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ABSTRACT

Globalization and Wage Convergence: Mexico and the United States*

Neoclassical trade theory suggests that factor price convergence should follow increased commercial integration. Rising commercial integration and foreign direct investment followed the 1994 North American Free Trade Agreement between the United States and Mexico. This paper evaluates the degree of wage convergence between Mexico and the United States between 1988 and 2011. We apply a synthetic panel approach to employment survey data and a more descriptive approach to Census data from Mexico and the US. First, we find no evidence of long-run wage convergence among cohorts characterized by low migration propensities although this was, in part, due to large macroeconomic shocks. On the other hand, we do find some evidence of convergence for workers with high migration propensities. Finally, we find evidence of convergence in the border of Mexico vis-à-vis its interior in the 1990s but this was reversed in the 2000s.

JEL Classification: F15, F16, J31, F22

Keywords: migration, labor-market integration, factor price equalization

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The North American Free Trade Agreement (NAFTA) significantly increased commercial integration between the United States, Canada, and Mexico. Between 1994 and 2011, trade in goods between the two countries quadrupled in value, increasing from $108.39 billion to $461.24 billion (U.S.Census Bureau). The value of U.S. goods exported to Mexico increased from $50.84 to $198.39 billion, while the value of Mexican goods exported to the United States increased from $49.49 billion to $262.86 billion. In 2011, total exports to Mexico accounted for 13.4 percent of overall U.S. exports and total imports from Mexico accounted for 11.9 percent of overall U.S. imports (Office of the United States Trade Representative). In 2012, the total value of trade between Mexico and the U.S. closely approached half a trillion dollars. By 2013, total trade between all three NAFTA countries reached 1 trillion dollars.

GDP per capita has also increased in both countries. In constant 2005 U.S. dollars, U.S. GDP per capita increased from $32,015 to $43,063 between 1992 and 2012. While Mexico has had some macroeconomic setbacks, such as the December 1994 peso crisis, recovery has generally been rapid. In constant 2005 U.S. dollars, Mexican GDP per capita increased from $6,628 to $8,215 over the same time period.[1]

Rather than converge, however, Mexican GDP per capita and U.S. GDP per capita grew apart. The ratio of Mexican to U.S. GDP per capita fell from 20.7% of U.S. GDP per capita in 1992 to 19.2% in 2011.

The persistent and seemingly growing gap between GDP per capita is at odds with neoclassical trade theory, migration theory, and early applied general equilibrium predictions of the effects of NAFTA. The neoclassical Heckscher-Ohlin-Samuelson (HOS) framework, one of the canonical trade models, predicts that trade liberalization would lead to convergence in the

[1] World Bank Development Indicators. See http://data.worldbank.org/data-catalog/world-development-indicators.

prices of traded goods, which in turn would induce factor price convergence. In addition to the significant increase in trade noted above, Robertson, Kumar, and Dutkowsky (2009) find strong support for convergence in goods-level prices between Mexico and the United States, making the lack of convergence in income inconsistent with the prediction of trade models.[2]

The lack of convergence is also at odds with labor-based migration models. At the most basic level, an increase in labor supply from migration should reduce wages if the aggregate labor demand curve is downward sloping. Although debated, Borjas (2003) provides empirical evidence for the downward-sloping labor demand curve.[3] Emerging evidence also suggests that emigration increases wages of workers who stay behind. Mishra (2007) provides evidence that Mexican emigration bids up Mexican wages, and Elsner (2013a) finds similar results for Lithuania. Elsner (2013b) finds that emigration's effects are not uniform throughout the wage distribution. Because most Mexican migrants come from the middle to lower end of the age, education, and wage distribution (Chiquiar and Hanson 2005), convergence should be the most prominent for these demographic groups. Such movements would tend to raise Mexican wages and depress U.S. wages, thereby reinforcing the effects of free trade on wage convergence.

Early applied general equilibrium models generated predictions of NAFTA's effects that implied significant income convergence. Brown (1992) in particular surveys several of the pre-NAFTA applied general equilibrium models and demonstrates that the models that included both

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[2] The lack of evidence of factor price equalization generally has prompted many to question the validity of neoclassical HOS-type models. Schott (2003) finds that we live in a "multi-cone" world that precludes factor price equalization. Davis and Mishra (2007) suggest that ignoring important variation between the mix of factors employed in the production of domestic and imported goods obfuscates the possible effect that free trade may depress the wages of workers in relatively labor-intensive domestic industries. Goldberg and Pavcnik (2007) discusses evidence of rising inequality in poorer countries in the wake of many trade liberalizations in the eighties and nineties which is very much at odds with a standard HOS story of how globalization should unfold. The authors provide numerous reasons why the predictions of the standard HOS theory may not hold in the data such as technology, the pattern of tariff reductions, and within-industry shifts.

[3] For example, Card (1990, 2001) argues that the evidence for migration's effect on wages is weak.

Mexican and U.S. income gains all predicted that Mexican gains would be at least double (if not an order of magnitude greater than) the U.S. gains.

Although the above studies suggest that there should be some degree of wage convergence between Mexico and the United States, there has yet to be a study that investigates this directly. The closest papers to ours focus on within-country convergence or short-run convergence. Within-country changes may help explain changes in international comparisons, and early studies of the Mexican labor market did detect evidence of regional wage convergence within countries (Hanson 1996, 1997, and Chiquiar 2001). Robertson (2000) finds a strong, positive correlation between wage growth in the United States and wage growth for Mexican workers who reside on the border with the United States. Hanson (2003) also finds a similar result. Robertson (2005), however, finds no evidence that NAFTA increased the estimated degree of labor market integration between the United States and Mexico.

In this paper, we measure long-run international convergence using two complementary methodologies and four data sources. The first regression-based approach employs synthetic cohorts and matches quarterly data from the Current Population Survey (CPS) in the United States and the Encuesta Nacional de Ocupacion y Empleo (ENOE) in Mexico. The second approach is more descriptive and employs census data from Mexico and the United States.

Following Robertson (2000), Borjas (2003), and Mishra (2007), we first divide Mexican and U.S. working-age people into forty-five age-education cohorts. Comparing exclusively Mexican and U.S. workers in the same education-age cohort effectively controls for variation in returns to skill and allows us to use quarterly CPS data to identify time-series patterns. The disadvantage is that it focuses only on workers residing in urban areas in Mexico.

The second approach overcomes this disadvantage by using data that include rural workers, but it has the disadvantage that the data are observed only once every ten years. These data have the added advantages that, in a given year, the sample sizes are larger and have more complete information about hours worked. First, we compare mean wage differentials by education and age cohort and look at how these have evolved over time. Next, we look deeper into the data and investigate how the relative wage distributions have evolved over time by comparing changes in a given percentile for a given age and education level. Finally, we conduct an exercise in which we treat the United States and Mexico as one "integrated economy" and decompose wage inequality in this integrated economy into between and within components and investigate how these has changed over time.

The results demonstrate that there has been very little, if any, convergence between U.S. and Mexican wages over time for everyone but the least educated. While there is evidence of some convergence in the high-migration cohorts (*i.e.* younger people with less than twelve years of education), this seems to be primarily due to falling U.S. wages at the bottom of the U.S. income distribution, as opposed to rising Mexican wages. The overall divergence from 1990-2000, however, has much to do with the effect of the peso crisis of 1994. We do see some convergence in the high frequency data post-1994 but this abates in 2001. A more detailed look at the census data reveals that there was convergence in the border region of Mexico relative to the interior in the 1990's but subsequently, there was divergence in the 2000's. Since foreign direct investment in Mexico is mainly concentrated in the border, NAFTA may have indeed led to some initial wage convergence that was reversed during the 2000's.

Finally, we compare rising wage inequality in the United States and falling inequality in Mexico and show that each is driven by changes to the variation in wages within educational/age cohorts rather than across them, which is not consistent with a standard HOS explanation of how trade liberalization should impact inequality. Similarly, we also show that in the US-Mexico integrated economy the variance of log wages has declined and that this is due to reductions in variation in wages across education/age cohorts not within them which, once again, is not consistent a standard explanation of trade liberalization and inequality since it implies that trade liberalization should reduce the demand for a given factor in one country and raise the demand for *the same factor* in the other. While these results are not consistent with the HOS model of trade, richer models may be able to account for what convergence we do see.

We begin presenting these results with a simple theoretic model that motivates our focus on the equilibrium wage differential between Mexico and the United States in Section I. After describing the data in Section II, we present empirical results in Section III and IV. We then evaluate mechanisms that may be behind these findings and offer conclusions in Section V.

I. Theoretical Foundation

Our empirical work focuses on the long-run wage differential between Mexico and the United States. We posit that the differential is a function of labor-market integration following Robertson (2000). Consider an economy composed of two regions ("Mexico" and "United States"). We assume that Mexican and US workers are price substitutes, such that an increase in the wages of American workers increases the demand for Mexican labor. We also assume that capital flows between the two regions are not instantaneous, such that the lagged U.S. wage affects the demand for Mexican labor. A general form that captures the previous assumptions is:

$$L_{jt}^{d} = \delta_{0j} + \delta_1 w_{jt-1}^{us} - \delta_2 [w_{jt}^{mx} - \gamma w_{jt-1}^{mx}] \quad (1)$$

where L^d is labor demand, w^{us} is the natural log of the U.S. wage, and w^{mx} is the natural log of the Mexican 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_{0j} is a group-specific effect on labor demand.

If U.S. wages rise, Mexican workers choose to emigrate to the United States. 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 Mexican labor is responsive to wage levels in both regions. A general form that captures these assumptions is:

$$L_{jt}^{s} = \sigma_{0j} - \sigma_1 w_{jt}^{us} + \sigma_2 [w_{jt}^{mx} - \varphi w_{jt-1}^{mx}] \quad (2)$$

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_{0j} is a group-specific effect on labor supply.

The coefficients δ_{0j} and σ_{0j} represent the frictions in our model. The wage differential will be increasing as these two parameters move away from each other. We will show that when they are the same, there is no differential. One can interpret these as the cost of migration to demanders and suppliers of labor, respectively.[4]

In the presence of exogenous costs, an equilibrium differential separates regional wages. Wage shocks may temporarily move U.S. or Mexican wages away from equilibrium, but they will eventually return to it. We represent the short-run equilibrium as:

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

$$(3) \qquad \delta_{0j} + \delta_1 w_{jt-1}^{us} - \delta_2\left[w_{jt}^{mx} - \gamma w_{jt-1}^{mx}\right] = \sigma_{0j} - \sigma_1 w_{jt-1}^{us} + \sigma_2[w_{jt}^{mx} - \varphi w_{jt-1}^{mx}]$$

By solving (3) for the current Mexican wage, we obtain an expression in terms of the lagged Mexican wage, the current U.S. wage, and the lagged U.S. wage:

$$(4) \qquad w_{jt}^{mx} = \frac{\delta_{0j}-\sigma_{0j}}{\delta_2+\sigma_2} + \frac{\gamma\delta_2+\varphi\sigma_2}{\delta_2+\sigma_2} w_{jt-1}^{mx} + \frac{\sigma_1}{\delta_2+\sigma_2} w_{jt}^{us} + \frac{\delta_1}{\delta_2+\sigma_2} w_{jt-1}^{us}$$

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

$$(5) \qquad w_{jt}^{mx} = \alpha_{0j} + \alpha_1 w_{jt-1}^{mx} + \alpha_2 w_{jt}^{us} + \alpha_3 w_{jt-1}^{us}$$

As specified in Robertson (2000), Hendry and Ericsson (1991) show that long-run homogeneity between w^{mx} and w^{us} implies that the sum of α_1, α_2 and α_3 equals 1. Thus, we may take a differenced form of (5) to obtain:

$$(6) \qquad \Delta w_{jt}^{mx} = \alpha_0 + \alpha_2 \Delta w_{jt}^{us} + (1-\alpha_1)(w^{us} - w^{mx})_{jt-1}$$

Because $(1-\alpha_1)$ is positive, increases in the US wage relative to the Mexican wage will result in higher Mexican wages tomorrow.

The long-run 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, $\Delta w_{jt}^{mx} = 0$, $\Delta w_{jt}^{us} = 0$ and $(w^{us} - w^{mx})_{jt-1} = (w^{us} - w^{mx})_{jt}$. We impose this restriction and solve for $(w^{us} - w^{mx})_{jt}$:

$$(7) \qquad (w^{us} - w^{mx})_{jt} = \left(\frac{\alpha_0}{\alpha_2 - 1}\right) \quad = \frac{\delta_{0j} - \sigma_{0j}}{\delta_2(1-\gamma) + \sigma_2(1-\varphi)}$$

This difference is analogous to the migration cost in most theoretic migration models. Although ubiquitous, few papers analyze the long-run behavior of the equilibrium migration cost. Deepening economic integration, changes in policy, and a host of other factors may affect the long-run differential. For example, an increase in Mexican labor supply increases the wage gap, while an increase in Mexican labor demand reduces the gap. Increased responsiveness to wages (such as through a reduction in long-run migration costs that reduce the δ_2 and σ_2 parameters in the denominator) cause the gap to fall (as long as current wages are weighted more than past wages). Finally, if $\delta_{0j} - \sigma_{0j}$ is zero, then US and Mexican wages are the same in equilibrium.

II. Data

We use four datasets that represent two separate types of data. The first type is quarterly urban household survey data that cover the 1994-2011 period. U.S. household survey data are a representative sample of both urban and rural U.S. households, but the rural population is much smaller in the U.S. than in Mexico, leading us to assume that the covered populations are comparable. Second, we use census data that have two advantages over the survey data. The first is that the Mexican census data contain much more accurate information about rural households. The second is that the sample sizes are much larger so we can obtain a more detailed understanding of what is happening to the relative wage distributions. That said, they have the disadvantage of only being available in ten years intervals.

__Household Survey Data__

We extract all data on Mexican households from the Encuesta Nacional de Empleo (ENE) over the period 1988-2004 and from the Encuesta Nacional de Ocupacion y Empleo (ENOE) over the period 2005-2011. Data on U.S. households are from the Merged Outgoing Rotation Groups (MORG) data of the CPS over the entire 1988-2011 period. We exclude working-age adults who have zero or unreported earnings. The sample is further restricted to adult males between 19 and 63 years of age. Focusing on male workers allows us to ignore the issue of self-selection on the participation of women in the labor force, as well as the effect of changes to self-selection patterns over time and between the United States and Mexico.

The Mexican data are reported as monthly earnings until 2005. The U.S. data report weekly earnings. We multiplied reported U.S. weekly wages by 4.33 to transform them into monthly wages.

Following Chiquiar and Hanson (2005), all earnings measures are converted into 1990 U.S. dollar units. Mexican earnings are converted into dollars by using simple quarterly averages of the daily official exchange rates published by the Mexican Central Bank (Banco de Mexico 2013). We then deflated the wages to 1990 dollars using the quarterly average of the U.S. Consumer Price Index (CPI) (Bureau of Labor Statistics). Also as in Chiquiar and Hanson (2005), we only use Mexican wages that are between $0.05 and $20.00 and U.S. wages that are between $1.00 and $100.00.

ENE/ENOE surveys have been extended to significantly more rural areas over the last two decades. In order to reduce the bias generated by greater participation of the rural Mexican population, we restrict the sample to workers from major metropolitan areas that have consistently been part of the surveys: Mexico City, the State of Mexico, San Luis Potosí, Leon, Guadalajara, Chihuahua, Monterrey, Tampico, Torreon, Durango, Puebla, Tlaxcala, Veracruz, Merida, Orizaba, Guanajuato, Tijuana, Ciudad Juarez, Matamoros, and Nuevo Laredo. No geographical restrictions have been imposed on MORG data.

Descriptive statistics for the raw survey data are displayed in Table 1. Each column gives an average of quarterly observations collected over a four- or five-year period. The average U.S. monthly wage ranges from $1466 to $1515, and it has remained roughly constant from 1988 to 2011. The average Mexican monthly wage ranges from $226 to $310. It has declined fairly steadily over time. The average age of the U.S. workforce has increased steadily between 1988 and 2011, from 37 to 40 years. The average age of the Mexican workforce has also risen steadily, from 35 years in 1988-1994 to 37 in 2008-2011.

The U.S. workforce is significantly more educated than the Mexican workforce, with about 90% of all workers in each time period having at least completed high school education. By contrast, the number of Mexican workers who completed high school education or attended college ranges from 30% in 1988-1994 to 32.3% in 2008-2011. Mexico has improved the education of its workforce. The steady rise in the number of high school graduates and college attendees has been accompanied by a steady decline in the number of workers with 0-5 years of education, which dropped from 18% in 1988-1994 to 12% in 2008-2011. The largest gains emerge in the 9-11 category because Mexico raised the compulsory education requirement from 6 to 9 years in 1992.[5]

Ideally, survey data would collect information from surveyed individuals at regular intervals, and neatly organize it as panel data. In the absence of such data, it is possible to use a time series of cross-sectional surveys to create a version of synthetic panels (Deaton, 1985). We

[5] See http://wenr.wes.org/2013/05/wenr-may-2013-an-overview-of-education-in-mexico.

create 45 age-education cohorts when using the survey data. In the absence of significant changes to the composition of the cohorts, the average behavior of each cohort over time should approximate the estimates obtained from genuine panel data (Deaton, 1997). Since our focus is not on wage growth of individuals over time, we do not “age” the cohort cells.

Working-age adults in each sample are subdivided into five education categories and nine age categories. The first age group includes workers aged 19-23 years old; the second includes workers aged 24-28, the third those aged 29-33, and so forth. The first education group includes adults with 0-5 years of education; the second includes adults with 6-8 years of education; the next comprise those with 9-11, 12-15 and finally 16 or more years of education. These categories are roughly comparable to those employed by Robertson (2000), Borjas (2003), and Mishra (2007). Unlike Borjas (2003), we are able to identify greater variation in the group of working adults who have not completed high school. We are unable to distinguish between high school graduates and workers with some college experience; we classify both groups as having 12-15 years of schooling. We exclude from the sample workers with zero or unreported amounts of education. Once workers are assigned to the 45 categories, we take the average wage of each cell with and without the sample (population) weights. Sample (population) weights are not available for Mexican household surveys during the 1994-2003 period.

Different demographic groups have different propensities to migrate, and since migration may drive equalization, Figure 1 shows the percentage of Mexican-born workers in the U.S. by age and education for each of the 45 cohorts. Most Mexican-born workers in the U.S. are younger. In addition, Mexican-born workers in the United States comprise a progressively declining share of the workforce among older groups. We also see that the bulk of Mexicans residing in the United States tend to be less educated.

Figure 2a plots the log of the real average monthly earnings of Mexican workers over time by education-age cohorts[6]. Several significant macroeconomic events are immediately apparent. The December 1994 peso crisis led to the rapid devaluation of the peso against the U.S. dollar, as nominal exchange rates doubled from 4 pesos/U.S. dollar to 8 pesos/U.S. dollar in a few months. The drastic change in exchange rates and the subsequent erosion of purchasing power represented a significant shock to Mexican wages. The peso/U.S. dollar exchange rate has been floating ever since. At least some of the increase in Mexican real wages between 1994 and 2001 may be attributed to a rebound in purchasing power experienced by Mexican workers as the effects of the crisis waned over time. The increase in wages reverses around 2001, which coincides with both the U.S. recession (March 2001) and China entering the WTO (December 11, 2001). Recovery resumes around 2005 and continues until the Financial Crisis and Great Trade Collapse in October 2008.

Figure 2b plots the log of the real average monthly earnings of U.S. workers over time by age-education cohorts. Compared to Mexican wages, U.S. wages are relatively stable. Real wages have experienced no significant expansion or contraction over the sample period, but may appear to decline slightly after 2001.

Figure 3 plots the difference between real U.S. earnings and real Mexican earnings over time. Once again, the differential experienced by workers aged 59-63 with 12-15 years of education has been omitted for the sake of overall clarity. Figure 3 shows less dispersion across cohorts than the individual country graphs, which suggests that the relative earnings structure in the two countries is relatively stable over time The differentials of different cohorts largely move together and changes in the differential coincide with significant macroeconomic events. To see

[6] The wages of 59-63 year-old male workers with 12-15 years of education are not shown. Since this particular demographic cohort of Mexican workers is very small, it displays a wildly erratic wage pattern that obfuscates the general picture; therefore, we chose to omit it.

these events more clearly, Figure 4a graphs the mean wage differential[7] and identifies some of the significant events affecting Mexico since NAFTA. The peso crisis is immediately apparent, as is the relatively rapid recovery. The reduction in the differential accelerates until 2001, when China enters the WTO. Dussel, Peters and Gallagher (2013) argue that China had a significantly negative influence on NAFTA trade. The differential grows until the middle of the 2000s and then falls until the financial crisis.

To formally identify structural breaks in the average differential, we apply tests for unknown breaks described by Vogelsang and Perron (1998). Figure 4a plots the relevant additive outlier test statistic. The local extrema of the test statistic indicates a trend break. The peso crisis is the most significant break, but a smaller local maximum appears around 2000. The 2000 break roughly corresponds to the 2001 U.S. recession and China's entrance into the World Trade Organization Therefore, in the empirical work that follows, we include structural breaks in both 1994 and 2001.

Figure 4b graphs the standard deviation of the earnings differentials across cohorts. The standard deviation of wage differential across cohorts exhibit breaks at the times indicated by the Vogelsang and Perron test statistic. The standard deviation rises steadily until the end of the sample, again supporting the use of multiple structural breaks. Figure 4b also motivates a more detailed look at changes in other measures of the wage distribution, which we carry out using census data.

While the differentials of different cohorts generally move together, there are some differences across cohorts. Figures 5a, 5b, and 5c present the trends for three different cohorts. Figure 5a shows that the differential for Cohort 4 (workers with 0-6 years of education and 34-38 years old) exhibits significant peso crisis effects. Around 2001, however, the recovery seems to

[7] The mean is calculated taking the unweighted arithmetic average across cohorts.

stop and the differential grows through the 2000s. The pattern for Cohort 38 (workers with 12-16 years of education and 54-58 years old), shown in Figure 5b, reveals a smaller peso crisis effect, but a rising wage gap during the 2000s. On the other hand, Figure 5c shows that the wage gap for the "high migration" cohort (19 to 23-year-old workers with 6-9 years of education) either remains flat or falls slightly throughout the 2000s. These differences across cohorts are consistent with the idea that migration helps to integrate markets by closing the wage differential across countries because migration propensities across these groups are different.

Census Data

We employ three years of census data from Mexico and the U.S.: 1990, 2000 and 2010. We use a 10 percent sample from the Mexican census. For the years 1990 and 2000, we use a 5 percent sample from the U.S. census. For 2010, we employ the American Community Survey, which is a 1 percent sample of the population.

The sample selection criteria that we use for the census data mimic that of the survey data. Specifically, we include men between ages 19 and 63 who report positive income in the previous year. In Mexico, hourly wages are constructed by taking monthly earnings and then dividing by reported hours worked during a typical week times 4.33. In the United States, hourly wages were computed by taking reported yearly earnings and then dividing by reported usual hours worked per year.[8] As with the survey data, all wages are in 1990 U.S. dollars. Mexican wages were, once again, converted to 1990 dollars by, first, converting wages in pesos to U.S.

[8] Hours worked per year were obtained by taking usual hours worked per week times the number of weeks that the respondent reported to have worked during the year.

Dollars using the exchange rate for that year and then deflating the wages to 1990 dollars using the U.S. CPI.[9]

We employ two samples from the Mexican census. The first is a sample of all workers meeting the criteria defined above, which we call "Sample 1." The second is a sample of primarily urban dwellers that includes the metropolitan areas employed in the survey data. We call this "Sample 2."

Table 2 displays descriptive statistics from the census data. We see that the average U.S. wage was between $14.21 and $15.07 for the three census years. In Mexico for Sample 1, average wages were between $1.43 and $1.59 and increased steadily over the 20 year period. The mean wages were slightly higher in Sample 2 when we only employed urban dwellers. The average age in the U.S. sample ranged between 36.83 and 39.66 and increased over time. The average age in Mexico also increased over the 20 year period but ranged from 34.79 and 37.10 in Sample 1 and 34.59 and 37.46 in Sample 2. Finally, as in the survey data, the statistics on years of schooling in Mexico indicate massive gains in human capital over this period. In Sample 1, the percentage of Mexicans with 0-4 years of schooling in 1990 was 29.56 percent but was only 11.89 percent in 2010. Similarly, the percentage of Mexicans with 9-12 years of schooling was 27.41 percent in 1990 but was 45.53 percent in 2010.[10] The numbers are similar in the other sample.

Figure 6 shows the percentages of Mexicans residing in the United States by 45 age and education categories. Note that for reasons discussed above the education groups in the Census data differ slightly from the survey data. The patterns in this figure are broadly consistent with

[9] We also converted Mexican wages to 1990 U.S. dollars by first deflating the wages to 1990 pesos using the Mexican CPI and then converting them to U.S. dollars using the 1990 exchange rate. Overall, this alternative method did not make too much of a difference.

[10] Note that the education categories in the census data are slightly different than what we use in the survey data due to the way that years of schooling were categorized in the U.S. census years 1990 and 2000.

Figure 1. One key difference, however, is that we see substantially more people in the second education category that we label as "ed1." The reason for this is that many Mexicans leave school between grades 5 and 6. The category "ed1" includes grade 5 in Figure 5 but excludes it in Figure 1.

III. Results: Household Survey Data

Our main variable of interest is the long-run U.S.-Mexican wage differential as derived in Section I across age-education cohorts. The trend in the long-run differentials may be affected by exogenous shocks (e.g. trade liberalization and exchange rate shocks) and differences in migration costs across cohorts. To describe the changes in the long-run differential, we use a simple trend analysis that accounts for both the peso crisis and the 2001 trend break. Since we expect changes in wage differentials to differ between the migrants and non-migrant groups, we also include a dummy variable for the high migration cohort (HMC). The following regression captures all these observations:

$$(8) \qquad w_{jt}^{d} = \beta_0 + \beta_1 time + \beta_3 HMC_j + \beta_4\left(time * HMC_j\right) + \beta_5 d94_t$$
$$+\beta_6(time * d94_t) + \beta_7 d01_t + \beta_8(time * d01_t) + \lambda_j + \vartheta_{jt}$$

where $\mathrm{w}_{\mathrm{jt}}^{\mathrm{d}}$ is equal to the difference between the natural log of the U.S. earnings and natural log of the Mexican earnings in education-age group j at time t. Negative values indicate wage convergence. The variable *time* is a time trend;HMC_j is a dummy variable that indicates whether *j* is the high migration cohort (workers of age 19-23 with 6 to 9 years of schooling); d_{94} is a dummy variable indicating whether the year is 1994 or later; d_{01} is a dummy variable indicating whether the year is 2001 or later and λ_j are group-specific fixed effects for an education-age group *j*.

The trend analysis based on equation (8) and variations of equation (8) are reported in Tables 3. The following results do not use weights, but in separately available results, we find that the same qualitative results emerge when we use U.S. sample weights, Mexican sample weights, U.S. cell sizes, and Mexican cell sizes as weights. All equations include fixed cohort effects and all estimated coefficients are statistically significant at the1% level.

Table 3 displays four variations of equation (8). The first column just includes the time trend. The positive sign indicates overall divergence, but the coefficient is quite small. Figure 3, however, shows the importance of controlling for macroeconomic events. Column 2, therefore, includes controls for the 1988-1994 and the 1994-2001 periods both in levels and interacted with the time trend. The overall trend (which represents 2001-2011) more than triples, representing overall divergence in wage differentials. Note that the controls for the two periods show the response to shocks with high intercept terms and large and negative convergence estimates.

We are also interested in the possibility that the rates of convergence differ across cohort characteristics. In particular, we are interested in whether or not the high-migration cohort exhibits different trends than the rest of the sample. Columns (3) and (4) show that the high migration cohort exhibits more convergence than the rest of the sample both with and without controls for the different macroeconomic shocks. Overall, therefore, these results are consistent with the hypothesis that migration helps close the wage gap between the United States and Mexico but overall, the gap has not been getting smaller.

To explore the robustness from using potentially poor measures of hours worked, we consider both monthly and hourly earnings. U.S. hourly wages have been computed by dividing weekly earnings by the number of hours usually worked each week. Mexican hourly wages have been computed by dividing monthly earnings by the number of hours worked each week times 4.33 until 2005, when the hourly wages of Mexican workers are directly available from ENOE data. The results for hourly earnings in the survey data are broadly consistent with the earnings results, but since the Census data have much more accurate hours measures, we describe the results for hourly earnings in detail in the next section.

The main picture that emerges from the household survey results is that we only observe convergence in the high-migration cohorts, and that this convergence emerges over the 2000s. In the next section, we explore the robustness of these results using Census data that have more detailed hours worked and geographic coverage.

IV. Results: Census Data

Mean Wage Differentials

We begin by plotting w_{ikt}^{d} which is the mean wage differential for education cohort *i* and age *k* at time *t* in Figure 7 to provide a visual understanding of the wage differentials in the census data. We do so using both samples from the Mexican census described in Section II. We see that for people with less education (*i.e.* 0 to 8 years of education) there was little change in the differential between 1990 and 2000 but there was a substantial decline between 2000 and 2010. This is the case in both Mexican samples. Also, noteworthy is that the mean differentials are smaller when we use Sample 2 which is the more urban sample; this is a consequence of urban areas being richer. Once we move on to people with slightly more years of schooling, we see a more attenuated decline between 2000 and 2010 while there still is little difference between 1990 and 2000. Finally, for the most educated cohort (more than 16 years of schooling), there is little difference from 1990 to 2010. Overall, this figure reflects the key finding from the survey data which is that there is some evidence of wage convergence for less educated people, although in the census, these results are concentrated during the 2000's.

In an attempt to quantify some of the results in Figure 7, we estimate the following regression model:

$$w_{ikt}^{d} = \beta_i + \beta_t + \beta_{it} + v_{ikt}$$

in which we regress the wage differential for each education/age cohort on a set of education (indexed *i*) and time dummies together with their interactions. The results are reported in Table 4.[11] In the first two columns, we employ Sample 1 from the Mexican census and in the last two columns, we employ Sample 2. In the first and third columns, we weight age education/age/year cells using weights from the U.S. census and in the second and fourth columns, we use weights from the Mexican census. These adjust each education/age/time cell for the share of the population that they represent in either Mexico or the U.S. for that year.[12]

It is important to bear in mind that the results in this table utilize 222 cohorts per year, whereas the results in Table 3 utilize 45 cohorts per quarter. The reason is that, while both use five education groups, for the Census data results, we collapse the data for every age between 19 and 63, whereas for the survey data, we collapse the data into a total of nine five-year age bins. We collapse by one and five year bins in the census and the survey data, respectively, because

[11] Note that we use people ages 19-63 for the first four education groups but only people ages 22-63 for the last education group which yields 222 groups per year.

[12] Once again, bear in mind that we have two layers of weighting. In the first, we use the weights from the U.S. and Mexican Censuses to construct averages for each age/education/time cell; these weights come from their respective Census. In the second, we weight each cell average with either the U.S. or the Mexican weights for that cell.

the larger sample sizes in the census enable us to use smaller cells. This accounts for the differences between the two tables.

The table essentially reinforces the results shown in Figure 7 but does provide some additional quantitative content. First, the constants in each column range from 2.25-2.39 suggesting that in 1990, people with zero to four years of schooling earned about ten times as much in the U.S. than in Mexico. This is broadly consistent with the average wage differentials shown in Table 2 for the census data as well as with figures shown in Table 2 of Hanson and Chicquiar (2005). Note that these differentials, which are on the order of about ten, are larger the differentials obtained from the Survey data which are on the order of five; this is not a consequence of differences in the Mexican survey and census data but instead in differences in the U.S. data since U.S. wages in the CPS are lower than in the census.

Next, the first column suggests that there was a substantial widening of the wage differential in 2000 but this is not borne out in the next three columns. Moreover, the last two columns, in which we employ Sample 2 from the Mexican census, show a statistically significant *narrowing* of the differential from 1990 to 2000. One reason for this discrepancy could be that weights based on the U.S. census place more emphasis on better educated people for whom we see substantial wage divergence in 2000 as shown in the fifth panel of Figure 8 in the first column. However, it is not quite appropriate to attribute the negative estimates for the year 2000 dummy to a narrowing of the wage differential during the nineties. The reason for this is that interaction between the 2000 dummy and the education variables, in columns three and four, by-and-large are positive and at least marginally significant for up to 12 years of schooling. Moreover, they tend to be larger in magnitude than the 2000 dummy which is indicative of a *widening* of the US-Mexico wage gap during the nineties, which is consistent with the results from the survey data.

Looking at the interactions between years of schooling and the 2010 dummy, we see evidence of convergence for less educated cohorts during the 2000's. This is true regardless of how we weight the regressions or what sample we use. In the first column, we see that the interactions with 0-4 and 5-8 are -0.163 and -0.137 and in the second column, they are -0.162 and -0.096. This indicates that, for these less-educated cohorts, the wage differential in 2010 was between 85.0 percent and 90.9 percent of what it was in 2000. The corresponding interactions are -0.110 and -0.139 in column three and -0.109 and -0.089 in column four.

Finally, comparing columns (1) with (3) and (2) with (4), we are able to see how using Sample 1 or Sample 2 from the Mexican sample affects our results. First, the interactions of the education variables with the 2010 dummy seem to be relatively unaffected by the choice of the rural/urban or just the urban sample. However, the interactions with the 2000 dummy do seem to be affected. In particular, these interactions in columns (3) and (4) for the urban sample (Sample 2) are larger than in columns (1) and (2) for the entire sample for people with up to 12 years of education. This suggests that there was overall divergence for these groups between 1990 and 2000 in urban areas. It is hard to say exactly why this is the case, but one possibility is that the Peso Crisis may have had larger effects in more urban parts of Mexico since these areas are more likely to be engaged in trade.

Changes in the Relative Wage Distribution over Time

Next, we investigate how the U.S. and Mexican wage distributions evolved from 1990 to 2010. To do this, we compute differences in percentiles of the U.S. and Mexican wage distribution by education and year for 2000-1990 and 2010-2000. To fix ideas, we let $q(\alpha)_{kt}^{l}$ denote the αth percentile for education cohort k at year t in country l. We then plot

$$\left(q(\alpha)_{k,2010}^{US} - q(\alpha)_{k,2010}^{MX}\right) - \left(q(\alpha)_{k,2000}^{US} - q(\alpha)_{k,2000}^{MX}\right)$$

and

$$\left(q(\alpha)_{k,2000}^{US} - q(\alpha)_{k,2000}^{MX}\right) - \left(q(\alpha)_{k,1990}^{US} - q(\alpha)_{k,1990}^{MX}\right)$$

as a function of α. The first term in parentheses in each of these expressions is the wage differential at the αth percentile between the U.S. and Mexico in either 2010 or 2000. The second term is the same quantity but from the previous census year. The difference in the two expressions in parentheses is then the change in the cross-border differential at a particular percentile over a ten year period. At this point, we only consider three educational cohorts since computing percentiles is more demanding of the data than computing means; the three cohorts that we consider are 0-11 (no high school), 12-15 (high school) and more than 15 years of schooling (college).

In Figure 8, we plot the changes in the relative wage distributions for 2000-2010 and 2000-1990 using both samples from the Mexican census. The most striking results are in the first row which displays 2010-2000. First, we see that at, all points in the wage distribution, there was a narrowing of the cross-border differential for people with less than twelve years of schooling. The estimates indicate that the wage differential in 2010 was roughly 85 percent of what it was in 2000 in Sample 1 and 80% of what it was in Sample 2. For high school and college graduates, we see convergence at the lower end of the distribution. The estimated change in the differential is negative through the 20th percentile for the college-educated and the 40th percentile for the high school-educated in Sample 1. In Sample 2, we do not see convergence for college graduates and but we do until the 40th percentile for high school graduates. This indicates that the wages of U.S. workers in the bottom half of the distribution became closer to their counterparts across the border in the 2000s.

The bottom panel displays the difference from 1990 to 2000. In Sample 1, the figure shows no stark patterns and, overall, is not indicative of any converge in the two wage distributions over this period. However, in Sample 2, we see some evidence of convergence among the college-educated; in particular, their wages in Mexico in 2000 were roughly 85% of what they were in 1990. However, the survey data results indicate that the peso crisis led to a large divergence during the mid-90's and that this may account for the lack of evidence of convergence which we see in Figure 8 for the period 1990-2000.

An important question to ask at this point is whether these changes are driven by Mexico catching up or the U.S. falling behind. To do this, we plot the change in the wage distributions in the U.S. and Mexico from 1990-2000 and 2000-2010. For each Mexican sample, we display these four profiles in three graphs corresponding to the three educational cohorts. The panel for people with less than twelve years of schooling indicates that a large part of the convergence that we see for the less educated is a consequence of U.S. workers falling behind. Indeed, real wages in the U.S. fell about 0.12 log points at all points in the distribution over this period. In contrast, there were modest gains in Mexican wages over this period. Turning to high school graduates in the middle panel, we see that from 2000-2010, U.S. wages fell behind quite a bit, particularly, at the bottom of the distribution. Mexican wages also declined over this period but, typically, by a smaller magnitude.

However, there is one very important difference in the behavior of the wage structure of high school graduates from 2000-2010 between the United States and Mexico. We see that the plot for the United States is increasing and that the plot for Mexico is decreasing. What this means is that the losses in the United States disproportionately hit the poor, whereas in Mexico, they disproportionately hit people towards the top of the distribution. This suggests that although mean wages of high school graduates may have fallen during the 2000's in both countries, inequality for this group declined in Mexico but increased in the U.S.

We now turn to the college-educated in the third row. In Sample 1, we do not see terribly strong evidence of either Americans falling behind or Mexicans catching up during either the 1990's or the 2000's. However, the results are starker in Sample 2. The wages of the college-educated in Mexico declined between 2000 and 2010 by roughly 10%. However, we also see that between 1990 and 2000, Mexican wage growth was over 10% larger than in the U.S. at most points in the wage distribution. This suggests that the evidence for convergence that we saw in Figure 8 for the college-educated between 1990 and 2000 was due to gains in Mexico.

Triple Diffs: Comparisons between the Border and the Interior

One way in which we can attempt to tease out the extent to which trade or migration is responsible for the observed narrowing of the US-Mexico wage gap during the period 2000-2010 in the census data is to conduct a similar analysis as in the previous section but to compare these changes between Mexico's border and interior states. The rationale behind this exercise that, as pointed by many including Robertson (2000), Mexico's border is more tightly linked with the United States than its interior. The two reasons for this are the presence of the maquiladora industry which is concentrated primarily along the US-Mexico border and the fact that many border cities are conduits for migrants, notably, Tijuana. In addition and perhaps more important, Figure 3 showed that the peso crisis of 1994 most likely confounds our ability to detect any convergence during the 1990's that may have occurred due to trade or migration.

Because the crisis impacted the entirety of Mexico, this third difference mitigates the bias from this confounding factor.

To investigate this, we consider a triple-difference version of the exercise from the previous section. Specifically, we compute

$$\left[\left(q(\alpha)_{k,2010}^{US} - q(\alpha)_{k,2010}^{MX,B}\right) - \left(q(\alpha)_{k,2000}^{US} - q(\alpha)_{k,2000}^{MX,B}\right)\right]$$
$$- \left[\left(q(\alpha)_{k,2010}^{US} - q(\alpha)_{k,2010}^{MX,I}\right) - \left(q(\alpha)_{k,2000}^{US} - q(\alpha)_{k,2000}^{MX,I}\right)\right]$$

where the superscript *B* denotes Mexico's border region and *I* denotes Mexico's interior.[13] So, we look at how the change in the US-Mexico wage gap between 2010 and 2000 changes as we move from Mexico's border to its interior.

We report the results in Figure 10. During the period 2000-2010, we do not see any evidence that convergence was any faster along the border than in the interior. In fact, using Sample 2 from the Mexican sample, we actually see that, relative to the interior, the wage differential along the border expanded from 2000 to 2010. What this may then indicate is that during the period 2000-2010 light industries may have exited Mexico's border region thereby reducing wages there vis-à-vis the interior. Next, we see that during the period 1990-200 that wages in Mexico's border region increased at a more rapid rate than in the interior. This is particularly the case in Sample 2.

It is important to emphasize that we see large movements in wage differentials in the border area relative to the interior at least once we restrict the sample to more urban areas. During the 1990's, wages in these cities close to the border saw large gains relative to the rest of Mexico and this was subsequently reversed in the 2000's. This is suggestive that trade has the

[13] We define "border" to be all of Mexico's states that border with the United States which includes Baja California, Sonora, Chihuahua, Tamaulipas and Coahuila. When we employ Sample 1, we use all wages from these states which include those from rural areas. When we employ Sample 2, we only use selected cities which include large border towns such as Tijuana and Juarez.

potential to narrow US-Mexico wage differentials but, at the same time, it also suggests that US-Mexico trade is not responsible for the convergence that we saw in the survey and the census during the 2000's since wages in Mexico's maquiladora sector took a substantial hit during this period. Rather, it may indicate that a third factor such as Chinese competition both adversely impacted Mexican and US wages.

Variance Decompositions

We conclude the analysis of the census data with a variance decomposition exercise. It is common in the inequality literature (*e.g.* Lemieux 2008) to decompose the variance of location *l* at time *t* into its "within" and "between" components as follows:

$$V_{lt} = W_{lt} + B_{lt}$$

where

$$W_{lt} = \sum_{i,k} \theta_{ikt}^{l} v_{ikt}^{l}$$

and

$$B_{lt} = \sum_{i,k} \theta_{ikt}^{l} \left(y_{iktl} - y_{tl}\right)^2$$

where θ_{ikt}^{l} is the population weight for cell *i*,*k*,*t* in country *l*, v_{ikt}^{l} is the variance in cell *i*,*k*,*t* in county *l*, y_{iktl} is the average log wage in cell *i*,*k*,*t* in country *l* and $y_{tl}$is the average of the log wage at time time *t* in country *l*. The within component measures variation in wages within education/age cohorts, whereas the between component measures variation across education/age cohorts. We conduct this wage decomposition for the U.S. and Mexico. We also combine data from the two countries and conduct the exercise for the integrated economy with appropriate modifications to the weights for relative country sizes and using the grand mean of the wage in the U.S. and Mexico in the formula for the between component.

Before we discuss our results, it is useful to consider how a simple HOS story with two countries would play out. In the aftermath of trade liberalization, demand for low-skilled labor in the United States should decline but increase in Mexico and, more generally, within a given skill set, wages should converge. What this suggests then is that in the US-Mexico integrated economy, the within group component of inequality should decline over time. Next, given the conventional wisdom that trade should hurt lower skilled workers in the United States but help them in Mexico, we should also expect to see that the between component of the variance should increase in the United States but decrease in Mexico.

The results are reported in Table 5. First, the table indicates that the total variance of log wages in the integrated economy has steadily declined since 1990 when we use all Mexicans but not when we restrict the sample to urban Mexicans. We do see that the within component of variance declined in the integrated between 1990 and 2000 but increased in 2010. Next, we see that the variance of wages has declined steadily in Mexico since 1990, but this decline is due to changes in the within component not the between component. Finally, inequality in the United States has steadily increased from 1990-2010, but similar to Mexico, this increase is due to increases in the within component of inequality. In summary, the data seem to suggest that Mexican wage dispersion has decreased and that American inequality has done the opposite but that this is not consistent with a textbook HOS story.

V. Conclusion

In this paper, we presented descriptive evidence on the evolution of wage differentials between the United States and Mexico over the period 1988-2011. On net, we showed that wages between the two countries diverged over this period. However, this had much to do with the peso crisis of 1994. Subsequently, there was a large convergence until 2001, the year in which China entered the WTO, after which we saw steady divergence. These findings strongly indicate that the divergence from 1988-2011 had much to do with large macroeconomic events which may have counteracted the effects of US-Mexico trade and migration.

A more detailed look at our data reveals that trade and migration may indeed bring more wage convergence, despite the overall divergence in the raw data. First, in the survey data, we show that, the peso crisis notwithstanding, there is steady convergence for young people with intermediate levels of schooling who are precisely the people who are most likely to emigrate from Mexico. One important topic for future work is to investigate more rigorously the effects of migration on US-Mexico long-run wage differentials. Second, in the census data, we show that over the period 1990-2000 that the border of Mexico caught up to the US relative to the interior. This exercise has the added benefit that it mitigates greatly the confounding effects of the peso crisis which allows us to better see the effects of NAFTA which should have been more prevalent in the border. On the other hand, this same exercise reveals that during the period 2000-2010 that there was divergence in the border relative to the interior. Given that we also saw that low-skilled US wages declined by around 10% over this period, this suggests that a third factor may have had adverse effects on the Mexico border and low-skilled US wages. Autor, Dorn, and Hanson (2012) show that much of the latter can be attributed to Chinese trade. Another important topic for future work is to conduct a similar analysis in Mexico.

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Table 1: Summary Statistics of Survey Data

		United States			
		1988-1994	1995-2002	2003-2007	2008-2011
Monthly Wage		$1,492.69	$1,504.65	$1,515.75	$1,466.30
		(679.02)	(703.75)	(677.00)	(681.38)
Hourly Wage		$8.26	$8.27	$8.41	$8.28
		(3.42)	(3.52)	(3.41)	(3.45)
Age		37.45	38.74	39.85	40.54
		(0.29)	(0.45)	(0.19)	(0.18)
Education					
	0-5	1.60%	2.30%	2.40%	2.10%
	6-8	2.70%	1.60%	1.40%	1.20%
	9-11	7.50%	7.80%	7.90%	6.50%
	12-15	61.50%	59.40%	57.00%	56.60%
	>16	26.70%	28.90%	31.30%	33.60%
Mean N per quarter		21,155.89	19,393.91	20,960.35	19,667.75
		Mexico			
		1988-1994	1995-2002	2003-2007	2008-2011
Monthly Wage		$310.57	$260.24	$272.11	$226.50
		(175.59)	(149.47)	(135.21)	(112.70)
Hourly Wage		$2.09	$1.36	$1.41	$1.24
		(1.33)	(0.81)	(0.74)	(0.64)
Age		35.05	35.56	36.88	37.32
		(0.11)	(0.41)	(0.35)	(0.09)
Education					
	0-5	18.40%	14.30%	12.90%	12.40%
	6-8	27.70%	26.80%	23.60%	22.10%
	9-11	24.10%	30.60%	31.60%	33.20%
	12-15	13.40%	13.10%	16.90%	18.90%
	>16	16.40%	15.20%	15.00%	13.40%
Mean N per quarter		33,445.89	42,934.50	31,427.05	27,756.00

Notes: All wages are in 1990 U.S. dollars. In Mexico, the monthly wage was computed by converting wages to U.S. dollars using the exchange rate for that year and then deflating the wages using the U.S. CPI. Standard deviations are in parentheses. Mean N per quarter represents the average number of observed individuals per quarter per period (without population weight expansion).

Table 2: Descriptive Statistics from Census Data

	1990	2000	2010
		U.S.	
Hourly Wage	14.21	15.07	14.98
	(11.38)	(12.49)	(13.09)
Age	36.83	38.33	39.61
	(11.59)	(11.50)	(12.27)
Education			
0-4	1.56%	1.56%	1.50%
5-8	3.26%	3.20%	3.01%
9-12	37.72%	35.42%	32.36%
13-16	47.99%	49.66%	52.07%
>16	9.47%	10.15%	11.06%
N	1,982,151	2,361,079	496,042
		MX – Sample 1	
Hourly Wage	1.43	1.55	1.59
	(1.82)	(1.92)	(1.81)
Age	34.79	35.39	37.10
	(11.20)	(11.04)	(11.38)
Education			
0-4	29.56%	18.10%	11.89%
5-8	30.01%	26.49%	21.60%
9-12	27.41%	37.42%	45.53%
13-16	5.62%	9.54%	12.22%
>16	7.42%	8.45%	8.77%
N	1,264,613	1,597,037	1,754,953
		MX – Sample 2	
Hourly Wage	1.61	1.77	1.74
	(1.98)	(2.15)	(1.97)
Age	34.59	35.42	37.46
	(10.97)	(10.91)	(11.35)
Education			
0-4	18.38%	10.95%	7.30%
5-8	31.00%	24.65%	18.85%
9-12	33.04%	43.12%	49.24%
13-16	7.81%	11.80%	14.62%
> 16	9.76%	9.47%	9.99%
N	507,068	538,663	360,515

All wages are in 1990 U.S. dollars. In Mexico, the hourly wage was computed by converting wages to U.S. dollars using the exchange rate for that year and then deflating the wages using the U.S. CPI. U.S. census data were 5% samples except for the American Community Survey sample in 2010 which was a 1% sample. The Mexican census was a 10% sample for all three years.

MX – Sample 1 uses all people who meet the sample criteria described above. MX – Sample 2 uses these criteria and further restricts the sample to the metropolitan areas that are employed in the Mexican survey data.

Table 3: Trends in U.S.-Mexico Wage Gap

VARIABLES	(1) Trend	(2) Breaks	(3) Migrants	(4) Migrants and Breaks
Time	0.002***	0.007***	0.002***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
Migrant_x_time			-0.003***	-0.003***
			(0.001)	(0.001)
1988-1994		4.139***		4.139***
		(0.077)		(0.076)
1994-2001		3.187***		3.187***
		(0.104)		(0.104)
Trend in 88-94		-0.031***		-0.031***
		(0.001)		(0.001)
Trend in 94-2001		-0.019***		-0.019***
		(0.001)		(0.001)
Constant	1.448***	0.393***	1.437***	0.381***
	(0.028)	(0.048)	(0.028)	(0.048)
Observations	4,320	4,320	4,320	4,320
Number of cohorts	45	45	45	45

Notes: Standard errors in parentheses. *** p<0.01.

Table 4: Mean Wage Difference Regressions, Census Data

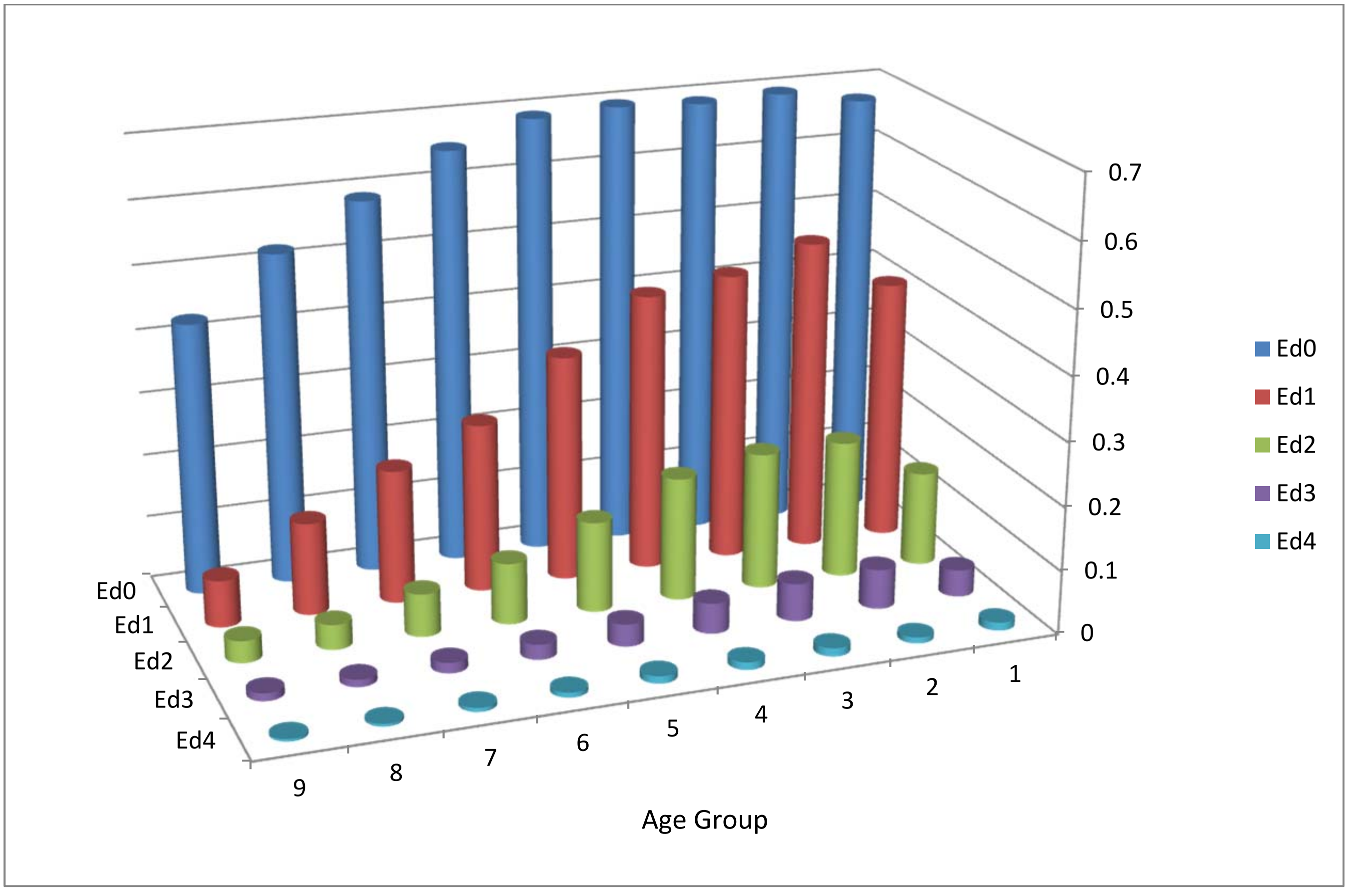
	(1)	(2)	(3)	(4)
Constant	2.393***	2.402***	2.238***	2.250***
	(0.052)	(0.012)	(0.056)	(0.016)
Years of Education				
0-4	-	-	-	-
5-8	-0.207***	-0.272***	-0.093	-0.154***
	(0.064)	(0.017)	(0.069)	(0.020)
9-12	-0.314***	-0.340***	-0.170***	-0.196***
	(0.054)	(0.017)	(0.058)	(0.019)
13-16	-0.569***	-0.586***	-0.464***	-0.480***
	(0.053)	(0.030)	(0.057)	(0.028)
>16	-0.332***	-0.358***	-0.249***	-0.270***
	(0.057)	(0.027)	(0.061)	(0.027)
Year				
2000	0.084**	0.033	-0.087**	-0.113***
	(0.030)	(0.033)	(0.032)	(0.031)
2010	-0.009	-0.008	-0.003	-0.013
	(0.029)	(0.032)	(0.031)	(0.030)
Education*Year				
0-4*2000	-0.058	-0.005	0.129	0.157***
	(0.080)	(0.038)	(0.085)	(0.040)
5-8*2000	-0.061	0.033	0.100	0.167***
	(0.059)	(0.037)	(0.064)	(0.036)
9-12*2000	-0.033	0.020	0.120***	0.145***
	(0.033)	(0.037)	(0.036)	(0.034)
13-16*2000	-0.204***	-0.136	-0.025	0.012
	(0.032)	(0.048)	(0.035)	(0.043)
0-4*2010	-0.163**	-0.162***	-0.110	-0.104***
	(0.080)	(0.040)	(0.087)	(0.042)
5-8*2010	-0.137***	-0.096***	-0.139**	-0.084***
	(0.060)	(0.037)	(0.064)	(0.036)
9-12*2010	0.008	-0.007	-0.006	-0.010
	(0.033)	(0.036)	(0.036)	(0.034)
13-16*2010	0.014	0.022	0.038	0.057
	(0.032)	(0.047)	(0.034)	(0.042)
MX Sample	1	1	2	2
Weights	US	MX	US	MX
R2	0.7548	0.7472	0.7213	0.6508
Number of Cohorts	666	666	666	666

Notes: The dependent variable is the log difference between the U.S. and Mexican hourly earnings for each match cohort. In the first and third column, we weight the regression using weights from the U.S. census; in the second and fourth column, we weight the regression using weights from the Mexican census. Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Variance Decompositions, Census Data

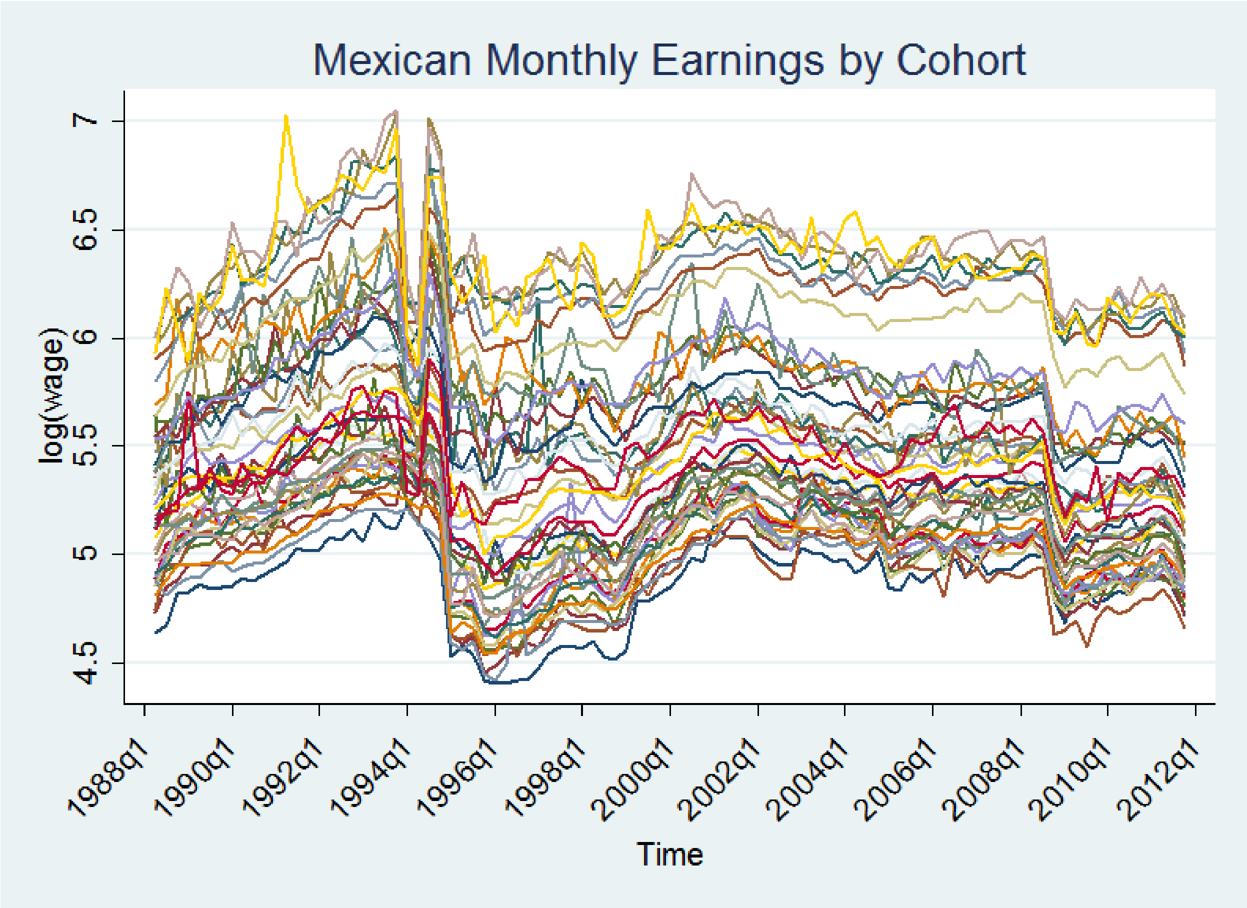
	MX and US	MX and US	MX	MX	US
			1990		
Within	0.420	0.404	0.649	0.588	0.345
Between	1.293	1.134	0.147	0.145	0.135
Total	1.713	1.538	0.796	0.733	0.480
			2000		
Within	0.405	0.400	0.519	0.482	0.366
Between	1.275	1.126	0.192	0.203	0.125
Total	1.680	1.526	0.711	0.685	0.491
			2010		
Within	0.426	0.427	0.461	0.462	0.414
Between	1.199	1.124	0.145	0.149	0.171
Total	1.625	1.551	0.606	0.611	0.585
MX Sample	1	2	1	2	-

Figure 1: Percentage of Mexican-born Workers in the U.S. by Age and Education, Household Surveys



Notes: The first age group includes workers aged 19-23 years old; the second includes workers aged 24-28, the third those aged 29-33, and so forth. The first education group includes adults with 0-5 years of education; the second includes adults with 6-8 years of education; the next comprise those with 9-11, 12-15, and finally 16 or more years of education.

Figure 2a: Time Series Behavior of Mexican Monthly Wages



Notes: Cohort 39 is excluded.

Figure 2b: Time Series Behavior of US Monthly Wages

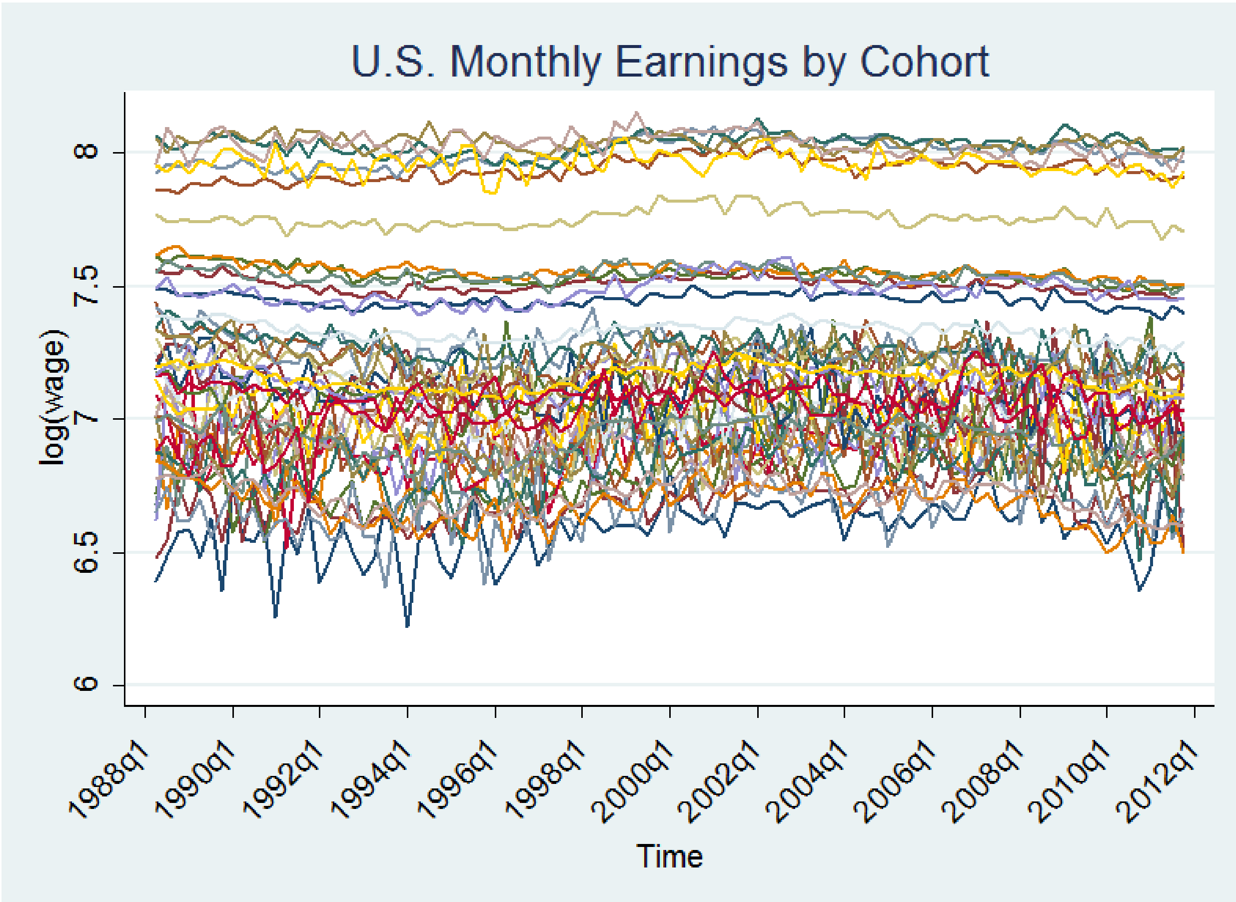


Figure 3: Time Series Behavior of Mean Differentials by Cohorts

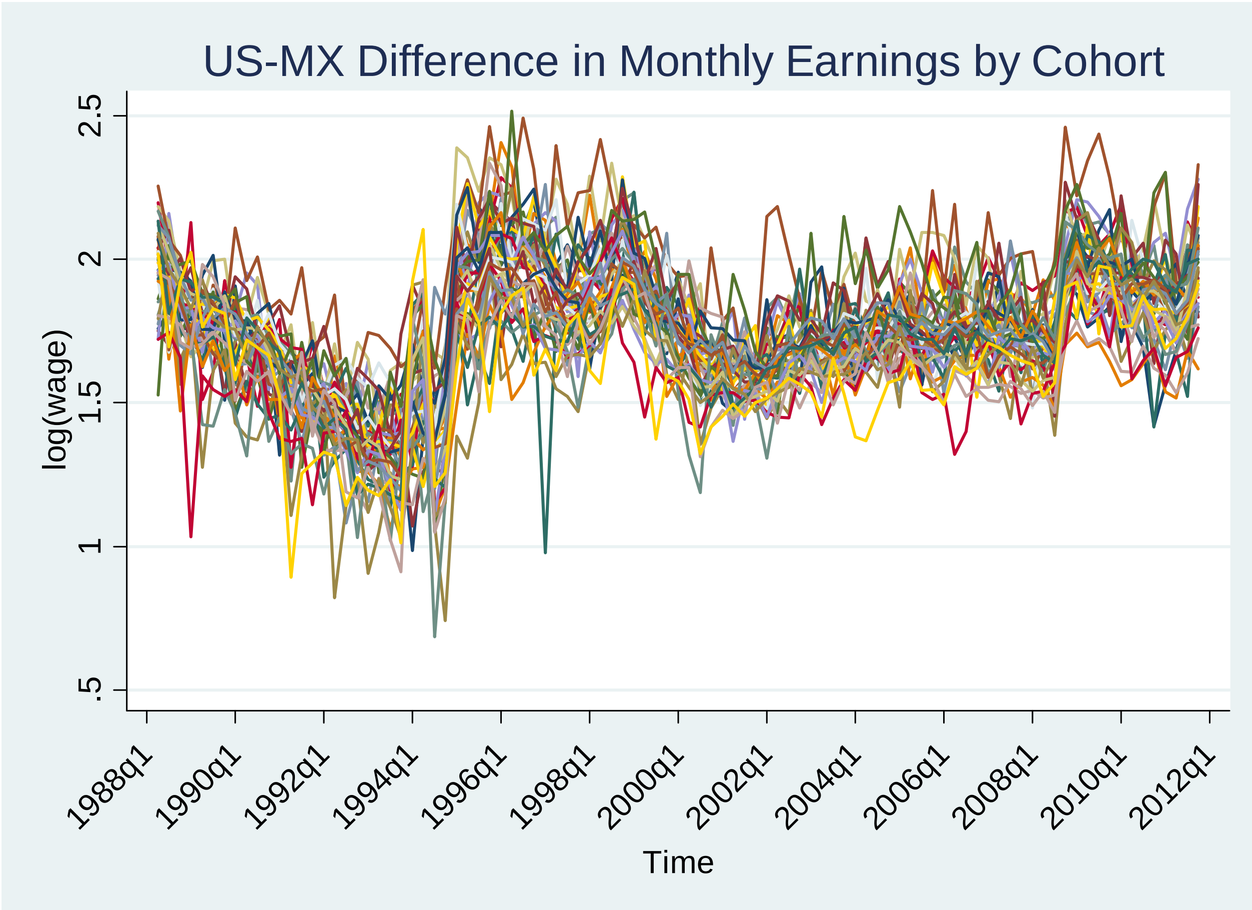
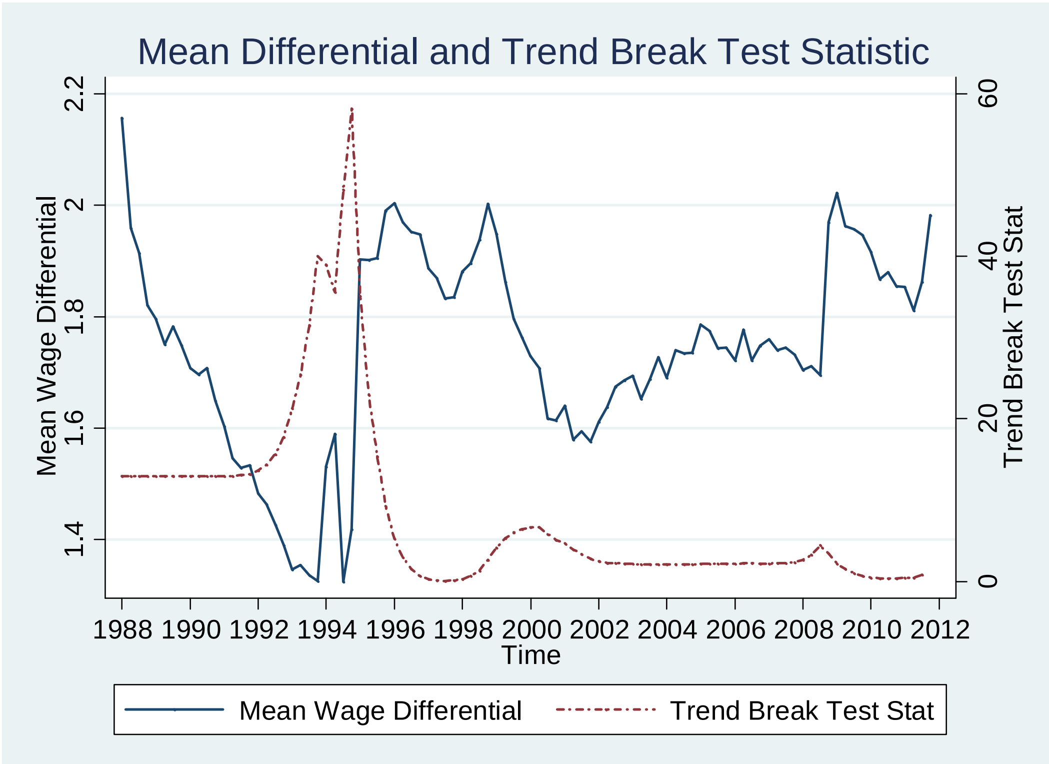
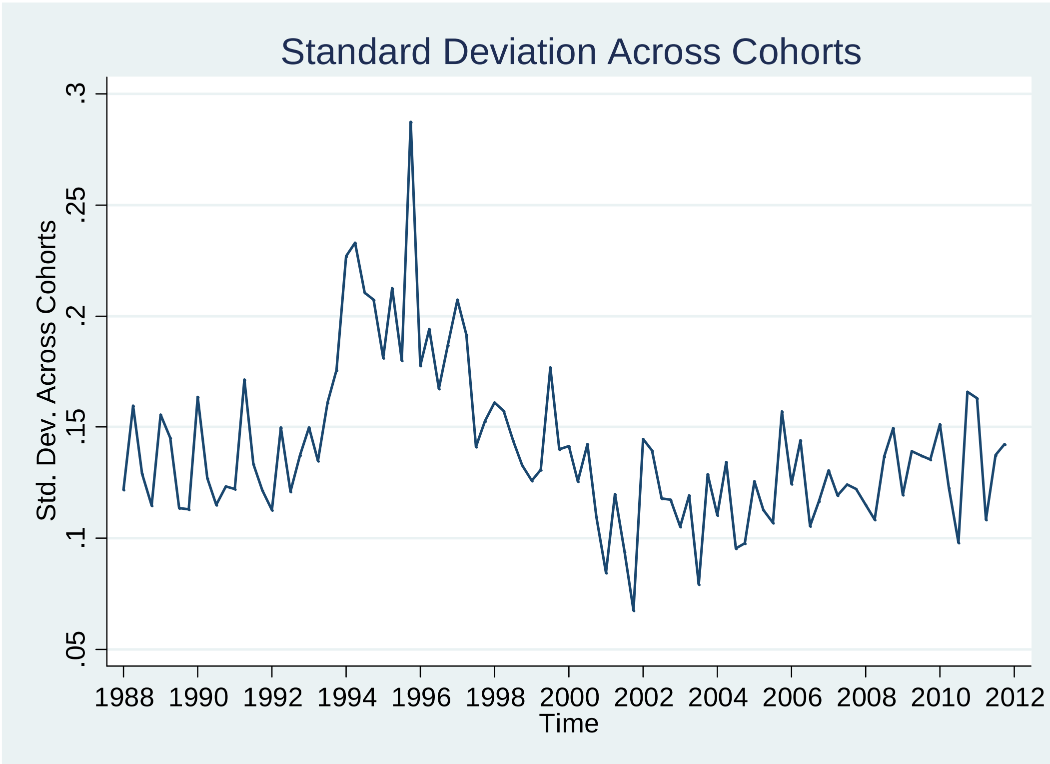


Figure 4a: Time Series Behavior of Mean Differentials across Cohorts



Notes: The trend break test statistic is test 2a from Volgelsang and Perron (1998), which is an additive outlier test for an unknown break. Note that peaks occur at the peso crisis (December 1994), the U.S. recession that started in March 2001, and the Financial Crisis (October 2008).

Figure 4b: Time Series Behavior of Standard Deviation of Diffentials across Cohorts



Notes: The peso crisis occurs in December 1994 and China enters the WTO on December 11, 2001.

Figure 5a: Wage Differentials, 0-6 Years of Education and 34-38 Years Old

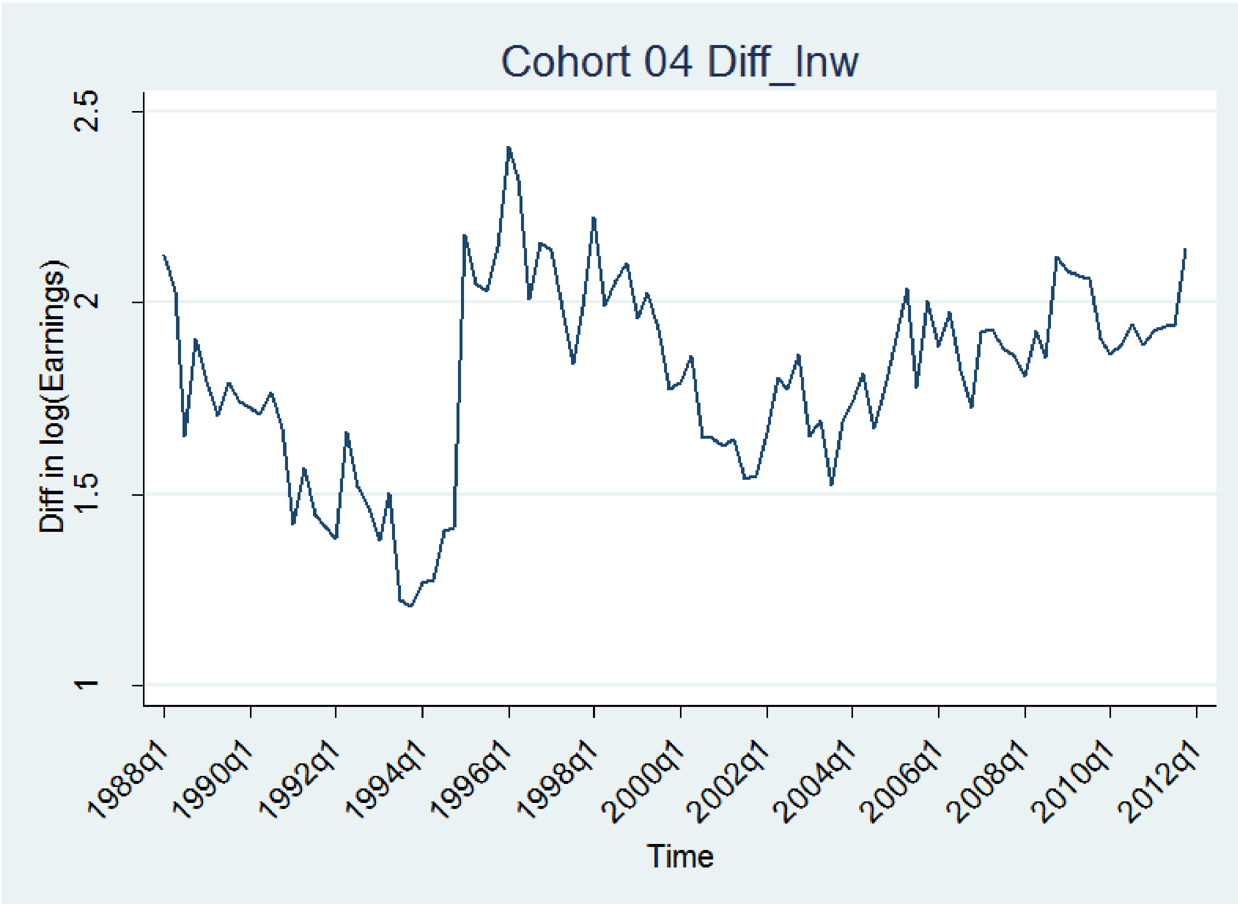


Figure 5b: Wage Differentials, 12-16 Years of Education and Age 54-58

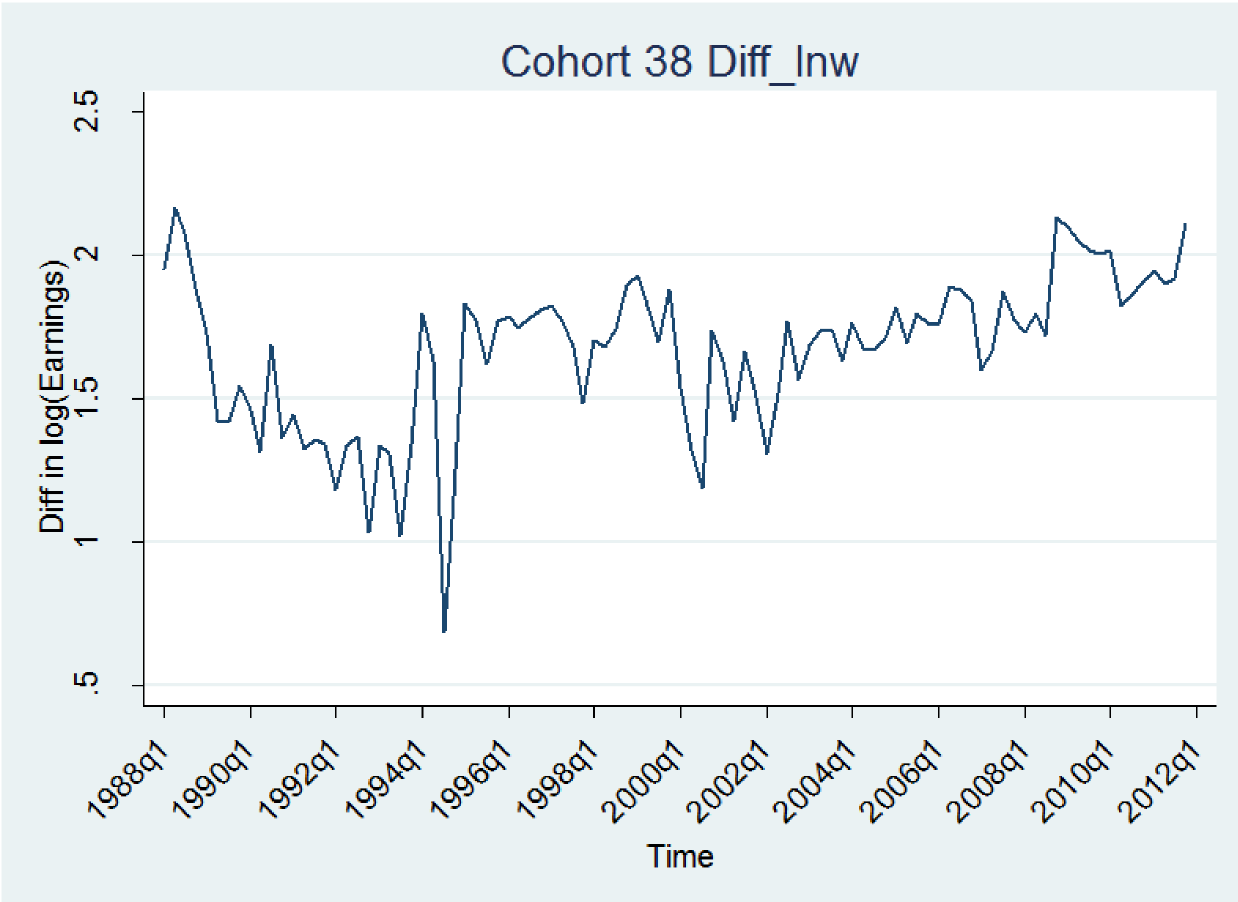


Figure 5c: Wage Differentials, 6-9 Years of Education and 19-23 Years Old

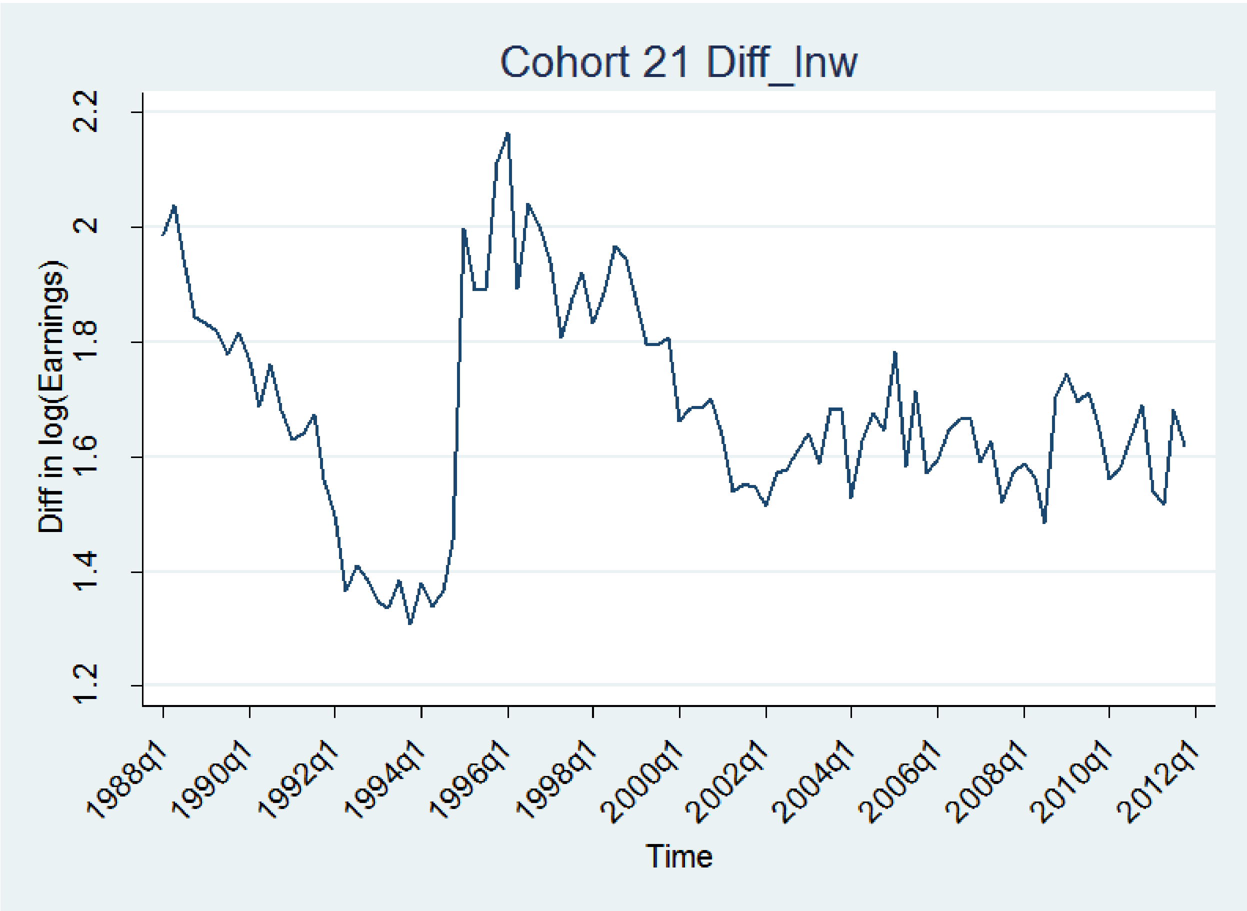
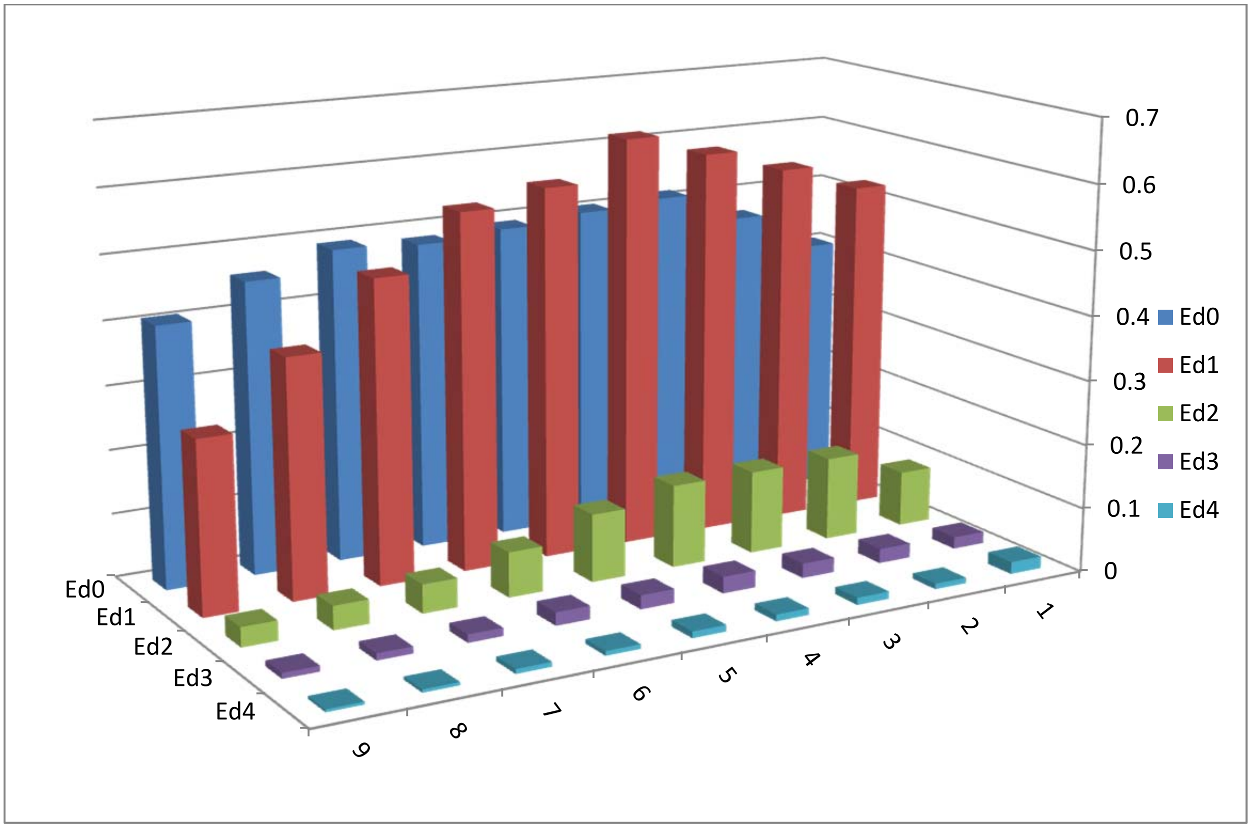


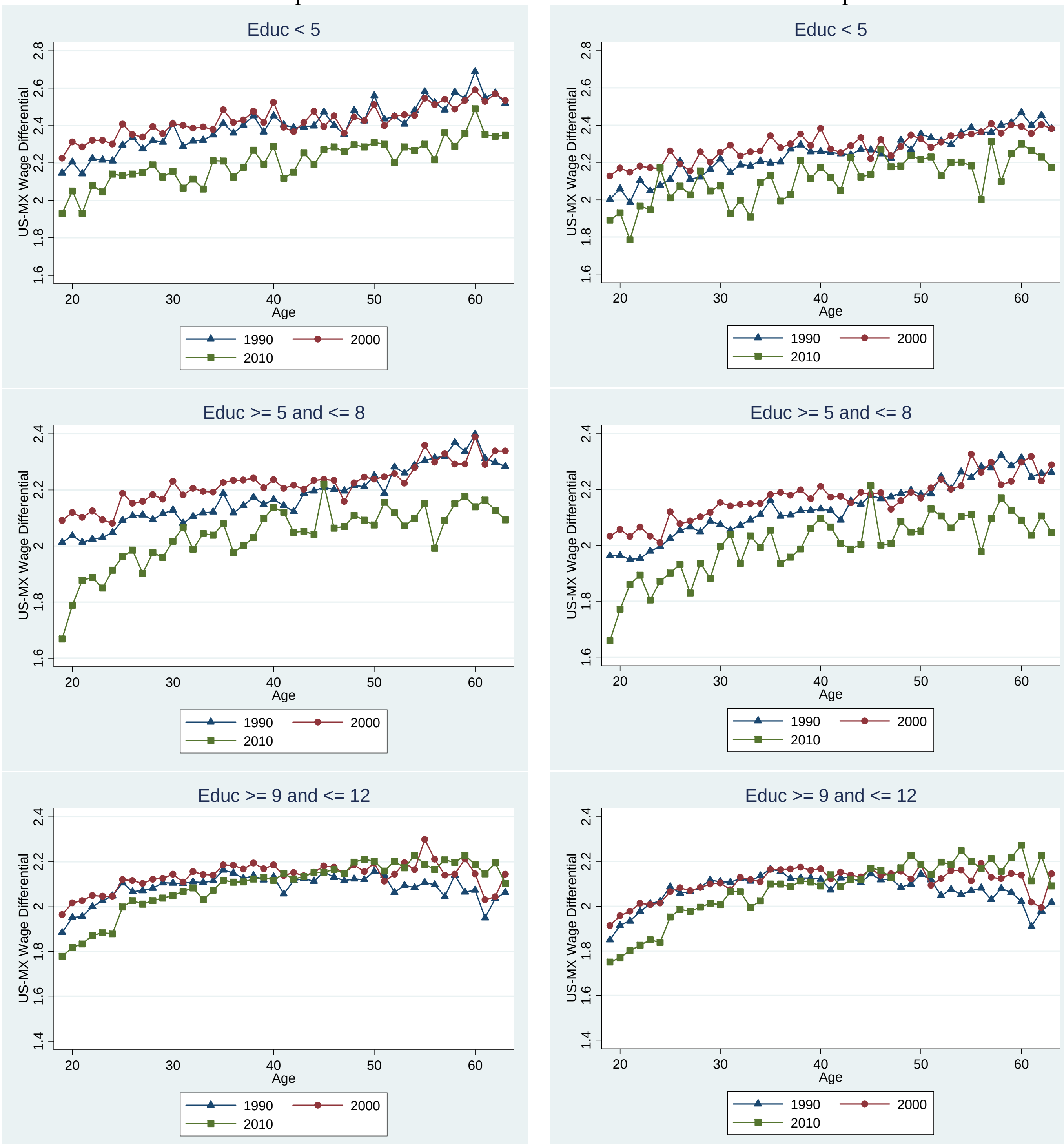
Figure 6: Percentage of Mexican-born Workers in the U.S. by Age and Education, Census Data



Notes: The first age group includes workers aged 19-23 years old; the second includes workers aged 24-28, the third those aged 29-33, and so forth. The first education group includes adults with 0-4 years of education; the second includes adults with 5-8 years of education; the next comprise those with 9-12, 13-16, and finally 17 or more years of education.

Figure 7: Mean Wage Differentials by Age, Census Data

MX – Sample 1 MX – Sample 2



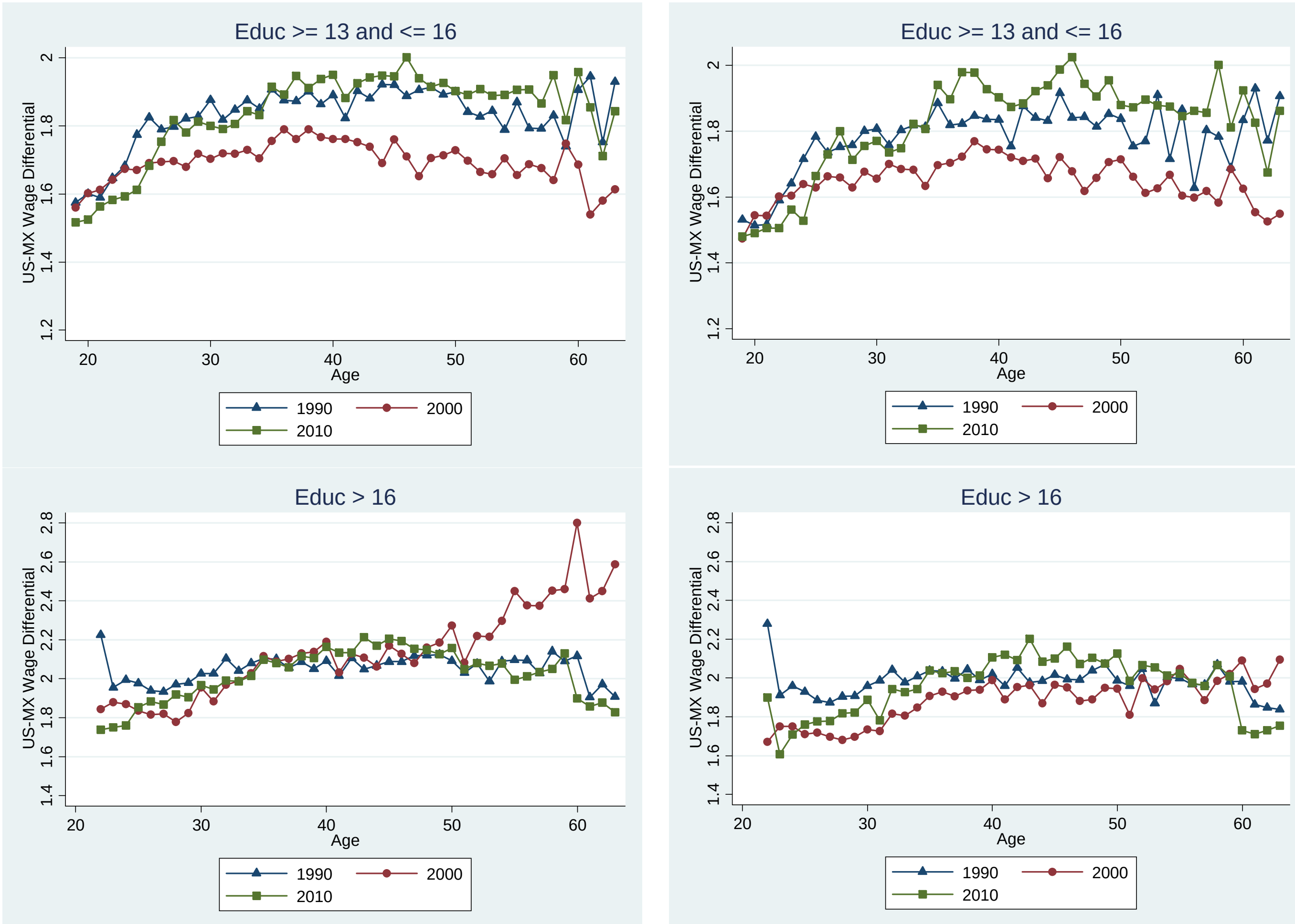

Educ >= 13 and <= 16
US-MX Wage Differential
Age
1990
2000
2010
Educ >= 13 and <= 16
US-MX Wage Differential
Age
1990
2000
2010
Educ > 16
US-MX Wage Differential
Age
1990
2000
2010
Educ > 16
US-MX Wage Differential
Age
1990
2000
2010

Figure 8: Changes in Wage Percentiles by Education

MX – Sample 1 MX – Sample 2

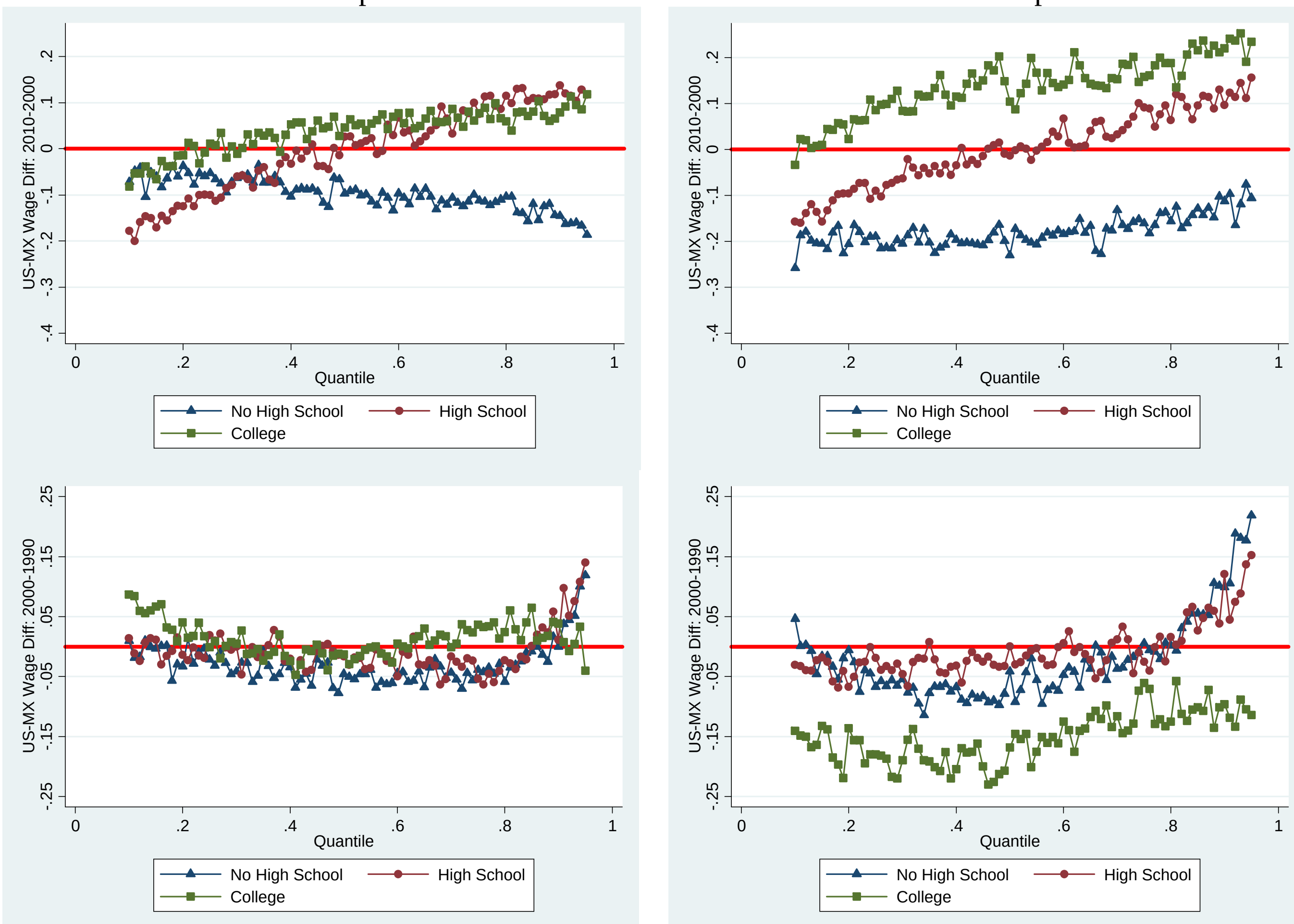


Figure 9: Decompositions of Wage Distribution Changes by Years

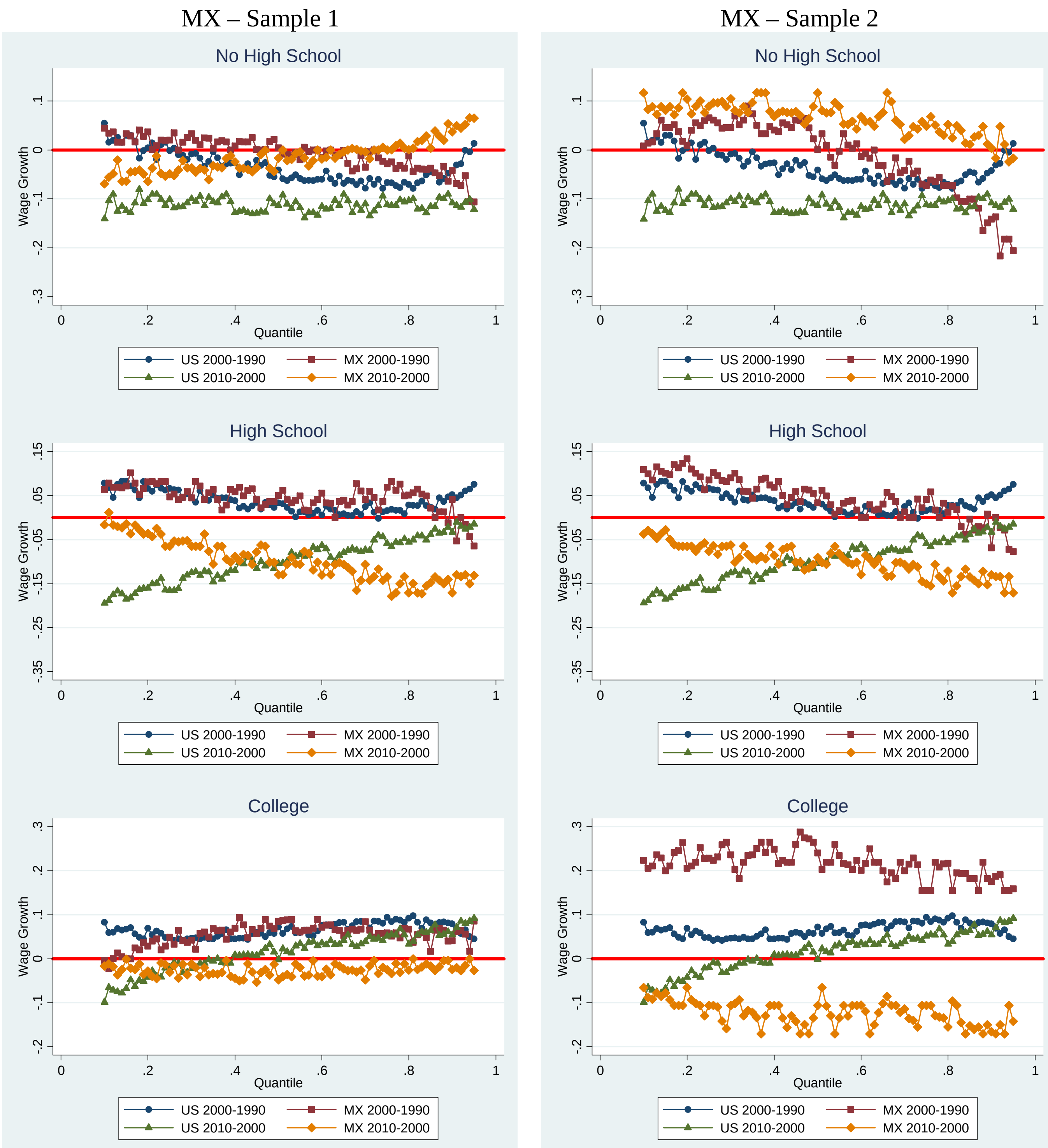


Figure 10: DDD Results – Differences in Changes in Wage Percentiles by Education across Mexico's Border and Interior