

### Do minimum wages help explain declining Mexico-U.S. migration?

### ¿Contribuye el salario mínimo a explicar el declive de la migración mexicana a los Estados Unidos?

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#### ABSTRACT

This paper finds that minimum wages of the United States and Mexico measured carefully in Purchasing Power Parity (PPP) help explain the well-documented post-2010 fall in Mexico-U.S. migration. Declining inequality also plays a role since the purchasing power of the minimum wage increased relative to the average wage in Mexico. Using time-series data, we find two positive partial correlations between minimum wages and net migration: one driven by wage differentials between the two countries and the other by wage inequality in Mexico. However, these results are found to be mediated through migrant social networks. Though relative wages are a classic migration driver, this paper is the first to explore the full minimum-average wage nexus. One clear policy implication of these results is that maintaining the real purchasing power of minimum wages helps reduce migration. An in-depth analysis is needed to demonstrate the causality of these correlations.

*Keywords:* 1. net migration, 2. minimum wage, 3. inequality, 4. Mexico, 5. United States.

#### RESUMEN

Este artículo encuentra que los salarios mínimos de México y EE. UU., medidos en Paridad de Poder de Compra (PPC), contribuyeron a la reducción de la emigración de mexicanos a EE. UU. después del año 2010. La disminución de la desigualdad observada en México también juega un papel en esta migración, debido a los aumentos en el poder adquisitivo del salario mínimo relativos al salario promedio en México. Utilizando datos de series de tiempo, se muestra la existencia de dos correlaciones parciales positivas entre el salario mínimo y la tasa de migración neta, vía los diferenciales salariales entre los dos países y vía la desigualdad salarial en México. Sin embargo, estos resultados son mediados por la existencia de redes sociales migratorias. Este artículo contribuye al análisis clásico de la relación entre la migración y los diferenciales salariales, al ser el primero en explorar todos los vínculos del salario mínimo. Estos resultados resaltan la importancia del poder adquisitivo de los salarios mínimos para detener la emigración, aunque se necesitan análisis más profundos para demostrar la causalidad de las correlaciones encontradas.

*Palabras clave:* 1. migración neta, 2. salario mínimo, 3. desigualdad, 4. México, 5. EE. UU.

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## INTRODUCTION

Starting in 2008, the total foreign-born Mexican population in the United States plateaued and then reversed. As return migration to Mexico remained constant, new arrivals declined, hence Mexicans' net migration becoming negative (Cuecuecha, 2018; Passel, Cohn, & Gonzalez-Barrera, 2012). This reversal appears to be the end of a remarkable 30-year migration surge which until recently had raised the foreign-born Mexican population in the United States from under a million in 1980 to over 11 million in 2010 (USCB, 1990, 2011, 2016). This paper explores how differentials in Mexico-U.S. minimum wage may explain this remarkable downturn in the net migration rates of Mexicans in the United States. There are at least three margins by which Mexico's minimum wage can affect migration: the first has to do with wage differentials, the second with wage inequality, and the third with employment.

Variations in the minimum wage can affect the entire wage distribution, for instance, workers who earn slightly above the minimum (Neumark, Schweitzer, & Wascher, 2004). Such fact is documented in the Mexican labor market (Fairris, Popli, & Zepeda, 2008), in both formal and informal sectors (Bouchot, 2017; Maloney & Nuñez, 2004). This would affect wage differentials between the United States and Mexico, which scholars claim as the main push factor for emigration (Sjaastad, 1962).

The effects of the minimum wage include changes in wage inequality (Fairris, Popli, & Zepeda, 2008), which, in turn, affects emigration because of relative deprivation effects (Stark, Taylor, & Yitzhaki, 1988). Relative deprivation refers to a situation where individuals at the bottom of the income distribution would have higher incentives to migrate than individuals at higher levels of the income distribution.

Changes in the minimum wage could affect the unemployment rate, which, in turn, could affect rural to urban, domestic migration (Harris & Todaro, 1970), international emigration towards the United States (Basu, 1996) as well as return migration to Mexico (Cuecuecha, 2018). This third margin is only controlled in all our estimations since the results are obtained conditioned on employment levels in both Mexico and the United States.

Guided by the above literature and debates centered on explaining the reversal of the Mexican net migration, this paper further explores the importance of wage differentials adjusted for purchasing power parity (PPP). Analysis of wage differentials adjusted for PPP has been used to explain return migration (Stark, Helmenstein, & Yegorov, 1997). Unlike (Stark, Helmenstein, & Yegorov, 1997) now-classic analysis of wage differentials, this paper focuses on how wage differentials between the United States and Mexico affect net migration or the aggregate number of foreign-born Mexican individuals who arrive or depart from the United States. Mainly, the purchasing power of wages has been used to explain domestic migration (Partridge, Rickman, Olfert, & Ali, 2012; Graves, 2012; Cohen, Lai, & Steindel, 2014). Purchasing power parity (PPP) between nations is used to explain return migration whenever a reversal in wage differentials

between nations measured in real terms has not materialized (Stark, Helmenstein, & Yegorov, 1997).

This paper presents evidence of the importance of PPP minimum wage differentials in explaining the U.S.-Mexico's net migration reversal. The U.S.-Mexico wage differential in PPP terms is measured as the difference between the U.S. federal minimum wage and the average minimum wage in Mexico. The partial correlation between these two variables is estimated to be between .3 and .33. The estimations also show that this U.S.-Mexico wage differential, even when it remains positive and unreversed, declined during the 2000 and 2016 period, especially when comparing it to wage differentials observed during the 1993 to 2000 period.

Furthermore, we measure the effects of wage inequality to explain declines in the net migration rate. The effects of wage inequality in explaining declines in the net migration rate are measured. Similarly, the measure of inequality consists of calculating the difference between average formal wages and average minimum wages in Mexico. The estimation shows that while wage inequality in Mexico remains large it declines over the 2000-2016 period, especially when compared to wage inequality observed in the 1993 to 2000 period. The results show a partial correlation between wage inequality and the net migration rate in the United States between .68 and .88. This margin is consistent with the existent relative deprivation effect (Stark, Taylor, & Yitzhaki, 1988) while confirming previous findings by Quinn (2006) attesting to the existence of a relative deprivation effect in Mexicans' internal migratory behavior.

The relation between the minimum wage and the net migration rate is found to be mediated by past net migration rates. We interpret this result as evidence that the relation between the minimum wage and the net migration is channeled through social networks effects.

An innovation of this paper is to compare the U.S.-Mexico PPP wage differential measured by the difference between the average wage for Latinos in the United States and the average PPP wage earned in jobs in Mexico's formal sector, which has a positive correlation with the net migration rate estimated to be between .37 and .72. This correlation is statistically significant in nine different specifications.

The above findings are presented in four parts: first, we survey different migration theories, wage differentials, and purchasing power parity, including the literature linking wage inequality to migration. Second, we estimate a simple standard model of migration, where wage differentials explain fluctuations in the net migration of Mexicans in the United States. The third section reviews data sources and trends in migration and wages. Finally, a fourth section presents our estimation results, relevant conclusions, and policy implications of this paper.

## THEORETICAL CONSIDERATIONS

### *The Importance of Wage Differentials*

The role of large wage differentials in explaining immigration flows between countries is well established. Sjaastad (1962) claims that differences in productivity underlie wage differentials and explains migration from low to high wage countries. Implicit in this model is that migration costs are proportional to wage differentials. Additionally, Harris and Todaro (1970) argue that individuals may also consider differences in unemployment rates to explain migration through expected earnings differentials between countries. Chiswick (1978) argues that wages reflect differences in returns to human capital, which in turn drive migration. As Borjas (1987) argues, differences in inequality, and returns to human capital as well as transferability of skills imported by immigrants explain migration.

### *Household Choices and Migrant Networks*

The importance of the decisions made by the household, who decide who should migrate and often finance the costs, was introduced by Katz and Stark (1986). According to this view, migration helps poor rural households diversify risk in the absence of insurance or financial markets. Under this argument, immigration takes place with or without wage differentials as long as expected income in the sending and receiving regions are not perfectly correlated.

Massey et al. (1987, 1993) argue that the cost of migration is specific to communities, so individuals rely on migrant kinship and community networks to decide on when, how, and where to migrate. Over time communities accumulate social capital appearing as social networks and information regarding the risks and benefits of migration. This social capital gradually reduces migration costs, inducing more migration to familiar communities (Massey & Zenteno, 1999). Munshi (2003) has shown that wage differentials depend on these migrant networks since individuals use these networks to obtain better wages and jobs (referrals, for example).

However, the migration fueling power of social capital is limited by the operation rules of the network between rural and urban areas (Fussel & Massey, 2004). Urban communities, for example, eventually become saturated, diminishing job prospects, and reducing members' incentives to migrate (Light & von Scheven, 2008).

### *Wage Inequality and Migration*

There is extensive literature that documents the effect of income inequality on migration. For example, Stark, Taylor, and Yitzhaki (1988) find that individuals may migrate due to an aversion to inequality generated and utility reducing relative deprivation. Implying that poor individuals often have a greater incentive to migrate than affluent individuals as greater inequality affects poor households more. This relative deprivation model assumes that individuals at the bottom of

the income distribution are more likely to migrate due to increasing income inequality. Quinn (2006) finds that the internal migration of Mexican communities is positively linked to income inequality.

Relative wage inequality is also associated with the selection of migrants based on their observable and unobservable characteristics (Borjas, 1987). For instance, if a worker originates from countries with higher wage inequality than the United States (e.g., Mexico, Brazil, etc.), individuals will be selected negatively in their unobservable characteristics. Whereas, if a worker originates from countries with less wage inequality than the United States (i.e., Sweden, Germany, etc.), migrants will be positively selected in their unobserved characteristics. Suggesting falling inequality in Mexico along with rising inequality in the United States will slow immigration.

Emerging research reveals another channel via which inequality can affect migration. This occurs when income inequality causes increased crime and violence (Songman, 2016), which seems to be push factors for domestic migration (Martinez, 2014) and international migration (Cantor, 2014). Then, economic inequality may affect migration by changing relative crime rates.

### *Minimum Wages and Migration*

According to Harris and Todaro (1970), increases in the minimum wage attract individuals from rural areas to urban areas, where the minimum wage limits the capacity of the urban labor market to absorb all rural migrants. Unemployment could affect international emigration towards the United States (Basu, 1996) and return migration towards Mexico (Cuecuecha, 2018).

However, variations in minimum wages have other effects on labor markets, including average wages, hours of employment, and unemployment rates (Neumark, Schweitzer, & Wascher, 2004; Fairris, Popli, & Zepeda, 2008; Bouchot, 2017; Maloney & Nuñez, 2004). The minimum wage can also affect expected wages and wage inequality. Research for Mexico confirms minimum wage changes affect the most workers with wages close to the minimum, in both in formal and informal labor markets (Fairris, Popli, & Zepeda, 2008; Maloney & Nuñez, 2004) and informal sectors (Bouchot, 2017; Maloney & Nuñez, 2004). The effects of minimum wage floors workers with wages near the minimum wage are explained by the numeraire effect and/or the lighthouse effect (Maloney & Nuñez, 2004). In the first case, the minimum wage is used as a reference to set formal sector wages. The lighthouse effect leads informal sector workers to establish their reservation wages, taking the minimum wage as a reference. These effects are documented throughout Latin American labor markets (Maloney & Nuñez, 2004).

Based on our survey of the above literature, to our knowledge, this is the first paper to study the effects of the minimum wages on wage differentials and wage inequality on net Mexico-U.S. migration.

## AN EMPIRICAL MODEL OF NET MIGRATION AND THE MINIMUM WAGE

We present a simple model of net migration where we assume two types of migrants involved. The first model involves immigrants importing high skill levels. Here, the wage differential (Sjaastad, 1962) that they can estimate depends on skill levels. In Mexico, for example, highly skilled individuals will expect to receive a specific wage ( $w_m^h$ ) measured by the average wage in the formal sector. This average wage is measured in PPP dollars. If these individuals choose to migrate to the United States, they will expect to receive a wage equal to  $w_u^h$ , which is measured by the average wage for Mexicans in the formal sector of the United States. Moreover, if they choose to return to their country of origin they can expect to return to Mexico's formal sector and earn  $w_m^h$ .

In Mexico, among the low-skilled individuals, they will expect to earn the minimum wage ( $w_m^l$ ), measured by the average minimum wage in PPP dollars. If they emigrate to the United States, they will expect to earn the minimum wage ( $w_u^l$ ), measured by the U.S. federal minimum wage. If they choose to return to Mexico, they can expect to receive the national minimum wage ( $w_m^l$ ) again.

These assumptions imply that the human capital of migrants will transfer freely between the two countries. It also assumes that the country-specific human capital depreciates when individuals change countries. The relevant literature also assumes that individuals can save only in the country where they live, earning a return to capital ( $k_m$ ) in Mexico. This is measured by the real federal funds rate in the United States ( $k_u$ ), while in Mexico by the 28-day interbank rate. This model assumes that savings can be transferred between countries, and consequently, it can be transferred to Mexico by returnees (Borjas & Bratsberg, 1996). Savings  $\phi$  for individuals with skill level  $s$  in country  $j$  is represented in the function  $\phi_j^s(w_j^s, k_j)$ .

The above equation also assumes that changes in net migration are related to different forms of inequality. First, individuals may face inequality based on relative deprivation (Stark, Taylor, & Yitzhaki, 1988). Second, inequality may be associated with crime and violence (Songman, 2016), which may become a push factor for domestic migration (Martinez, 2014) or international migration (Cantor, 2014). Unlike Stark, Taylor, and Yitzhaki (1988), which measure inequality by the Gini coefficient, in this paper, we measure inequality by the difference between the average wage and the minimum wage in Mexico and the United States. Note that for symmetry, our model assumes that inequality could affect migration both in Mexico and the United States.

Migration costs depend on social migrant networks as measured by previous migration levels (Massey et al., 1993) and are assumed to be proportional to the wage differential by skill level (Sjaastad, 1962).

We define the U.S.-Mexico wage differentials by skill level  $s$  by  $d^s = w_u^s - w_m^s$ , the internal wage differentials in country  $j$  by  $d_j = w_j^h - w_j^l$ , and the U.S.-Mexico's return to capital differential by  $\rho = k_u - k_m$ .

Equation 1 compares the net migration rate  $N$  from Mexico to the United States by skill level  $s$ :

$$1) \quad N_t^s = N^s(d^s, d_m, d_u, \rho, N_{t-1}^s, X_t)$$

Equation 1 has a positive relation with  $d^s$  because the model assumes that wage increases in the United States attract individuals in Mexico to emigrate. When inequality in Mexico is higher, individuals from each skill level would want to migrate more, implying  $d_m$  increases net migration in Equation 1. For symmetry, we assume that the net migration rate is inversely related to the U.S. internal wage inequality  $d_u$ . The relation between the net migration rate and the interest rate differential  $\rho$  does not have a clear sign. An increase in  $\rho$  could increase the entry flow since individuals could save and earn higher returns in the United States. However, an increase in  $\rho$  could also increase return migration because it could help individuals achieve faster their financial goals and trigger return migration (Borjas & Bratsberg, 1996). Equation 1 allows past immigration to increase  $N$  as more Mexican migrants in the United States reduce costs for future migrants (Massey, Alarcón, Durand, & González, 1987). Here it is possible that the first lag of the net migration rate  $N_{t-1}$  may have a negative sign if a surge in Mexican immigrants reduces the net benefits of migration, above and beyond its effect on  $d^s$ . For example, this might occur when a surge in immigration leads to a more restrictive immigration policy or if housing and job opportunities are limited by congestion (Light & von Scheven, 2008).

In Equation 1,  $X_t$  represents other push and pull factors that can influence net migration. These variables are the log of the nominal peso-dollar exchange rate, which is related to migration when large devaluations occur (Delechat, 2003), and its potential link with return migration (Yang, 2006). The log of Mexico's formal employment is introduced due to the importance of employment creation to explain the decline in Mexican migration into the United States (Cuecuecha, 2018), the relationship between employment, minimum wage, as well as migration (Harris & Todaro, 1970; Basu, 1996), and the importance that an excess supply of labor may have in the migratory flow (Lewis, 1954; Hanson & McIntosh, 2010). The log of total employment in the United States is included given the importance of job creation for new immigrants (Harris & Todaro, 1970; Passel, Cohn, & Gonzalez-Barrera, 2012; Hanson & McIntosh, 2010). The deportations log is a control variable because many researchers find it affects total migration (Passel & Cohn, 2009; Passel, Cohn, & Gonzalez-Barrera, 2012; Orrenious & Zavodny, 2015). Finally, the dependency log ratio is included because Mexico's recent migration is influenced by demographic transition (Massey, 2016; Hanson & McIntosh, 2010).

Equation 2 shows the aggregate net migration rate for Mexicans living in the United States in time  $t$ , by adding up the two types of migrants and dividing this aggregate number of migrants by the total population of Mexico, and leaving us with the following equation:

$$2) \quad N_t = N(d^h, d^l, d_m, d_u, \rho, N_{t-1}, X_t)$$

Equation 3 shows the log of  $N_t$ , as a linear function of the different variables mentioned before:

$$3) \quad \log N_t = \beta_0 + \beta_1 d_t^h + \beta_2 d_t^l + \beta_3 d_{mt} + \beta_4 d_{ut} + \beta_5 \rho_t + \beta_6 \log N_{t-1} + \beta_7 X_t + u_t$$

Equation 4 is a version of Equation 3 that addresses some econometric issues implicit in Equation 3. For example, spurious correlations may arise if the variables in Equation 3 are not stationary. Similarly,  $u_t$  could be correlated with the current values of the exogenous variables in Equation 3. We use the lagged first difference for all exogenous variables except the net migration rate to minimize these problems.

$$4) \quad \log N_t = \alpha_0 + \alpha_1 \Delta d^h_{t-1} + \alpha_2 \Delta d^l_{t-1} + \alpha_3 \Delta d_{m,t-1} + \alpha_4 \Delta d_{u,t-1} + \alpha_5 \Delta \rho_{t-1} + \alpha_6 \log N_{t-1} + \alpha_7 \Delta X_{t-1} + \Delta u_t$$

Equation 4 is not estimated because an Augmented Dickey-Fuller test with a trend and five lags finds that  $\log N_t$  is not stationary since a coefficient of .58 is found. Consequently, the non-stationarity hypothesis cannot be rejected. An analogous test for the first difference of  $\log N_t$  shows that it is stationary since a coefficient of minus 4.1 is found, which rejects at the 1% level of confidence the null non-stationarity hypothesis. These results are consistent with Cumulative Causation Theory (Massey & Zenteno, 1999), which argues that events triggering migration can have long-lasting effects. Hence the dependent variable in Equation 5 is the first difference of  $\log N_t$  and adds a trend component, as follows:

$$5) \quad \Delta \log N_t = \gamma_0 + \gamma_1 \Delta d^h_{t-1} + \gamma_2 \Delta d^l_{t-1} + \gamma_3 \Delta d_{m,t-1} + \gamma_4 \Delta d_{u,t-1} + \gamma_5 \Delta \rho_{t-1} + \gamma_6 \Delta X_{t-1} + \gamma_7 \text{time}_t + \Delta u_t$$

Equation 5 has eliminated potential unobserved fixed effects in Equation 3 by using the first difference of the net migration rate as a dependent variable. However, the complexity of the dynamic process for the net migration rate in Equation 5 may imply that there may be other variables excluded from the regression. Because of this, our final model specification, in Equation 6, includes two lags of  $N$  as exogenous variables  $\Delta \log N_{t-1}$  and  $\Delta \log N_{t-2}$ :

$$6) \quad \Delta \log N_t = \gamma_0 + \gamma_1 \Delta d^h_{t-1} + \gamma_2 \Delta d^l_{t-1} + \gamma_3 \Delta d_{m,t-1} + \gamma_4 \Delta d_{u,t-1} + \gamma_5 \Delta \rho_{t-1} + \gamma_6 \Delta X_{t-1} + \gamma_7 \Delta \log N_{t-1} + \gamma_8 \Delta \log N_{t-2} + \gamma_9 \text{time}_t + \Delta u_t$$

The number of lags to be included in the equation is decided empirically, conditional on the total number of observations and if the equation does not show the existence of serial autocorrelation, as indicated by the alternative test of Durbin (1970). The tests shown in Table 3 and 4 in our next section confirm the model with two lags does not suffer from autocorrelation.

## DATA AND A HISTORICAL AND DESCRIPTIVE ANALYSIS OF TRENDS

### *Data Sources*

The data used in this paper comes from a wide range of sources. The number of Mexicans living in the United States from 1970 to 2010 is obtained from the U.S. decennial censuses (USCB, 1990, 2011, 2016) and U.S. Dept. of Commerce (USDC, 1996). Annual data on the number of Mexicans living in the United States from 1994 to 2016 is estimated from Ruggles et al. (2019) among individuals who claimed to have been born in Mexico in the Current Population Survey



(CPS). To control for potential undercounts in the CPS established in the literature (Passel & Cohn, 2009), we compare this data against the Census data and apply a correction so that annual data from CPS will match with decennial censuses data.

The information from 2000 to 2016 comes from the National Survey of Occupation and Employment (ENOE, for its acronym in Spanish), which is collected by Mexico's National Institute of Statistics and Geography (INEGI, for its acronym in Spanish, 2012, 2013, 2014) and the data from 1993 to 2000 comes from National Urban Employment Survey (ENEU, for its acronym in Spanish) (INEGI, 1993 to 2000). Data on average Mexican minimum wages comes from the National Commission on Minimum Wages (CONASAMI, for its acronym in Spanish) (2017). We use the average per year because from 1982 to 2012, Mexico used three regional minimum wages, and between 2012 and 2015 used two regional minimum wages, and between 2015 and 2017, only one minimum wage. Nominal data were transformed to real data using Consumer Price Index reports by INEGI (2017).

Data from 2000 to 2016 regarding formal employment in Mexico comes from INEGI (2017), while information from 1993 to 2000 comes from the Statistical Appendix of the state of the union address (SEGOB, 2000). Data on Mexico's dependency ratio from 1960 to 2010 is interpolated using data obtained from Mexican censuses, the 1995 and 2005 count, and the 2015 intercensal survey, with data collected by INEGI and organized by the Integrated Public Use Microdata Series (IPUMS, 2019). Data on the 28-day interbank rate for Mexico comes from the Bank of Mexico (BANXICO, 2020). Data on the peso-dollar exchange rate comes from INEGI (2017). Data on the purchasing power parity peso-dollar rate comes from World Bank (2016).

Data on U.S. federal minimum wage comes from the U.S. Department of Labor (USDOL, 2017). Information on average wages for Latinos in the United States and data on employment comes from the U.S. Bureau of Labor Statistics (USBLS, 2017). Numbers on the price index come from the U.S. Federal Reserve Bank of Saint Louis (FRED, 2017). We obtained deportations numbers from the U.S. Department of Homeland Security (USDHS, 2015, 2016). Data on the U.S. Federal Fund rate comes from Macrotrends (2019).

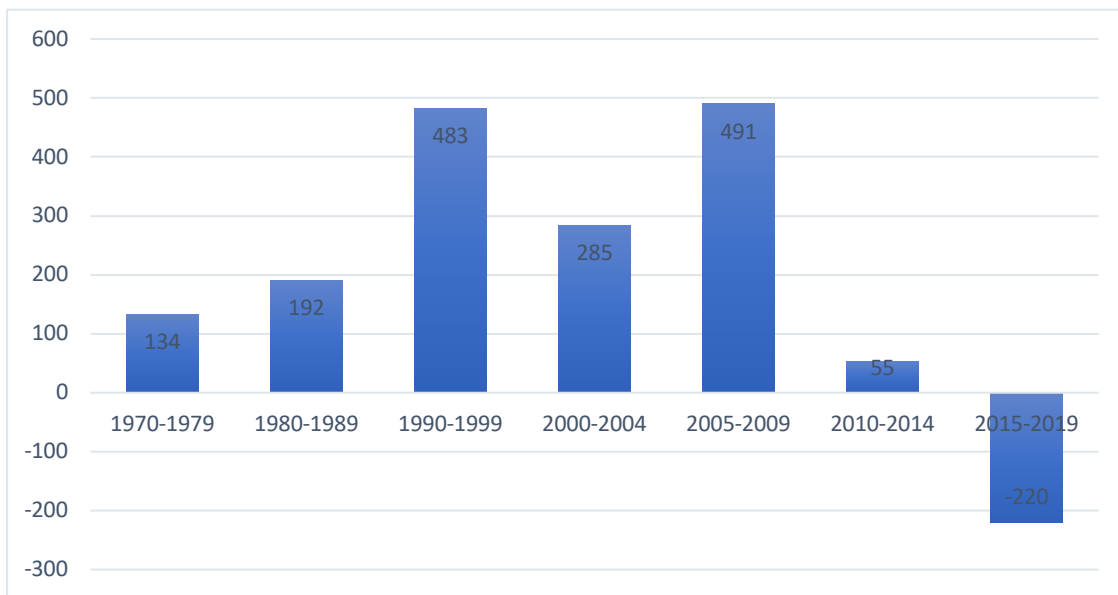
### *The Great Mexican Immigration and the Slowdown*

Figure 1 shows the growth in Mexican-U.S. immigration since the 1970s. Between 1970 to 1979, 134 thousand immigrants entered the United States per year, but during the decade of 1990 to 1999, this number reached a total of 483 thousand immigrants per year (USCIB, 1990, 2011; USDC, 1996).

Scholars have explained this extraordinary growth through different reasons. Firstly, demographic changes (Hanson & McIntosh, 2010), secondly, using Cumulative Causation Theory and Social Migrant Networks (Massey et al., 1993; Massey & Zenteno, 1999), thirdly, historical events like the United States' economic boom of the 1920s (Massey, 2016; Durand, 2016), and lastly, changes in U.S. immigration policies. Major changes in U.S.

immigration policies include a) The Bracero program beginning in 1942 and ending in 1964 (Donato & Massey, 2016), b) the Hart-Celler Act of 1965 facilitating the immigration of family members (Durand, 2016; Fuentes-Mayorga, 2022), c) the Immigration Reform and Control Act of 1986, which offered amnesty for certain undocumented immigrants (Massey, 2016), and d) the militarization of the border that started in 1992, following a racialized public narrative about Mexicans as criminalized, “illegal aliens” (Massey, 2015; Massey, Durand, & Pren, 2018; Donato & Massey, 2016).

Figure 1. Annual Increase in U.S. Foreign-Born Mexican Population (Thousands)



Source: Authors’ estimates using data from several sources including: USCB (1990, 2011, 2016), USDC (1996), and Ruggles et al. (2019).

However, Figure 1 also shows that from 2000 a dramatic shift was starting in the Mexican-U.S. immigration. For example, there was an increase in the foreign-born Mexican population during the first five years of the 21st Century. It was almost as big as the population that entered between 1980 and 1989. Nevertheless, by the second half of that decade, only 55 thousand individuals entered per year. Finally, between 2015 and 2019, the number of foreign-born Mexican individuals living in the United States declined by about two hundred and twenty thousand per year.

*Explaining the Decline in the Net Migration from Mexico to the United States*

The Great Economic Recession of 2008 has been claimed as responsible for the decline in net migration (Passel & Cohn, 2009). Subsequently, Passel, Cohn, and González-Barrera (2012) link the reduction to the slow recovery of the U.S. economy, increased deportations, and return migration prompted by family reunification in Mexico. Orrenious and Zavodny (2015) attribute the reduction in Mexican migration to new laws requiring employers to verify immigration status. In 2006, for example, Arizona required electronic verifications of immigration status to employers via E-Verify. This system spread to some other localities and states but not all. Orrenious and Zavodny (2016) argue that E-Verify caused migrants to relocate within the United States and increased return migration to Mexico, at times due to forced deportation.

However, Massey (2016) argues demographics reduced migration as Mexico's demographic transition took place faster than expected. Such transition is a sharp fall in the birth rate generally driven by a reduction in child mortality and/or increased education and employment opportunities for women. Mexico's transition included falling mortality and fertility rates (Coale, 1989). Massey (2016) explains that the fall in the supply of prime-age migrants reduced net migration, as birth rates decreased from almost 6% in the 1970s to over 2% in post-2000. However, Hanson and McIntosh (2010) argue that the demographic transition was not as effective in reducing Mexican emigration because long-standing social networks continued to dominate migrate decisions. Massey (2016) also argues the drastic reduction in Mexico's fertility and diminishing returns to social capital did slow migration. Further research suggests migrant networks did encounter saturation. For example, the decline in members' access to resources in the United States reduced incentives for migration (Light & von Scheven, 2008).

More recently, Warren (2017) claims that planned return migration is increasing among Mexicans in the United States due to improved employment conditions in Mexico. Supporting this claim Cuecuecha (2018) has shown that during the 2000-2016 period, there was a growth in job creation, which could have reduced incentives to migrate.

In this paper, the first objective is to explore the importance of changes in wage differentials to explain net migration. Table 1 shows what happens if we look at the gap measured between the minimum wage in Mexico and the United States. Over the 1993 to 2016 period, the gap increased in constant 2016 prices. In the 1993-2000 period, the U.S.-Mexico minimum wage ratio was 7.2. From 2015 to 2017, this wage ratio was 4.1. Although the wage gap is large, the decline observed in the period analyzed is remarkable. Table 1 also shows a qualitatively similar pattern when using formal jobs wage differentials between foreign-born Mexicans living in the United States and native-born individuals living in Mexico in dollar terms and PPP units. These findings are consistent with the decline of the Mexican-U.S. net migration.

Table 1 also illustrates the behavior of the domestic Mexican wage differential. In the period from 1993 to 2000, an individual earning the average Mexican wage obtained five times more than the minimum wage. By 2017, this ratio was 4.3 a general pattern also consistent with declining Mexican-U.S. net migration.

Table 1. U.S.-Mexico Wage Differentials 1993-2017

Time Interval	Wage Ratios		Min. Wage Ratios		MX Wage Ratios
	Avg. U.S. wage for Mexicans in dollars / Average wage in Mexico in dollars	Avg. U.S. wage for Mexicans in PPP dollars/Avg. wage in Mexico in PPP dollars	Min. U.S. wage in dollars /Min. wage in MX in dollars	Min. U.S. wage in dollars /Min. wage in MX in PPP dollars	Avg. Wage in Mexico/Min Wage in Mexico
1993-1999	3.1	4.1	8.4	7.2	4.9
2000-2004	3.1	2.0	6.2	5.2	3.8
2005-2009	3.1	2.0	6.9	5.1	4.2
2010-2014	3.0	1.9	7.4	4.9	4.3
2015-2017	4.7	2.2	8.7	4.1	4.3

Source for wages: Authors’ calculations using INEGI (2017), INEGI (1993 to 2000), CONASAMI (2017), USDL (2017), and USBLS (2017); source for PPP, and price indexes: INEGI (2017), World Bank (2016), and FRED (2017).

Nevertheless, Table 1 cannot be considered evidence of a causal relation. To move toward causality the following section provides estimates of different empirical models that demonstrate how the minimum wage can explain the decline in Mexican migration to the United States. Limits on the number of observations restrict our ability to use methods that could reveal causal effects in a migration model with many endogenous elements (Campos-Vazquez & Lara, 2012). Consequently, our analysis will present relations between our variables of interest.

### ESTIMATION RESULTS

We now present estimations that allow us to show the behavior of our main variables for the 1993-2016 period. The average net migration rate, defined as the total number of Mexicans living in the United States divided by Mexico’s total population, is 10% in the period from 1990 to 2016. The average PPP U.S.-Mexico wage differential is 4.5, implying that a Mexican could earn 4.5 times more in the United States than in Mexico. The average PPP U.S.-Mexico minimum wage differential in the period was 8.66, meaning that Mexicans working jobs that pay the minimum wage in the two countries could earn 8.66 times more in the United States than in Mexico. Mexico’s domestic wage differential was 6.1 times, which implies that a worker in the formal sector could earn 6.1 times the minimum wage of Mexico. The U.S. domestic wage differential was 2.1, indicating that the average wage for Mexicans in the United States is 2.1 times the U.S. Federal minimum wage. The Mexico-U.S. real interest rate differential is 4.8, which implies that, on average, the real interest rate in Mexico, not controlling for expected depreciation, was almost five times the real interest rate in the United States.

Table 2 presents the average values for the different variables used in the empirical estimations while including the mean values for the various control variables added to rule out alternative explanations for the decline in Mexican migration to the United States. For instance, Table 2 shows Mexico had an average of 13 million formal jobs during the 2000-2013 period. On the other hand, the United States had 131 million jobs on average. The total number of deportations (for all nationalities) during this period was 1.1 million. The peso-dollar exchange rate was on average 10.9 Mexican pesos per dollar. The average dependency ratio was .70 in the period analyzed.

Table 2. Mean and Standard Deviation for Variables Used in Estimation, 1993-2016

Explanatory variables	Mean	Standard
		Dev.
Net migration rate	0.10	0.01
U.S. -MX wage differential (ratio)	4.54	0.60
U.S.-MX min wage differential (ratio)	8.66	1.29
MX internal wage differential (ratio)	6.18	0.84
U.S. internal wage differential (ratio)	2.09	0.20
MX-U.S. real Interest rate differential (ratio)	4.82	6.38
MX formal employment (millions)	13.40	2.54
U.S. total employment (millions)	131.00	7.30
Deportations (millions)	1.15	0.43
U.S.-MX exchange rate	10.90	3.16
MX dependency ratio	0.71	0.06

Source for migration: Authors' calculations using USCB (1990, 2011, 2016), USDC (1996), Ruggles et. al. (2019); source for wages INEGI (2017), INEGI (1993 to 2000), CONASAMI (2017), USDL (2017), USBLS (2017); source for employment: Authors' calculations using INEGI (2017), Zedillo (2000), USBLS (2017); source for deportations: USDHS (2015, 2016); source for interest rates, exchange rates, PPP, and inflation: Macrotrends (2019), BANXICO (2020), INEGI (2017), World Bank (2016), FRED (2017); source for dependency ratio: Authors' calculations using data from IPUMS (2019).

The estimation for different versions of Equation 5 is presented in Table 3. This model uses the first difference of the net Mexican-U.S. migration rate log as a dependent variable. In every

case, the partial correlation of the U.S.-Mexico’s PPP wage differential is statistically significant. This partial correlation is between .58 and .72, implying that an increase in the U.S.-Mexico PPP wage differential moves positively with increases in the net migration rate. Table 3 also shows that the partial correlation between Mexico’s internal wage inequality and the net migration rate is positive and significant, with a coefficient estimated between .68 and .83. No other variable is statistically significant in the equation.

The U.S. internal wage inequality and the U.S.-Mexico real interest rate differential are not statistically significant individually and jointly. A statistical test of the hypothesis that they are both simultaneously zero generates an F value of .53, which implies that it cannot be rejected. For all models, the Alternative Durbin test shows that there is no autocorrelation.

Table 3. Models for Net Migration Rate, 1993-2016

Explanatory variables	Model (1)	Model (2)	Model (3)	Model (4)
D.US-MX PPP wage (t-1)	0.582** (0.183)	0.600** (0.179)	0.717** (0.225)	0.572** (0.171)
D.US-MX PPP min wage (t-1)	0.246 (0.136)	0.272 (0.133)	0.258 (0.132)	0.200 (0.120)
D. Wage/ min Wage MX (t-1)	0.821** (0.276)	0.827** (0.261)	0.819** (0.253)	0.676** (0.228)
D. Wage/ min Wage US (t-1)	-0.140 (0.247)			
D.US-MX real interest Rate (t-1)	0.002 (0.004)			
Trend	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.004 (0.002)
D.Log Exchange Rate (t-1)			-0.086 (0.073)	
D.Log Deportations (t-1)				-0.117 (0.084)
Constant	4.966 (3.346)	4.701 (3.115)	4.770 (3.110)	7.263 (3.974)
R <sup>2</sup>	0.56	0.60	0.60	0.62
Alternative Durbin test	.24	.20	.23	.05
N	22	22	22	22

\*\*Significant at 5% level.

Note: D. refers to the first difference of the indicated variable. Log refers to the logarithm of the indicated variable.

Source: Own estimations based on various sources. See data section for details.

Columns 1 to 3 in Table 4 present three additional versions of Equation 5, while columns 4 and 5 show two versions of Equation 6. In all equations, the partial correlation of the U.S.-Mexico

PPP wage differential with the net migration rate is found positive and statistically significant. A partial correlation between .37 and .63 is estimated.

The partial correlation of the U.S.-Mexico PPP minimum wage differential with the net migration rate is found significant in two of the three different versions of Equation 5. However, it is not significant in any version of Equation 6. This positive and significant partial correlation is estimated to be between .30 and .33.

The partial correlation between Mexico's internal wage inequality and the net migration rate is found positive and statistically significant in the three versions of Equation 5. Yet, it is not found significant in Equation 6. The partial correlation is estimated to be between .83 and .88.

Various estimates of Equation 5 are shown in Tables 3 and 4, including additional variables such as the nominal exchange rate, deportations, employment in the United States, employment in Mexico, and the dependency ratio. Only the dependency ratio is statistically significant (Column 3 in Table 4). The partial correlation between this variable and the net migration rate is found to be -.44, implying that with increases in the dependency ratio, the net migration rate shows a decline. The sign of this partial correlation is unexpected. Column 5 in Table 4 shows that if we condition past values of the net migration rate the significance of the dependency ratio vanishes, which probably shows that the dependency ratio may be determined jointly with the net migration rate.

Columns 4 and 5 in Table 4 show the estimation of Equation 6, which includes past values of the net migration rate. We included two lags in the model since one lag meant autocorrelation according to the Alternative Durbin Test. The partial correlation between the net migration rate and its past values is found to be significant and negative only for the first lag. The estimated partial correlation is between minus .59 and minus .55. The significance of all other variables disappears except for the U.S.-Mexico PPP wage differential, meaning that the correlation observed between the net migration rate and other variables is mediated through the past values of the net migration rate.

A relation between the net migration rate and the U.S.-Mexico PPP wage differential exists because of the choices made by individuals that have wages above the minimum wage in Mexico and the United States. The importance of this margin in all nine estimations reflects that Mexicans in such labor markets do find ways to migrate to the United States.

Table 4. Models for the First difference of the Net Migration Rate, 1993-2016

Explanatory Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
D.US-MX PPP wage (t-1)	0.606** (0.199)	0.575** (0.174)	0.627** (0.180)	0.373* (0.154)	0.373* (0.155)
D.US-MX PPP min wage (t-1)	0.269 (0.153)	0.297* (0.134)	0.333* (0.128)	0.091 (0.064)	0.118 (0.076)
D. Wage/ min Wage MX (t-1)	0.828** (0.269)	0.846** (0.257)	0.876** (0.262)	-0.104 (0.348)	-0.028 (0.401)
Trend	-0.002 (0.002)	-0.002 (0.002)	-0.003 (0.002)	-0.006* (0.002)	-0.005 (0.003)
D.Log Employment MX (t-1)	0.030 (0.317)				
D.Log Employment US (t-1)		0.641 (0.389)			
D.Log Dependency Ratio MX (t-1)			-0.436* (0.179)		-0.120 (0.118)
D.Net Migration Rate (t-1)				- 0.589** (0.181)	- 0.545* (0.193)
D.Net Migration Rate (t-2)				-0.593 (0.305)	-0.529 (0.343)
Constant	4.696 (3.224)	3.814 (3.601)	5.239 (3.216)	11.746* (4.743)	11.023 (5.245)
R <sup>2</sup>	0.58	0.61	0.63	0.58	0.56
N	22	22	22	20	20
Alternative Durbin test	.18	.05	.18	.14	.01

\*\*\*Statistically significant at 1%, \*\*Statistically significant at 5%, \*Statistically significant at 10%.

Note: D. refers to the first difference of the indicated variable. Log refers to the logarithm of the indicated variable.

Source: Own estimations based on various sources. See data section for details.

The relation between the net migration rate and the minimum wage stems from individuals whose migratory decisions are affected by the minimum wage. The results shown above confirm the importance of Mexico’s minimum wage to explain the net migration rate. It does so through two margins: the first is via the U.S.-Mexico minimum wage differential, measured in PPP terms, which implies that one of the most important segments of the population that migrates to the United States is the low skilled, this margin is important in two out of nine specifications estimated. The second margin is through Mexico’s internal wage differential, which implies that high wage inequality in Mexico pushes individuals out of the country, a significant margin in



seven out of nine specifications. The importance of the labor market segment that offers minimum wage level employment is very clear for Mexicans.

However, the obtained results imply that the relation between Mexico's minimum wage and the net migration rate are mediated through past values of the net migration rate. There may be at least two possible reasons for this to happen. Firstly, if minimum wage earners decide to migrate and depend on having networks in the United States, then their migration costs and benefits could depend on their social networks (Massey, Alarcón, Durand, & González, 1987; Munshi, 2003). Secondly, unlike in the past, migrating for this group is no longer dependent on those conditions due to current U.S. migratory policies (Orrenious & Zavodny, 2016; Orrenious & Zavodny, 2015). Unfortunately, our current analysis can not distinguish between these two channels directly, only indirectly. As stated before, in Table 4, deportations were not significant in the model, indicating that the main transmission channel is through the social network channel.

The negative sign found on past values of the net migration is in line with the arguments that the migrant social network no longer fuels migration as Mexico's demographic transition has been achieved (Massey, 2016). This implies that there is a convergence between the population growth rate in Mexico and the United States (Hanson & McIntosh, 2010). Also, the migrant social network has saturated its job and housing opportunities in the United States (Light & von Scheven, 2008). Notice that our estimation cannot distinguish between the relative importance of these ideas.

It is also worth mentioning that in estimations not shown because of lack of space, employment in Mexico is negatively correlated with the net migration rate. Meanwhile, in the United States, employment is positively correlated with the net migration rate whenever we do not include a trend in the regression. Those results confirm the importance of employment creation in both Mexico (Warren, 2017; Cuecuecha, 2018; Hanson & McIntosh, 2010) and the United States (Passel, Cohn, & Gonzalez-Barrera, 2012; Hanson & McIntosh, 2010) to explain variations in the Mexican net migration rate. Because the trend is needed to generate stationarity in the data, this may be evidence that changes in technology (proxied by the trend) perhaps drive employment growth in Mexico and the United States, which in turn interact with the net migration rate.<sup>4</sup> Moreover, the trend is found to be statistically significant in one of nine estimations, and the sign is always estimated to be negative. If the trend indeed proxies for technological change, this sign would imply that, on average, occupations performed by Mexicans in the United States are being eliminated by technological change.

Our model did not find statistical significance for variations in the U.S. internal wage inequality, the U.S.-Mexico real interest rate differential, the exchange rate, and deportations. Perhaps, Mexicans do not consider wage inequality in the United States because they come from a country with even higher wage inequality. Estimations not shown here because of lack of space

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<sup>4</sup> These results are available from the authors upon request.

demonstrate that wage inequality is smaller in the United States compared to Mexico. The lack of significance for the real interest rate differential may imply the fraction of Mexicans that can take decisions based on this spread is very small. The significance of the exchange rate confirms the hypothesis that migrants take into account PPP comparisons (Stark, Helmenstein, & Yegorov, 1997). The non-significance of deportations contradicts arguments regarding the importance of border regulation and the decline of Mexican migration (Passel, Cohn, & Gonzalez-Barrera, 2012; Orrenious & Zavodny, 2016). This result supports the hypothesis that migrants respond to deportation by crossing yet again (Reyes, 1997; Massey et al., 1993).

## CONCLUSIONS AND POLICY IMPLICATIONS

This paper confirms the importance of the U.S.-Mexico wage differential to explain variations in the U.S.-Mexico net migration rate. The positive partial correlation between these variables is estimated to be between .38 and .72 (see Tables 3 and 4). The behavior of PPP differentials is consistent with the decline in the U.S. net migration rate. However, a causal relation cannot be established with confidence since we also find evidence of a trend in migration. Perhaps, if this trend is due to technical change, it may explain a reduction in the net migration as well as falling wage differentials between countries. Proving causality, however, goes beyond the scope of this paper.

The role of Mexico's minimum wage was also explored to explain the decline or variations in the net migration rates of Mexicans to the United States since 2008. It finds that Mexico's minimum wage affects net migration by at least two channels. The first one is the U.S.-Mexico wage minimum wage differential, measured carefully in PPP terms, where we estimate a partial correlation between .30 and .33 (see Table 4). This suggests a large proportion of Mexican migrants to the United States have a reservation wage close to the minimum wage of their country of origin. Hence a rise in the minimum wage reduces migration. Also, this suggests coordination between both countries to change their minimum wage could affect migration flows. The new United States-Mexico-Canada Agreement (USMECA) does mention that wage-setting in some Mexican industries may be a step in this direction. Although, the ones mentioned are part of the formal sector and high above Mexico's minimum wage.

Mexico's internal wage inequality also affects migration flows, as measured by the difference between the average wage in formal jobs and the minimum wage. The estimated partial correlation stands between .68 and .88 (see Table 4). The importance of wage inequality in Mexico confirms the existence of relative deprivation in Mexico (Quinn, 2006). These results show the importance of designing social policies that can reduce labor market inequality in Mexico.

However, an important caveat is that these two effects of the minimum wage depend on past values of the net migration rate: if we include lagged migration flows, both minimum wage effects vanish. Nevertheless, this is also consistent with another minimum wage effect, one that depends on migrant social networks and leads to the observed path dependence.

We find the migrant social network effect on the net migration rate is negative, implying that Mexicans have exhausted their job and employment opportunities in the United States (Light & von Scheven, 2008). It could also imply that Mexico's current demographic stage is relative to the population growth of the United States, characterized by a convergence in growth rates and little migration (Hanson & McIntosh, 2010). This indicates that Mexico has completed its demographic transition (Massey, 2015; 2016). It is important to note that some authors did not anticipate the end of Mexican migration (Hanson & McIntosh, 2010). This implies that if Mexican minimum wages fall sharply, U.S.-Mexican migration may resume.

Our results also confirm the importance of job creation as an explanatory variable for net migration in Mexico (Cuecuecha, 2018; Hanson & McIntosh, 2010) and in the United States (Passel, Cohn, & Gonzalez-Barrera, 2012; Hanson & McIntosh, 2010). However, this importance is also found to be mediated by a time trend in the equation, which could indicate that they operate through secular changes in technology that drive employment in both countries.. The time trend itself is found to have a negative partial correlation of minus .01. On average, this implies that technological change is eliminating jobs performed by Mexicans in the United States. Also, these results demonstrate the significance of active labor market policies in Mexico, the need for bi-national coordination of job-creating policies in both countries, and the possibility that under negative employment shocks, migration may resume, as the current COVID 19 economic crisis shows (Mirrof, 2020).

These results have important implications. First, they suggest that Mexico's policy uses the minimum wage as a nominal anchor to control inflation (Aspe, 1993). It also erodes the real value of the minimum wage and increases inequality in Mexico (Bosch & Manacorda, 2010). In turn, this inequality, created as a side effect an increase in emigration of Mexican individuals to the United States, as the social programs created after 1994 to compensate for the falling minimum wage did not recover the purchasing power of individuals located at the bottom quartile of the income distribution (Velázquez Leyer, 2018). This effect is interesting considering that the real minimum wage was so low that it became non-binding for Mexico's labor market. This is probably explained by the minimum wage's repercussions due to its numeraire and 'lighthouse' effects (Maloney & Nuñez, 2004; Fairris, Popli, & Zepeda, 2008; Bouchot, 2017).

Second, the authors also suggest that efforts to increase the real value of the minimum wage in Mexico after 2010, as demonstrated by the harmonization of the different minimum wage zones in Mexico previous to 2012 (Bouchot, 2017), reduced incentives for migrants to travel to the United States. This change in migration was affected by a marginal reduction in the U.S.-Mexico's wage differential, particularly among low-skilled workers, and in Mexico's internal wage differentials.

Third, Mexico's current economic goals to increase the minimum wage (Gerhard, Guizar, Jiménez, Arana, & Gutiérrez, 2018) and increase public employment programs (STPS, 2019) may reduce both wage inequality and migration to the United States (Sovilla, 2019). The only potential problem with this prediction is the impact of the formal jobs' creation slowdown of

2019 and the destruction of formal employment during 2020 on incentivizing migration, given that the net migration of Mexico is highly sensitive to the creation of formal jobs, as shown in this paper and by recent increases in border crossings (Cucuecha, 2018; Hanson & McIntosh, 2010).

Finally, variation in the U.S. minimum wage is not explored in this paper. Our findings suggest that the interaction between shifts in the minimum wage in the United States and the migrant decisions of Mexicans already in the United States are important. Also, emerging research shows that shifts in gender and class composition influence the traditional and new destinations for Mexican migrants in the United States (Fuentes-Mayorga, 2022). Similarly, a topic that is not addressed in this paper is the extent to which increases in Mexico's minimum wage can continue to reduce wage differentials within both countries without creating other problems with job creation in Mexico. This is another area for future research.

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