differences across borders that persist may suggest that economic integration is incomplete and therefore there are still significant opportunities to pursue measures to integrate markets and realize these efficiency gains.

A third reason why labor market integration is important is that studying labor market integration may reveal the specific channels through which different kinds of economic integration lead to rising (or falling) wages. Foreign investment may contribute to labor market integration if the flow of capital from one country to another responds to wage differences across borders.

Migration, obviously, works in the same way: in theory, workers moving from low-wage countries to high-wage countries could contribute to wage convergence. Trade in commercial goods may be sufficient under the restrictive assumptions of the HOS model described above. Bloom and Noor (1995) find the labor market integration increased sharply among East and Southeast Asia countries from 1980s to 1991. The integration was achieved mainly through the sharp increase in integrational trade, and that the contributions of labor mobility and capital mobility were small, but more research from other regions is lacking.

All three of these reasons suggest that measures of labor market integration are important measures of economic integration. The first step to such studies, however, is developing appropriate metrics and baseline statistics for labor market integration. Therefore, the goal of this paper is to examine two measures of labor market integration for Latin America. The first measure is wage convergence. The second is the co-movement in wages. Both measures follow from a sizable literature on both market integration generally and factor-market integration in particular.

Latin America is the focus of this paper for three reasons. The first is that Latin America has experienced a rapid expansion in the number of bilateral and multilateral trade agreements over the last 25 years. As a result, there has been a dramatic reduction of trade barriers. Trade and investment flows have increased, but lingering discontent with trade liberalization has raised the question of how much these measures have contributed to labor market integration throughout Latin America. The second reason is that labor market integration in Latin America has been less studied than labor market integration in Asia. A third reason is that newly available data sets have created the opportunity to advance the literature generally on labor market integration, which is an aspiration of this paper.

The rest of the paper follows the usual structure. The next section briefly reviews the literature on measures of market integration (of which labor market integration is a special case) and then presents theoretic considerations that guide our empirical measures of labor market integration. The third section presents the results for the two measures and the fourth section concludes with a discussion of the implications of these measures.

II. Measuring Factor-Market Integration

The literature provides three alternative concepts that are useful for assessing the degree of integration of factor markets across borders. We first review such indicators and then provide a theoretical framework with the objective of showing how these concepts are applied to labor markets in particular.

A. Three Indicators of Market Integration

The goal of this paper is to develop and estimate measures of labor market integration. Measures of market integration are found throughout the academic literature. Our goal is to review these briefly to identify those that would be appropriate for measuring labor market integration.

Some, such as Barrett (2001), define market integration as the ability of products to be moved from one market to another. That is, the degree of physical mobility determines the degree of market integration. The motivation for this idea seems to be that price differences between different markets can be eliminated if goods are free to move. Of course, this idea therefore implies that a more accurate measure of integration would be price convergence, especially for labor markets. Neoclassical trade theory suggests that mobility is not required to achieve factor price convergence. Secondly, labor mobility is often restricted, either de juris or de facto. Therefore, using the movement of labor (migration) as a measure of labor market integration may be misleading.

Instead, it seems that a more appropriate measure of market convergence for our study would be price convergence. Price convergence as a measure of market integration is pervasive throughout economic literature.[1] McCallum (1995) and Engel and Rogers (1994) are two well-known studies that use output prices as a measure of international market integration and suggest that persistent price differences imply that borders segment markets. Other studies that use prices, such as Berkowitz and DeJong (2003) and Knetter and Slaughter (2001), find different results. In particular, Knetter and Slaughter (2001) show that European countries seem to be moving toward a single market, but the convergence of Europe and the United States is weak.

The metric of price convergence internationally has its own sizable literature, including both the debate over purchasing power parity[2] and international market integration. One lesson from this literature is that barriers to trade inhibit price convergence, but prices may still be cointegrated across markets with natural or other barriers. Paul, Miljkovic, and Ipe (2001) apply cointegration procedures to gasoline markets in United States and Mohanty, Peterson, and Smith (1996), Ghosh (2003), and Mohanty and Langeley (2003) are examples that apply cointegration measures to agricultural markets.

Studies of capital market integration have taken their cues from product-market integration studies and applied both price convergence and cointegration of prices. Oh's (2003) price-convergence study finds that European capital market integration is far from complete. Beck and Subramanian (1996) apply the concept of price convergence to the prime rate and find that loan market integration increased.

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[1] In particular, studies of agricultural markets are common. Examples include Dawson and Dey (2002), Mohanty, Peterson, and Smith (1996), Ghosh (2003), and Mohanty and Langeley (2003).

[2] There may be too many papers to list here, but some examples include Broda and Weinstein (2006), Engel and Rogers (1994), and Robertson, Kumar, and Dutkowsky (2009).

Labor market integration studies follow the product and capital market integration literature in the sense that studies use three similar metrics. Differences in absolute levels of wages, covariation of wages over time, and the convergence of wages back to equilibrium differentials all appear as metrics of labor market integration. Rothenberg (1988) connects labor market integration with wage rate dispersion. Rosenbloom (1989, 1995) uses the differences in wage levels when measuring the labor market integration. Allen (1990) uses real wage convergence to analyze how tightly integrated labor markets were between regions that sent and received migrants. O'Rourke (1993) uses both the co-variation of wages in different countries over time and the convergence of wage levels. Robertson (2000) uses both the co-variation and convergence of wages and finds that U.S. and Mexican labor markets were integrated even before the North American Free Trade Agreement (NAFTA).

B. Theoretical Framework

Three measures have emerged as the main measures of labor market integration. The first is the difference in absolute wage levels. The second is the co-movement of wages over time. The third is the rate of convergence back to an equilibrium differential. All of these measures focus on the wage differential between two countries for similar workers. Although it is well-known that the trade-theoretic prediction of Factor Price Equalization rarely holds, we present measures of the size of differentials between countries to illustrate and motivate the additional two measures. We posit that the difference in absolute wage levels differential is a function of labor-market integration following Robertson (2000).

Consider an economy composed of two countries ("A" and "B"). We assume that labor in the two countries are price substitutes, such that an increase in the wages of "A" workers increases the demand for "B" workers. We also assume that capital flows between the two regions are not instantaneous, such that the lagged country B wage affects the demand for labor in country A. A general form that captures the previous assumptions is:

(1) $$L_{jt}^{dA} = \delta_0 + \delta_1 w_{jt-1}^{B} - \delta_2[w_{jt}^{A} - \gamma w_{jt-1}^{A}] + \delta_{3j}$$

Where L^{dA} is labor demand in country A, w^{A} is the natural log of the country A wage, and w^{B} is the natural log of the country B wage. The subscript j represents an education-experience group and subscript t represents the time period. The parameter γ captures the responsiveness of demand to lagged wages, and δ_{3j} is a group-specific effect on labor demand.

If wages rise in country B, country A workers may choose to emigrate to country B. We assume that workers may migrate instantaneously from one region to another, because labor is more mobile than factors that shift demand, such as capital. Therefore, the supply of country A labor is responsive to wage levels in both regions. A general form that captures these assumptions is:

(2) $$L_{jt}^{sA} = \sigma_0 - \sigma_1 w_{jt}^{B} + \sigma_2[w_{jt}^{A} - \varphi w_{jt-1}^{A}] + \sigma_{3j}$$

The variable L^{s} represents labor supply. The subscript j represents an education-experience group and subscript t represents the time period. The parameter φ captures the responsiveness of supply to lagged wages, and σ_{3j} is a group-specific effect on labor supply.

The coefficients δ_1 and σ_1 represent the cost of migration to demanders and suppliers of labor, respectively. These costs are exogenous, but they are high enough to prevent perfect wage equalization from occurring.[3] In the presence of exogenous costs, an equilibrium differential separates regional wages. Wage shocks may temporarily move wages away from such an

[3] As an example of these migration costs, Roberts et al. (2010) estimate smuggling costs.

equilibrium, but they will eventually return to it. We represent equilibrium as:

$$(3)\quad \delta_0 + \delta_1 w^{B}_{jt-1} - \delta_2\left[w^{A}_{jt} - \gamma w^{A}_{jt-1}\right] + \delta_{3j} = \sigma_0 - \sigma_1 w^{B}_{jt-1} + \sigma_2[w^{A}_{jt} - \varphi w^{A}_{jt-1}] + \sigma_{3j}$$

That is, such that demand equals supply. By solving (3) for the current country A wage, we obtain an expression in terms of the lagged country A wage, the current and lagged country B wage:

$$(4)\qquad w^{A}_{jt} = \frac{\delta_0 - \sigma_0}{\delta_2 + \sigma_2} + \frac{\delta_{3j} - \sigma_{3j}}{\delta_2 + \sigma_2} + \frac{\gamma\delta_2 + \varphi\sigma_2}{\delta_2 + \sigma_2} w^{A}_{jt-1} + \frac{\sigma_1}{\delta_2 + \sigma_2} w^{B}_{jt} + \frac{\delta_1}{\delta_2 + \sigma_2} w^{B}_{jt-1}$$

For the sake of simplicity, we may rewrite (4) as:

$$(5)\qquad w^{A}_{jt} = a_0 + a_{0j} + a_1 w^{A}_{jt-1} + e_1 w^{B}_{jt} + e_2 w^{B}_{jt-1}$$

As specified in Robertson (2000), Hendry and Ericsson (1991) show that long-run homogeneity between w^{A} and w^{B} implies that the sum of a_1, e_1 and e_2 equals 1. Thus, we may take a differenced form of (5) to obtain:

$$(6)\qquad \Delta w^{A}_{jt} = \alpha_0 + \alpha_1 \Delta w^{B}_{jt} + \alpha_2 (w^{A} - w^{B})_{jt-1} + \mu_{jt}$$

This equation represents the first measure of labor market integration: the responsiveness to shocks from another country (represented by the alpha 1 parameter) and the speed at which the wages, when shocked, return to the equilibrium differential (the alpha 2 parameter). Measuring labor market integration in this way allows for a persistent “place premium” described elsewhere in the literature. More integrated markets will have stronger responses to shocks (larger alpha 1 parameters) and faster convergence speeds (more negative alpha 2 parameters). Measuring labor market integration in this way captures the “short run.”

In the long run, however, we might think that wages would converge. The wage differences between two countries may remain large in the short run, but economic integration in the longer run is often predicted to lead to convergence. An alternative measure is the estimated long-run equilibrium wage differential. The condition of equilibrium implies that wages in both regions are such that labor markets clear; as long as labor markets remain in equilibrium, wage levels do not change over time. As a result, $\Delta w^{A}_{jt} = 0$, $\Delta w^{B}_{jt} = 0$ and $(w^{A} - w^{B})_{jt-1} = (w^{A} - w^{B})_{jt}$. We impose this restriction and solve for $(w^{A} - w^{B})_{jt}$:

(7) $$(w^{A} - w^{B})_{jt} = -\left(\frac{\alpha_0}{\alpha_2}\right)_{jt} + \varepsilon_{jt}$$

We then estimate the long-run equilibrium wage differential between matched workers across country pairs. As illustrated above, the equilibrium differential is a function of the "deep" parameters that capture the responsiveness of capital and labor mobility on wages. Deepening economic integration, changes in policy, and a host of other factors may affect the long-run differential. Since the differential may also be affected by changes in the domestic wage structures, we also analyze how the differential changes in the context of changes in the domestic wage structure.

III. Empirical Results

The discussion of the econometric results has three parts. Prior to presenting the data and results concerning the convergence of wages across and within countries, the following section covers the analysis of international convergence of GDP per capita.

A. Stylized Facts: Latin American Wage Convergence in Context

Using GDP per capita data[4] for 169 countries, Figure 1 shows the standard deviation and mean pairwise differences for all countries. The figure shows divergence between countries' GDP per capita over the 1990-2008 period. Starting with the 2008 financial crisis, we observe income convergence. This pattern would be consistent with the higher-income countries pulling ahead

[4] The data are PPP-valued GDP per capita in constant (2011) dollars from the World Development Indicators.

during the boom period, and then falling relative to the rest during the crisis.

We also estimate (6) using these data to estimate the effect of the transmission of shocks across borders and the rate of adjustment back to the long-run equilibrium. We merge in gravity model data to explore the relative transmission of shocks across countries that share borders relative to the rest of the world. Incorporating the border effects is one way to estimate the relative importance of neighbors.

Table 1 shows that the model (6) performs as expected in the sense that the estimated coefficient on the first term is positive. The lagged difference terms are negative as expected but extremely small. These results are consistent with the idea that on average the effects of shocks in an average country on another average country are not large and that there is very little evidence of global convergence.

When we look at the relative importance of neighbors, as measured using the border dummy variable, we find that the countries that share borders have much more strongly correlated shocks. In Table 1, we estimate that the transmission of shocks across countries that share common borders is about four times that of countries that do not share borders. This result is stronger when we use the inverse of the log distance between countries as weights, which reinforces the idea that neighborhood effects are important. The effect of borders is also very prominent when estimating the speed of convergence, as shown in columns (3) and (4) of Table 1. The rate of convergence for countries that share a border is an order of magnitude larger than that of a random (non-contiguous) pair of countries.

Using GDP per capita data for 28 Latin American countries covering the period 1990-2013,[5] Figure 2 illustrates both the standard deviation and the average value of the absolute value

[5] The data are PPP-valued GDP per capita in constant (2011) dollars from the World Development Indicators.

of the pairwise (log) difference over time. An increase indicates wage divergence, while a fall indicates convergence. Overall the series shows clear business cycle patterns over the 24 year period, but the average log difference and the standard deviation are nearly identical in 2013 and 1990. The small difference between 1990 and 2013 suggests that there is little evidence of long-run convergence.

To more formally evaluate the transmission of shocks within different regions, Table 2 presents a variation of (6) with regional controls added for East Asia and the Pacific (EAP) and Latin America (LAM). The rest of the countries of the world make up the omitted (reference) category. The results suggest that Latin American countries are much more integrated than the EAP countries in the sense that LAM countries are both more responsive to shocks and exhibit more rapid convergence back to the equilibrium differential.

To focus just on Latin American countries, Table 3 presents the same estimation results when the sample is limited to Latin American countries. These results suggest that bordering countries in particular (columns 3 and 4) react very strongly to neighbor's shocks. The rate of convergence is also more rapid for neighboring countries. The point values in tables 2 and 3 tell a consistent story of Latin American countries being more integrated than East Asian and Pacific countries in particular and global countries generally.

Ratios of GDP per capita may be different than the ratios of wages for several reasons. First, GDP per capita includes all potential sources of income, including capital earnings. Since a relatively small minority of people in Latin America have significant earnings from capital, a comparison of labor income and GDP per capita may differ. Secondly, the GDP per capita may differ due to demographic differences. An older, more educated population may have a higher GDP per capita than a neighboring country even if the wage ratios are equal to one. Therefore, micro data have the potential to present much more accurate comparisons of wage convergence and labor market integration.

B. The Microeconomic Data

To control for the differences in demographic changes across countries, we draw upon Latin American household surveys from 16Latin American countries: Argentina, Brazil. Chile, Colombia, Dominican Republic, Costa Rica, Bolivia, Ecuador, El Salvador, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, and Uruguay. We restrict the samples to just years after 2000 and before 2014. We impose other sample restrictions as well, including limiting the age to the 18-65 year range and, in this first pass, we limit the sample to males with positive earnings. We also drop observations of income in the top and bottom 1% in each country.

There is a great deal of variation in sample size across countries. Table 4 shows the number of observations by country (and average per year) after the sample restrictions are imposed. There is much variation in the size of the sample, with the smallest sample being in Nicaragua. Mexico has the largest sample. The main point of Table 4, however, is that even the relatively small sample sizes are large enough to have confidence in the estimates of mean wages.

As is well-known, the demographic distribution differs across countries. Figure 3 demonstrates one aspect of this by presenting the age distribution by country (before the sample restrictions are imposed) for the latest year that the data are available for each country. In general, the poorer countries have larger population spikes at the younger ages. This is important because differences in demographic distributions across countries can affect aggregate comparisons (such as GDP per capita) and therefore helps motivate our focus on matching demographic groups.

To generate the mean wage estimates, we identify five age groups (18-26, 27-35, 37-45,46-

53, and 54-65) and five education groups based on years of education (1-5, 6-8, 9-11, 12-15, and more than 16 years). Using sample weights, we generate the mean of PPP-adjusted 2005 dollar-value monthly earnings for each cell. These cells are identified by age, education, country, and year.

To link the micro analysis with the macro analysis presented earlier, Figure 4 compares the mean wages calculated from the household surveys and the log GDP per capita from the 2009-2013 period. The GDP per capita explains about half of the variation in wages across countries, which suggests that GDP per capita convergence only tells part of the story about labor market integration. Note that Peru, Bolivia, and Paraguay have higher-than-predicted mean wages (given their GDP per capita) while the poorer Central American countries (Nicaragua, Honduras, and El Salvador) have lower-than-predicted wage levels.

C. Empirical Results

To compare wages more formally, the mean wages for each demographic cell from country "A" are matched with the corresponding mean wage from every other Latin American country for each year. We then take the absolute value of the difference for each pair of countries. For illustrative purposes, we present the mean (absolute value of) wage differentials by cell in Figure 5. Figure 5 reveals the first main result from this study: the wage differentials across demographic groups are not constant. They are, however, consistent with, among others, migration theories in the sense that the differentials across countries are lowest for the middle education groups. The middle education groups, of course, are those most likely to migrate. Note that the oldest workers also tend to have the highest differentials. The older workers are least likely to migrate. We illustrate these results more formally in the empirical analysis that follows.

Once the demographic groups are matched, we formally compare the convergence or divergence of pair-wise wage differentials. Tables 5 and 6 contain summary statistics for the matched differentials. Table 5 contains the mean of the absolute value of the pair-wise differential across all demographic groups for each country and each of three periods (2000-2004, 2005-2008, and 2009-2013). In general, the results suggest that there has been significant wage convergence. The mean wage differentials for all but four of the 16 countries fall over time. In many of the countries the differentials fall by more than 10 log points.

Two exceptions – Mexico and Peru – experience falling differentials over the first two periods but rising differentials in the third period. The other two exceptions – Argentina and Honduras exhibit other patterns (constant for Argentina and consistently rising for Honduras). Given that Honduras is a low-income country, the rising differentials suggest that Honduras has been falling behind, which is a result not immediately apparent in the GDP per capita data.

Table 6 contains the mean year-on-year changes in differentials for the same three periods. Negative values here indicate convergence while positive values indicate divergence. The results are not surprisingly quite consistent with those of Table 5. Most countries exhibit convergence over the sample periods, and the same exceptions emerge.

To provide additional context for the size of the differentials, Table 7 contains a comparison of wage differentials across Latin American countries and wage differentials between cities within Mexico and states within the United States. The comparison shows the expected result that wage differentials within countries are much smaller than those across countries.

To more formally evaluate some of the driving forces associated with the changes in differentials over time, we first estimate equation (6) using wages that are matched across country pairs by demographic group. If education quality differs across countries, then matching the cells across countries will not be appropriate. If education quality differs dramatically between countries, appropriate matching would require a consistent measure of education quality across all of our sample countries. We have not been able to find such a measure for all of the countries in our sample and therefore offer the following results with the caveat that they may not be robust to differences in education quality across countries.

The results in column (1) of Table 8 are consistent with those presented in Tables 1-3. The effects of shocks are strong and positive and the lagged difference is negative and statistically significant. The coefficient magnitudes are not necessarily intuitive, however. Boyer and Hatton (1994) suggest that the speed of convergence can be estimated as (1-b)/b. This implies that the speed of convergence would imply that convergence would be very slow (taking more than 53 years). For comparison, columns (2) and (3) present the results from the same exercise for shocks within the United States (2) and Mexico (3). For the United States we use monthly data from the Monthly Outgoing Rotation Groups (MORG) of the Current Population Surveys. For Mexico we use the quarterly household surveys from the ENOE surveys.

The results in columns (2) and (3) suggest that within-country convergence is much more rapid than convergence across countries. For the United States, convergence back to an equilibrium differential would take about 4 months.[6] Convergence to the equilibrium differential within Mexico takes considerably longer – about 7.6 years. This result is consistent with Chiquiar (2001) who suggests that differentials between Mexico's northern border and southern regions grow over time. Note, however, that the responsiveness of shocks is similar across the three columns, which may suggest that the three are subject to common external shocks.

[6] For another comparison, Robertson (2000) finds that the speed of convergence to the equilibrium differential between the United States and the Mexican border city Tijuana is about 4 months. Convergence to equilibrium differentials between the United States and the interior of Mexico takes longer.

Turning to the long-run behavior of the differentials across countries, Table 9 focuses on the time-series properties of the long-run differential defined in (7). We estimate the change in these differentials as a function of age and education group dummy variables and a time trend. The first main message that emerges from Table 9 is that the second and third education groups have the lowest differentials. The least educated group has the largest differentials. Those groups with higher differentials are the least likely to migrate. The second main message from Table 9 is that there is some evidence of convergence over time of about 1.5 log points per year.

To explore the hypothesis that proximity may be driving differentials (as might be the case if countries that shared a border were more likely to have migrants or trade), we add the border dummy variable used in the macro analysis and interact it with the education groups. While the differentials are smaller for the same groups identified in Table 9, three of the border interaction terms are statistically significant and positive, suggesting that bordering countries are less likely to converge – especially for the most educated workers. Again, these are the workers that may be least likely to migrate. Note, however, that now the convergence rates for the most educated workers in non-bordering countries are statistically significant. The trend term remains statistically significant and negative.

Since the trend term is consistently suggesting convergence, we explore the possibility that the convergence occurs at different rates across the different periods. Table 10, which contains period controls, shows that the convergence is increasing over the sample period and that there was considerable convergence in the 2009-2013 period. This result is consistent with Figure 2. The higher rate of convergence during this period might be explained by the relatively strong contraction in the higher-income countries during the global financial crisis. The possibility that trade, migration, and foreign investment are contributing to convergence over time would be consistent with this result.

To explore the possibility that the different groups converged over time at different rates, column 2 of Table 10 contains the period dummy variables interacted with the education variables. The results suggest that the convergence does not differ by period across education groups. This suggests that the convergence in wages that we have seen over the 1999-2013 period was not due to migration of certain factors or due to trade that favored one group over another. Instead, the lack of statistically significant results suggests that macroeconomic factors, such as business cycles, may be driving the convergence.

IV. Conclusions: Labor Market Integration as an Indicator of Economic Integration

Understanding and measuring labor market integration is important for several reasons. Labor market integration offers a measure of economic integration that reflects how well broader mechanisms of economic integration, such as trade and foreign investment, may be affecting the standard of living of a country's workers. Measuring labor market integration also has the potential for revealing the potential to realize further gains from economic integration. Furthermore, understanding labor market integration helps us understand how well different policies, such as those that foster trade and investment, may actually lead to economic integration.

The goal of this paper is to present and estimate three measures of labor market integration for Latin America. The first two measures are based on short-run shocks: how labor markets respond to short-run shocks in neighboring countries and how quickly wages in different countries converge back to a long-run differential. The third measure takes a long-run approach and estimates the time series properties of the wage differentials across national borders.

This paper applies these measures to several different data sets, including the macro level of GDP per capita and the micro level of wages of demographically-comparable workers across countries. Using the GDP per capita data allows us to put Latin American labor market integration into context. The results suggest that Latin American labor markets are generally more integrated than other regions of the world and more integrated than East Asia and Pacific nations in particular. Labor market integration within Latin America, however, is far from complete. Using comparable data from Mexico and the United States, we find (not surprisingly) that labor markets across countries are less integrated than labor markets within countries. Overall, these results suggest that market integration within Latin America is far from complete.

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Figure 1: Comparing the Mean Pairwise Differentials and Standard Deviation of GDP per Capita over Time
All Available Countries

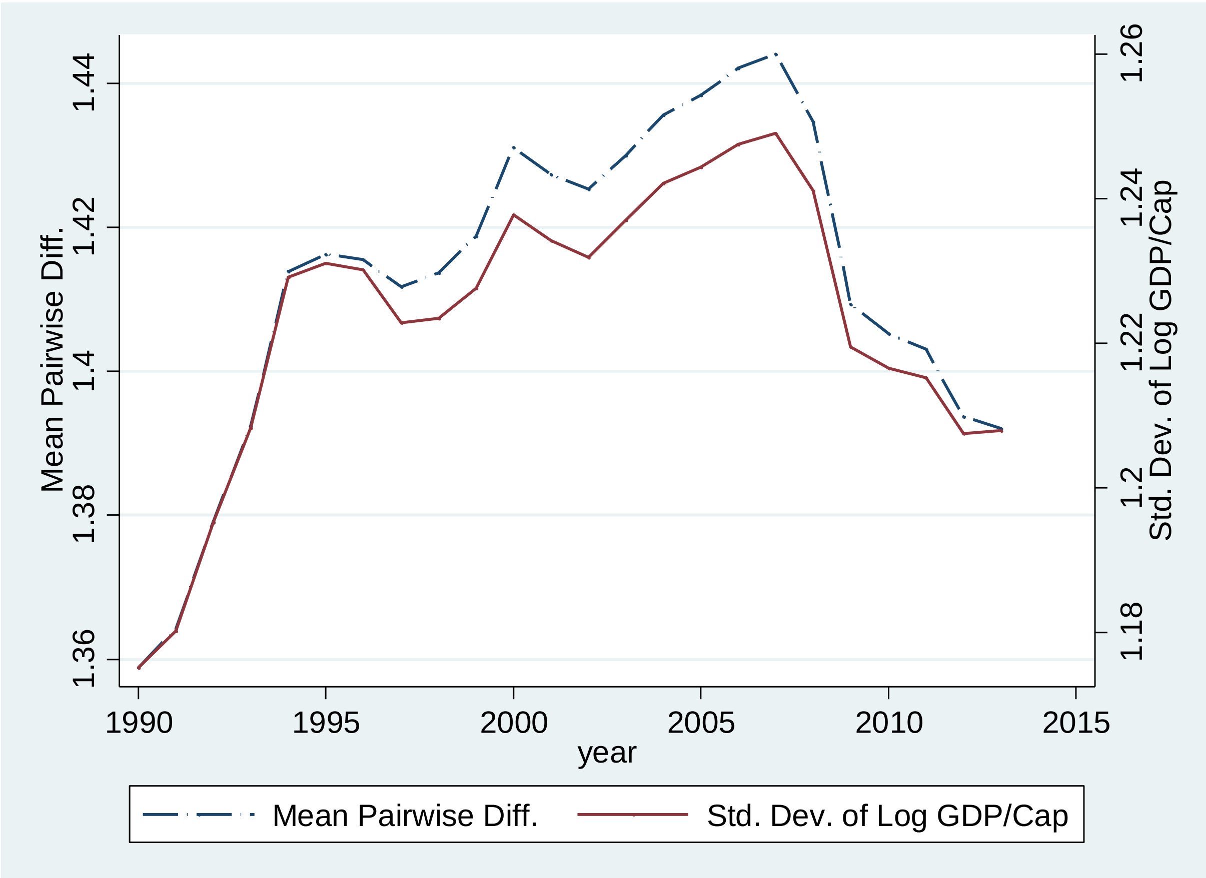

Figure 2: Comparing the Mean Pairwise Differentials and Standard Deviation of GDP per Capita over Time Latin American Countries

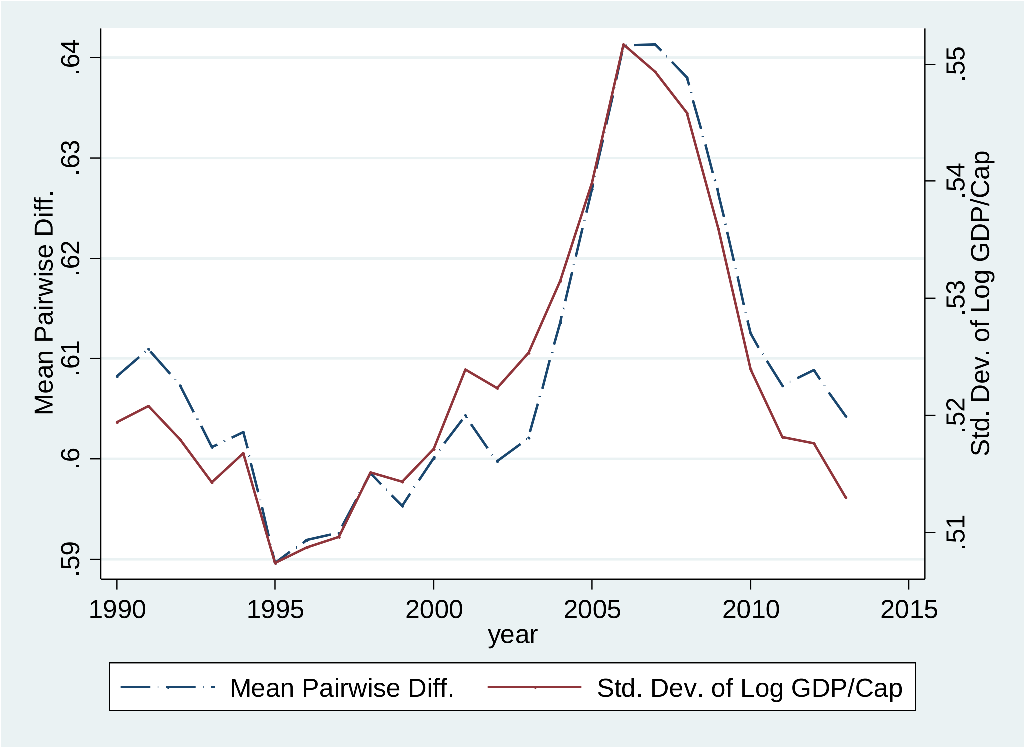

Figure 3: Age Distribution by Country

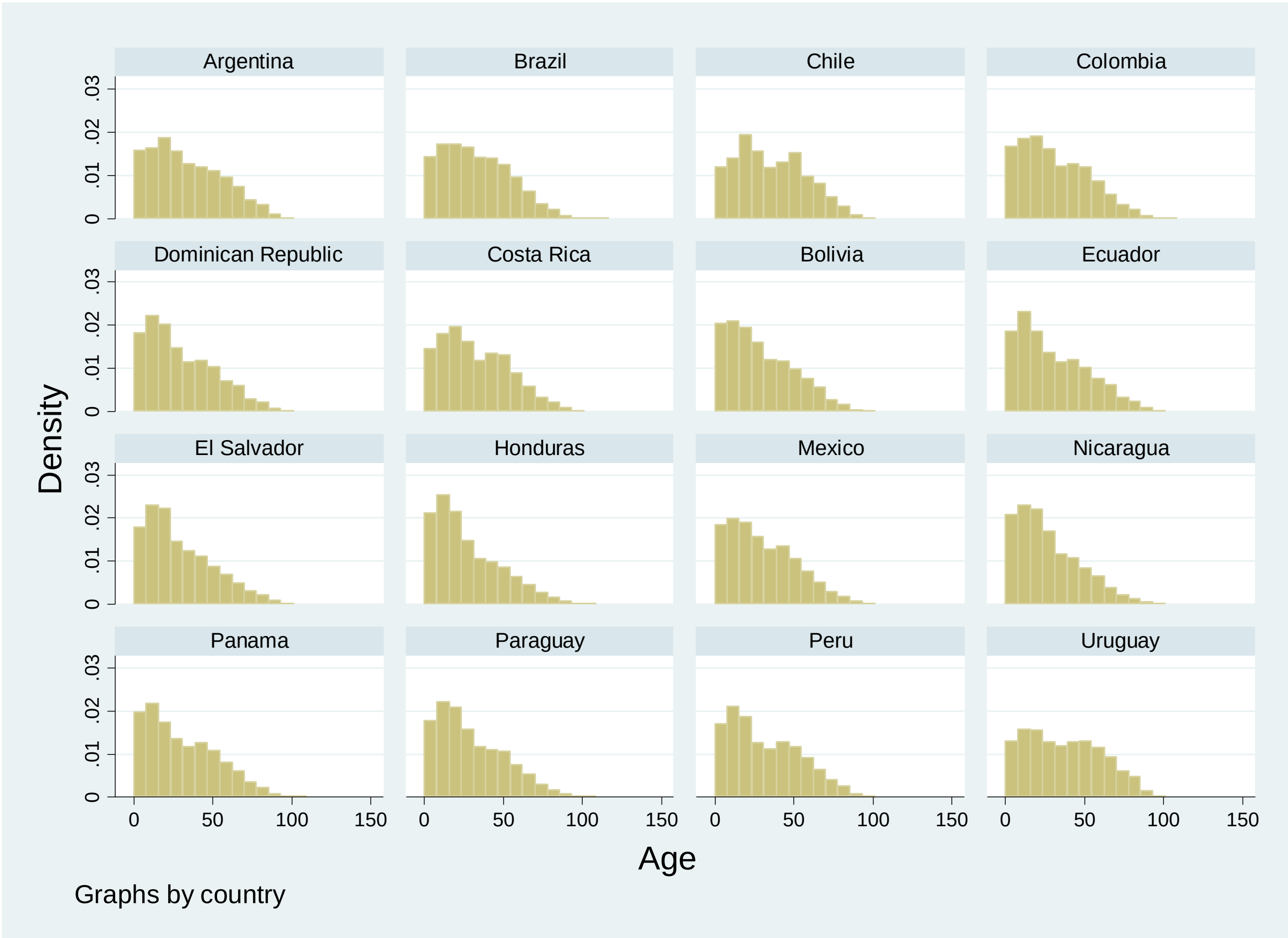

Figure 4: Comparing Wage and GDP per capita

Notes: The Adjusted R-squared from the simple fit line is 0.498, which suggests that GDP per capita

explains about half of the wage variation across countries.

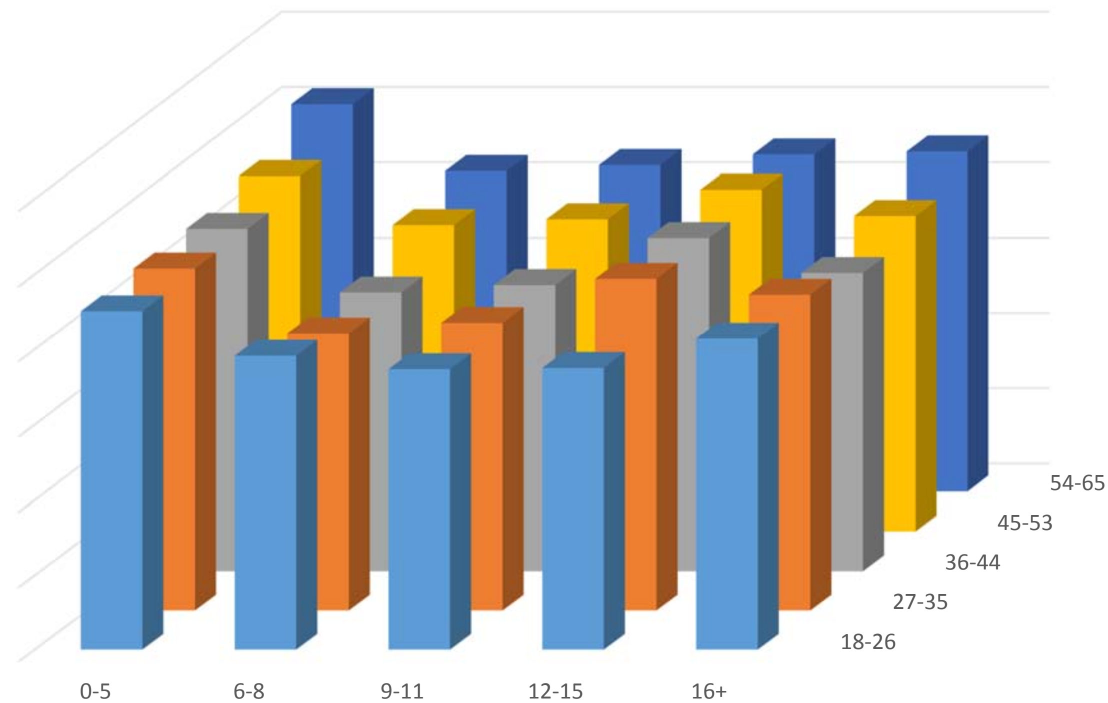

Figure 5: Mean Wage Differentials
By Age and Education

Table 1: Error Correction Model of Shocks across Borders in Log GDP per Capita
169 Countries with Border Interaction Terms

VARIABLES	(1) Unweighted	(2) Weighted	(3) Unweighted	(4) Weighted
Change in GDP B	0.067***	0.071***	0.063***	0.066***
	(0.001)	(0.001)	(0.001)	(0.001)
Change x Border			0.187***	0.191***
			(0.009)	(0.008)
Lagged Difference	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
L. Diff x Border			-0.003***	-0.003***
			(0.001)	(0.001)
Constant	0.017***	0.017***	0.017***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	592,480	592,480	592,480	592,480
R-squared	0.004	0.005	0.005	0.006

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. In column three, the sum (standard error) of the change and the border interaction effect is 0.250 (0.009). The sum of the lagged difference and interaction effect is -0.0032 (0.0007). In column four, the sum (standard error) of the change and the border interaction effect is 0.257 (0.008). The sum of the lagged difference and interaction effect is -0.0028 (0.0006). The main contiguous effect is included but not reported.

Table 2: Error Correction Model of Shocks across Borders in Log GDP per Capita
169 Countries with Regional Interaction Terms

VARIABLES	(1) Unweighted	(2) Weighted	(3) Unweighted	(4) Weighted
East Asia & Pacific	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Latin America	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Change GDP B	0.066***	0.070***	0.066***	0.070***
	(0.001)	(0.001)	(0.001)	(0.001)
x EAP	0.013	0.021*	0.013	0.021*
	(0.012)	(0.012)	(0.012)	(0.012)
x LAM	0.056***	0.057***	0.059***	0.061***
	(0.013)	(0.012)	(0.013)	(0.012)
Lagged Difference	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
x EAP			0.000	0.000
			(0.000)	(0.000)
x LAM			-0.003***	-0.003***
			(0.001)	(0.001)
Constant	0.017***	0.017***	0.017***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	592,480	592,480	592,480	592,480
R-squared	0.005	0.005	0.005	0.005

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. In column three, the sum (standard error) of the change and the interaction effect for East Asia is 0.0787 (0.012) and for the differenced effect is 0.0003 (0.0003). For Latin America, the sum (standard error) is 0.125 (0.013) and -0.0026 (0.0006). In column 4 the sums (standard errors) for East Asia are 0.091 (0.012) and -0.0001 (0.0003). For Latin America, the sums (standard errors) are 0.130 (0.012) and -0.0027 (0.0006).

Table 3: Error Correction Model of Shocks across Borders in Log GDP per Capita Latin America

VARIABLES	(1) Unweighted	(2) Weighted	(3) Unweighted	(4) Weighted
Change in GDP B	0.131***	0.136***	0.123***	0.128***
	(0.008)	(0.008)	(0.008)	(0.008)
Change x Border			0.138***	0.128***
			(0.032)	(0.031)
Lagged Difference	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
L. Diff x Border			-0.002	-0.002
			(0.002)	(0.002)
Constant	0.018***	0.018***	0.018***	0.018***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	17,388	17,388	17,388	17,388
R-squared	0.018	0.019	0.019	0.020

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. In column three, the sum (standard error) of the change and the interaction effect is 0.259 (0.031). In column four, the sum is 0.254 (0.030). In column three, the sum (standard error of the lagged difference and the interaction effect is -0.0035 (0.0016). In column 4 the sum is -0.0033 (0.0015). The main contiguous effect is included but not reported.

Table 4: Sample Sizes from Household Surveys

Country	1999-2003	2004-2008	2009-2013	Total
Argentina	64,300	59,603	63,950	187,853
Brazil	323,905	456,237	343,928	1,124,070
Chile	11,206	11,769	11,799	34,774
Colombia	65,815	104,963	214,912	385,690
Dominican Republic	20,322	31,826	33,046	85,194
Costa Rica	41,216	49,882	49,734	140,832
Bolivia	14,813	19,560	24,892	59,265
Ecuador	33,888	82,007	81,861	197,756
El Salvador	53,701	59,887	79,794	193,382
Honduras	45,850	65,031	42,439	153,320
Mexico	450,262	1,198,260	1,329,774	2,978,296
Nicaragua	3,701	6,768	75,589	86,058
Panama	49,080	56,400	53,895	159,375
Paraguay	23,286	24,255	22,544	70,085
Peru	48,140	94,301	111,076	253,517
Uruguay	46,008	143,371	146,585	335,964
Total	1,295,493	2,464,120	2,685,818	6,445,431

Table 5: Mean Wage Differentials
(Standard Deviations in Parentheses)

Country	2000-2004	2005-2008	2009-2013
Argentina	0.390	0.360	0.360
	(0.370)	(0.295)	(0.233)
Brazil	0.464	0.402	0.346
	(0.443)	(0.313)	(0.240)
Chile	0.415	0.360	0.338
	(0.413)	(0.313)	(0.226)
Colombia	0.378	0.297	0.270
	(0.347)	(0.247)	(0.181)
Dominican Republic	0.416	0.315	0.308
	(0.425)	(0.266)	(0.206)
Costa Rica	0.581	0.524	0.424
	(0.478)	(0.342)	(0.255)
Bolivia	0.558	0.376	0.326
	(0.329)	(0.245)	(0.220)
Ecuador	0.521	0.328	0.298
	(0.305)	(0.244)	(0.203)
El Salvador	0.642	0.424	0.382
	(0.288)	(0.236)	(0.226)
Honduras	0.373	0.402	0.497
	(0.380)	(0.306)	(0.326)
Mexico	0.417	0.314	0.332
	(0.402)	(0.267)	(0.218)
Nicaragua	1.607	1.098	0.579
	(0.313)	(0.280)	(0.264)
Panama	0.377	0.315	0.300
	(0.383)	(0.263)	(0.189)
Paraguay	0.366	0.299	0.275
	(0.384)	(0.258)	(0.172)
Peru	0.529	0.504	0.571
	(0.465)	(0.342)	(0.290)
Uruguay	0.400	0.325	0.311
	(0.370)	(0.261)	(0.216)

Table 6: Mean Changes in Differentials
(Standard Deviations in Parentheses)

Country	2000-2004	2005-2008	2009-2013
Argentina	-0.030	0.000	-0.030
	(0.187)	(0.185)	(0.310)
Brazil	-0.062	-0.056	-0.118
	(0.209)	(0.187)	(0.345)
Chile	-0.055	-0.022	-0.077
	(0.188)	(0.201)	(0.336)
Colombia	-0.081	-0.027	-0.108
	(0.179)	(0.177)	(0.314)
Dominican Republic	-0.102	-0.007	-0.108
	(0.275)	(0.218)	(0.445)
Costa Rica	-0.056	-0.100	-0.157
	(0.212)	(0.212)	(0.369)
Bolivia	-0.182	-0.051	-0.233
	(0.185)	(0.218)	(0.330)
Ecuador	-0.193	-0.030	-0.223
	(0.167)	(0.172)	(0.265)
El Salvador	-0.217	-0.042	-0.259
	(0.152)	(0.184)	(0.252)
Honduras	0.029	0.095	0.124
	(0.309)	(0.258)	(0.493)
Mexico	-0.102	0.017	-0.085
	(0.214)	(0.265)	(0.442)
Nicaragua	-0.509	-0.519	-1.028
	(0.221)	(0.166)	(0.268)
Panama	-0.062	-0.015	-0.077
	(0.207)	(0.187)	(0.343)
Paraguay	-0.067	-0.024	-0.091
	(0.212)	(0.187)	(0.345)
Peru	-0.026	0.067	0.041
	(0.206)	(0.199)	(0.353)
Uruguay	-0.074	-0.014	-0.088
	(0.228)	(0.219)	(0.310)

Table 7: Mean Wage Differentials Over Time

Year	USA	Mexico	Latin America
2000	0.204	0.250	0.467
2001	0.199	0.261	0.552
2002	0.196	0.269	0.524
2003	0.193	0.245	0.486
2004	0.195	0.223	0.454
2005	0.188	0.265	0.438
2006	0.194	0.253	0.417
2007	0.208	0.251	0.408
2008	0.207	0.237	0.359
2009	0.208	0.222	0.356
2010	0.209	0.220	0.364
2011	0.213	0.217	0.357
2012	0.205	n.a.	0.372
2013	0.209	n.a.	0.374
Total	0.202	0.243	0.422

Table 8: Error Correction Model of Shocks in Log Wages
Latin America/United States/Mexico Cities

VARIABLES	(1) Latin America	(2) United States	(3) Mexico Cities
Change in wage B	0.372***	0.389***	0.335***
	(0.006)	(0.012)	(0.004)
Lagged Difference	-0.0188***	-0.324***	-0.0572***
	(0.002)	(0.015)	(0.002)
Constant	-0.0859***	-0.112***	-0.0490***
	(0.001)	(0.005)	(0.001)
Observations	25,856	338,954	43,148
R-squared	0.114	0.196	0.135

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Wage Differentials over Time--Levels
Latin America/United States/Mexico Cities

VARIABLES	(1) LAM: Levels	(2) LAM: Interactions	(3) United States	(4) Mexico Cities
Year	-0.015***	-0.015***	0.002***	-0.002
	(0.004)	(0.004)	(0.001)	(0.001)
Ed 6-8 yrs	-0.077***	-0.087***	0.015	-0.050***
	(0.013)	(0.016)	(0.010)	(0.005)
Ed 9-11 yrs	-0.073***	-0.090***	-0.152***	-0.077***
	(0.023)	(0.028)	(0.011)	(0.008)
Ed 12-15 yrs	-0.037	-0.059	-0.253***	-0.060***
	(0.037)	(0.040)	(0.012)	(0.009)
Ed 16+ yrs	-0.049	-0.069*	-0.191***	-0.061***
	(0.031)	(0.033)	(0.013)	(0.011)
Border		-0.088		
		(0.067)		
Ed 6-8 yrs x Bor		0.053*		
		(0.029)		
Ed 9-11 yrs x Bor		0.093		
		(0.053)		
Ed 12-15 yrs x Bor		0.119*		
		(0.056)		
Ed 16+ yrs x Bor		0.107*		
		(0.055)		
Ages 27-35	0.012	0.012	-0.026***	-0.009**
	(0.007)	(0.007)	(0.004)	(0.003)
Ages 37-45	0.008	0.008	0.002	-0.001
	(0.010)	(0.010)	(0.005)	(0.004)
Ages 46-53	0.032**	0.032**	0.019***	0.005
	(0.014)	(0.014)	(0.004)	(0.004)
Ages 54-65	0.053**	0.053**	0.043***	0.039***
	(0.019)	(0.019)	(0.006)	(0.007)
Constant	30.162***	30.162***	-3.669***	4.195
	(8.044)	(8.044)	(1.028)	(2.912)
Observations	40,000	40,000	429,065	54,766
R-squared	0.031	0.034	0.181	0.027

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Education by Period--Levels
Latin America/United States/Mexico Cities

VARIABLES	(1) LAM: Levels	(2) LAM: Interactions	(3) United States	(4) Mexico Cities
2005-2008	-0.098***	-0.104***	-0.005	0.013
	(0.022)	(0.033)	(0.004)	(0.009)
2009-2013	-0.149***	-0.153**	0.017***	-0.02
	(0.038)	(0.052)	(0.005)	(0.013)
Ed 6-8 yrs	-0.077***	-0.083***	0.014	-0.050***
	(0.013)	(0.011)	(0.010)	(0.005)
Ed 9-11 yrs	-0.073***	-0.053**	-0.153***	-0.077***
	(0.023)	(0.021)	(0.011)	(0.008)
Ed 12-15 yrs	-0.037	-0.047	-0.254***	-0.060***
	(0.037)	(0.036)	(0.012)	(0.009)
Ed 16+ yrs	-0.049	-0.071**	-0.191***	-0.061***
	(0.031)	(0.032)	(0.013)	(0.011)
Ed 6-8 yrs x Per 2		0.001		
		(0.013)		
Ed 6-8 yrs x Per 3		0.017		
		(0.018)		
Ed 9-11 yrs x Per 2		-0.032		
		(0.020)		
Ed 9-11 yrs 3 x Per 3		-0.019		
		(0.030)		
Ed 12-15 yrs x Per 2		0.018		
		(0.023)		
Ed 12-15 yrs x Per 3		0.007		
		(0.037)		
Ed 16+ yrs x Per 2		0.044		
		(0.026)		
Ed 16+ yrs x Per 3		0.015		
		(0.043)		
Ages 27-35	0.012	0.012	-0.026***	-0.009**
	(0.007)	(0.007)	(0.004)	(0.003)
Ages 37-45	0.008	0.008	0.002	-0.001
	(0.010)	(0.010)	(0.005)	(0.004)
Ages 46-53	0.032**	0.032**	0.019***	0.005
	(0.014)	(0.014)	(0.004)	(0.004)
Ages 54-65	0.053**	0.053**	0.043***	0.039***
	(0.019)	(0.019)	(0.006)	(0.007)
Constant	0.540***	0.543***	0.343***	0.289***
	(0.048)	(0.052)	(0.013)	(0.017)
Observations	40,000	40,000	429,065	54,766
R-squared	0.032	0.033	0.181	0.031

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1