

Do Remittances Boost Economic Development? Evidence from Mexican States*

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Summary

Remittances have been promoted as a development tool because they can raise incomes and reduce poverty rates in developing countries. Remittances may also promote development by providing funds that recipients can spend on education or health care or invest in entrepreneurial activities. From a macroeconomic perspective, remittances can boost aggregate demand and thereby GDP as well as spur economic growth. However, remittances may also have adverse macroeconomic impacts by increasing income inequality and reducing labor supply among recipients. We use state-level data from Mexico during 2003-2007 to examine the effect of remittances on wages and employment in the formal sector, unemployment rates, wage inequality and school enrollment rates. Two-stage least squares specifications among high-migration states suggest that remittances lead to improved labor market conditions, with higher employment and lower unemployment rates. They also indicate that remittances may shift the wage distribution to the right by reducing the fraction of workers earning the minimum wage or less.

Do Remittances Boost Economic Development? Evidence from Mexican States

The U.S. recession and housing bust that preceded it have reduced Mexico-U.S. migration flows and led to falling remittances to some of the poorest states in Mexico. Policymakers are concerned about the effects of a reduction in money transfers at a time when local economic growth is also slowing. Whereas politicians and policymakers are seemingly in agreement about the many benefits of remittances, the large literature on remittances has often reached contradictory findings.

Out-migration and the remittances that migrants send back create both costs and benefits for a country. The loss of workers and their human capital reduces potential output and changes the wage structure. If relatively skilled workers leave, the loss of human capital is greater and returns to physical capital that is complementary to such workers may fall. If relatively unskilled workers leave, wages may rise for the remaining low-skilled workers, compressing the wage distribution. The effect on income per capita depends both on the relative skill level of out-migrants and on the amount of remittances they send back. Although remittances boost the incomes of recipients, exchange rate and price effects can undo some of the positive effects on consumption, leading to little real aggregate impact. Remittances can slow economic development by exacerbating income inequality and reducing labor supply among recipient families. Alternatively, remittances can boost economic development by increasing incomes, consumption and investment. This study examines the effect of remittances on economic development as measured by employment, unemployment, wages and school enrollment in Mexican states during the period 2003-2007.

The impact of remittances on economic development is a hotly-debated topic. Researchers agree that long-run impacts are likely to be bigger if remittances are invested in improvements in the agricultural sector, in entrepreneurial activities or in education rather than spent on consumption or housing but disagree on the extent to which remittances finance investment rather than consumption. Studies give widely disparate estimates of the base multiplier on remittances, with some suggesting small aggregate impacts on income (e.g., El-Sakka and McNabb 1999), others finding large positive effects (e.g., Adelman and Taylor 1992; Taylor et al. 1996) and some even finding negative effects (e.g., Chami, Fullenkamp and Jahjah 2005). Changes in prices and exchange rates—the so-called “Dutch disease”—may have offset the positive impact of remittances on consumption and output in some Latin American nations (Acosta, Lartey and Mandelman 2007; López, Molina and Bussolo 2007).

The impact of remittances on income inequality is also uncertain. Some research suggests that the relationship between remittances (and migration) and inequality is an inverse-U shape, with inequality first increasing as migration and remittances rise from relatively low levels (Koechlin and León 2007; McKenzie and Rapoport 2007). Inequality eventually falls as higher levels of migration expand networks and drive down migration costs and as remittances rise, allowing lower-income families to migrate and share in the benefits. Other studies conclude that the net effect of migration and remittances is to exacerbate income inequality (e.g., Barham and Boucher 1998; Mora-Rivera 2005) while some find evidence that remittances have no effect or reduce inequality (e.g., Acosta et al. 2006, 2007; Ahlburg 1996).¹

¹ Mora-Rivera (2005) finds opposite distributional effects of international versus domestic remittances. Looking at a nationally representative sample of rural households in Mexico, he finds that international remittances increase the Gini coefficient while domestic remittances have the opposite effect. He attributes the different effects to the selection of movers in his sample, with domestic migrants more likely to come from the lower half of the income distribution and international migrants come from the middle or upper half of the distribution.

Previous research has also investigated whether remittances reduce poverty and act as countercyclical insurance. Most research concludes that remittances do reduce poverty rates, albeit perhaps modestly in some countries (Adams and Page 2005; Acosta et al. 2007). For the Mexican case, one study indicates that remittances reduce the likelihood of being in poverty by 10 to 14 percent (Esquivel and Huerta-Pineda 2007). Some research finds that remittances are countercyclical and act as insurance against disasters or economic downturns, allowing households to better smooth their consumption (Ratha 2003; Spatafora 2005). A study of 12 developing countries, however, concluded that countercyclical remittances only occurred in one country, India (Sayan 2006).

In addition to studies of the macroeconomic impact of remittances, a large literature examines the determinants and effects of remittances at the individual or household level. (For recent surveys, see Rapoport and Docquier 2006; Adams 2007.) Remittances tend to increase with migrants' earnings, education, family ties and probability of return and decrease with migrants' length of stay in the host country. Remittances offer many benefits to recipients, including extra funds to spend on consumption goods and services or to invest in education, health care or housing. Remittances also appear to finance entrepreneurial activity, suggesting that households with migrants are credit constrained. Another potential effect of remittances is for recipients to increase their leisure time and reduce their labor supply (Acosta 2006; Hanson 2007a, 2007b; Rodríguez and Tiongson 2001), dampening the positive impact of remittances on income and consumption.

The impact of remittances on education may be particularly important for economic development in the long run. Household-level data from Mexico indicate that remittances are associated with more education for children, particularly girls, with low-education mothers and

in rural areas (Borraz 2005; Hanson and Woodruff 2003). However, one study reports mixed evidence of a positive effect of remittances on school attendance in Mexico (López-Córdova 2005), and another does not uniformly find a positive effect of remittances on children's educational attainment across Latin American countries (Acosta, Fajnzylber and López 2007). In El Salvador, remittances increase the likelihood that children remain in school, particularly in rural areas and for girls and young boys (Acosta 2006; Edwards and Ureta 2003). Evidence for the Philippines also suggests that higher remittances increase child schooling (Yang 2008).

Research has also shown that remittances can help create financial markets. In Mexico, the remittance process has sown the seed of financial intermediation in small communities that might otherwise have little access to banking and other formal financial services (Demirgüç-Kunt et al. 2007). Development or deepening of financial markets thus provides another channel by which remittances can spur economic development (Giuliano and Ruiz-Arranz 2006).

The effect of remittances on economic development at both the aggregate and the household level in Mexico is of particular interest because the country has experienced a staggering outflow of workers and large remittance inflows. About 8 million people—over 15 percent of the Mexican-born labor force—have migrated to the United States in recent years. There is considerable controversy about the relative skill level of these emigrants, with some studies contending that out-migrants are drawn from the bottom of the skill distribution (e.g., Ibarra and Lubotsky 2007) and others suggesting that they are from the top half or middle of the skill distribution (e.g., Chiquiar and Hanson 2005; Orrenius and Zavodny 2005). Having grown at double-digit rates for many years, remittances to Mexico reached an all-time high of almost \$24 billion in 2007, occupying third place as a foreign exchange generator for Mexico after oil and maquiladora exports.

The traditional migrant-sending regions of Mexico benefit disproportionately from these transfers, as shown in Figure 1. The poorer central-western states attract most of the remittance flows, with Michoacán at the top with almost \$2.4 billion in 2006 (or 15 percent of gross state product, or GSP), followed by Guanajuato with \$2.1 billion (8 percent of GSP), Estado de México with \$2.0 billion (2.7 percent of GSP) and Jalisco with \$2.0 billion (4.2 percent of GSP). In richer regions, such as Distrito Federal or the northern Mexican states of Baja California, Sonora, Chihuahua, Nuevo León, Coahuila and Tamaulipas, remittances are less than 2 percent of GSP and play a much smaller role in the state economy.

This study examines the effect of remittance inflows on several indicators of economic development at the state level in Mexico and makes several important contributions. First, remittances may be better measured at more aggregate levels than at the household level, which means state-level data reduces concerns about measurement error. As discussed in the theoretical framework section below, using state-level data also reduces concerns about unobserved heterogeneity and selection bias. Still, to address any remaining endogeneity, we instrument for remittances using migrant-weighted U.S. wages and for migration using historic labor supply shocks in Mexican states. The two-stage least squares results suggest that remittances boost formal-sector employment and lower the unemployment rate in high-migration states. They also suggest that remittances shift the wage distribution to the right, shrinking the share of lowest-wage workers, but do not boost school enrollment rates.

Theoretical Framework

Remittances, which are income transfers, are likely to affect wages and employment both at the household level and in the aggregate. If leisure is a normal good, remittances should reduce

labor supply among recipient households by creating a pure income effect. Although this reduction in labor supply partially offsets the positive income impact of remittances, the increase in income should cause the aggregate demand curve to shift out, resulting in greater production of goods and services overall. The increase in aggregate demand and the reduction in labor supply from recipient families should both boost wages, which will lure some members of non-recipient families into the labor market. However, if the skill levels and hence the wages of recipient and non-recipients are very different, compositional effects could mask the wage effect by causing the average wage to fall even though workers earn higher wages. In contrast, the net effect of higher remittances on employment and unemployment rates is ambiguous—it depends on the relative magnitude of the changes in labor supply among recipient and non-recipient households and in labor demand.

Remittances are also likely to have distributional effects. The income distribution changes if there is selection in which households receive remittances or if remittances alter the wage distribution. Suppose, for example, that remittances are primarily received by households in the middle of the income distribution. Concomitant reductions in labor supply from these households should first and foremost raise wages for similar workers; *relative* wages at the bottom and top ends of the skill distribution could rise or fall, depending on the degree of substitutability of workers of different skill levels. If remittances help recipients invest in businesses, as might be the case in the presence of credit constraints, there might be further distributional effects vis-à-vis wages. In addition, in a flexible exchange rate regime, remittances drive up the exchange rate and reallocate activity away from the tradable sector into non-tradables as home country exports become less competitive. Workers in the non-tradable sector

thus may benefit at the expense of workers in the tradable sector. In sum, the net impact of remittances on the income and wage distributions is theoretically ambiguous.

All of these simple predictions—or lack thereof—ignore any direct effects of the out-migration that is a necessary precondition for remittances. Out-migration should boost wages and reduce employment rates as workers move abroad. Indeed, research finds a significant positive correlation between Mexican wages and out-migration (Hanson 2007a; Mishra 2007). In addition, the distribution of wages may change, depending again on whether emigrants are drawn from a particular segment of the skill or wage distribution and on the degree of substitutability of workers of different skill levels. Some research suggests that relative wages for low-skilled workers have fallen in Mexico as a result of out-migration (Aydemir and Borjas 2007). Unemployment rates may rise or fall, depending on whether out-migrants were unemployed, while employment rates almost surely rise since the population is falling.

If households face binding credit constraints, remittances may boost investment in both human and physical capital. Evidence for Mexico suggests that remittances may relax credit constraints for the very poor and can lead to more child schooling (Borraz 2005; Hanson and Woodruff 2003). However, migration may confound the positive effect of remittances on education (McKenzie and Rapoport 2006). Children who anticipate migrating to the U.S. in the future have less incentive to accumulate education given that the return to education is lower in the U.S. than in Mexico. Because children who live in households with a migrant are more likely to migrate themselves, it is important to calculate the effect of remittances on children's educational attainment independent of the effect of migration.

From an empirical standpoint, it is often difficult to separate the effects of remittances and migration at the household level since remittances are conditional on migration and the two

are likely jointly determined. One obvious empirical strategy is to estimate the effect of remittances only among a sample of households with a member who has migrated. This creates the disadvantage of being unable to generalize to all households, not just those with migrants. At the aggregate level, one strategy is to jointly model the effects of migrant outflows and remittance inflows, which requires identifying variables that affect only migration or remittances (or relying on non-linearity to identify the two-equation system). Another strategy is to simply control for migrant outflows when estimating the impact of remittances. We adopt this last strategy. An advantage of the state-level panel data we use is that we can control for migrant outflows using government estimates of migrant flows as well as state and time fixed effects.

Advantages of State-Level Analysis

Remittances have been linked to a host of beneficial outcomes, such as lower poverty, greater investment in education and health and increased entrepreneurial activity. Most of these linkages have been made by comparing recipient to non-recipient households in household-level data, although some studies also compare countries. This study takes a different approach by examining the effect of remittances over time at the state level.

The advantage of state-level analysis is first and foremost that all formal transfers are captured by the data.² Household surveys in Mexico typically capture only about one-third the official volume of international remittances.³ The volume and growth rate of official remittances to Mexico are much higher than those implied by household survey data from senders and

² Note that we examine only remittances sent from abroad, not repatriated funds brought back by returning migrants or domestic remittances from rural-urban migration.

³ Esquivel and Huerta-Pineda (2007) discuss recipient-based measures from a large nationally representative household survey in Mexico called ENIGH (Encuesta Nacional de Ingreso y Gasto de Hogares) and suggest that in 2002 there were 1.4 million recipient households who received \$2,560 on average. Based on the household survey responses of recipients, remittances to Mexico totaled \$3.6 billion in 2002, only 37 percent of official estimates for that year.

receivers and by other measures, such as U.S.-Mexico remittance estimates supplied by the U.S. Department of Commerce. Also, as discussed above, the remittance impact is not limited to recipients. When remittances are large, as is the case in some Mexican states, non-recipients are affected by ensuing changes in labor and capital markets. Aggregate analysis captures these indirect effects.

An additional advantage of aggregate analysis is that concerns about endogeneity bias are smaller than in household-level studies because the remittance impact is measured across all households, not just recipient families. At the household level, both remittances and migration are likely to be endogenous with respect to outcomes of interest. Migration and remittances are often a response to household needs and priorities, so the causality runs both ways. For example, do remittances improve schooling outcomes, or are families who want to invest in schooling more likely to send a member abroad who will remit funds? McKenzie and Sasin 2007 note the “pervasive endogeneity” in such household-level decisions and urge using differences or instrumental variables techniques to control for bias arising from reverse causality, selection and omitted variables.

Moreover, at the household level at a single point in time, the confounding effects of migration make the remittance impact hard to study. Children may leave school to fill in for a father when he migrates. The remittances he eventually sends back may allow the children to return to school. On net, then, there might be no change in children’s educational attainment. Time-varying data of the kind we use here can better disaggregate the remittance and migration effects than most household surveys, which tend to be cross-sectional.

In addition to the literature using household-level data to measure the impact of remittances, studies have also used cross-country data to examine the effect of remittances on

economic variables like GDP, income inequality and poverty. Such studies typically pool cross-sectional or time-series data on a number of countries either around the world or in a certain geographic area, such as Latin America (e.g., Acosta et al. 2006, 2007). Using time-series data allows such studies to include country fixed effects in order to control for time-invariant, unobservable differences across countries. We implicitly take a similar approach by comparing states within a single country but argue that states are more economically, culturally and geographically similar than different countries. Examining states within a single country gives the advantages of time-series, cross-national studies while removing potential problems arising from country-specific changes over time that are difficult to model empirically, such as changes in political regime or in enforcement of property rights.

Using aggregate data may lessen concerns about unobservable heterogeneity between recipient and non-recipient (or migrant and non-migrant) households but does not completely mitigate all endogeneity or selection problems. As in the household case, reverse causality may be a problem since both migration and remittances are likely to depend on macroeconomic conditions. Our use of state fixed effects reduces such concerns about endogeneity bias. In addition, we implement a two-stage least squares (2SLS) specification where we instrument for remittances using migrant-weighted measures of U.S. wages from the Current Population Survey (CPS) and Covered Employment and Wages (CEW) data. Previous research has used U.S. earnings measures to instrument for remittances (see, for example, Amuedo-Dorantes, Georges and Pozo 2008). We instrument for migration using Mexican labor supply shocks in the form of state-level demographic data on the size of male birth cohorts in the mid-1970s.

Data and Methodology

We use the state breakdown of Mexican remittances provided quarterly by the Banco de México since 2003. In 2000, Banco de México launched a major overhaul of the collection and recording of remittance data. Efforts initially focused on better recordkeeping within the central bank and then on better collection from sources outside the bank (Cervantes 2007). To this end, in October 2002, Banco de México issued rules under which all banks and money transfer companies had to register with the central bank and report monthly remittances by Mexican state of destination. Before 2003, state remittances were not available and aggregate monthly remittance levels were inferred from reporting based on a 1990 census of financial institutions, money exchange houses and wire transfer companies. The reporting requirement led to much improved data collection and a clear break with past trends in remittance numbers. Figure 2 shows remittances to Mexico (in real U.S. dollars, deflated using the CPI-W) on a quarterly basis during the period 2000-2007. After the reporting requirement begins in 2003, the data show more rapid growth and greater seasonality. Of course, despite the improved statistics, official remittance flows are still an undercount since unrecorded remittances continue to occur through informal channels.

We merge quarterly state-level remittances with quarterly state-level data on formal-sector *Instituto Mexicano del Seguro Social* (IMSS) employment and median wages per day (in real pesos, deflated using regional Mexican CPI). Although formal-sector employment is highly correlated with overall employment, it would be preferable to have a direct measure of all employment and wages, since research suggests that remittances have a large impact on the informal sector (Brambila 2008). Data on the much-larger informal labor market, however, are not readily available in quarterly frequency at the state level. The unemployment rate is an

exception. It was made available in 2008 as quarterly state data and captures overall unemployment in urban areas, with workers in the informal sector counted as employed.⁴ We also include quarterly values of real state foreign direct investment (FDI) and estimates of net international migration flows at the state level. In addition, we include a quarterly measure of the labor force—formal plus informal—as a control variable.

While our analysis of wages, employment and unemployment is conducted at the quarterly level, we only have annual data on school enrollment and the wage distribution. For that portion of the analysis, we merge annual remittances with enrollment rates in primary, secondary, tertiary and vocational (‘technical’) schools in the state and with the fractions of workers earning less than or equal to the national minimum wage, 1-2 times the minimum wage, 2-3 times the minimum wage, 3-5 times the minimum wage and more than 5 times the minimum wage. These last variables should capture effects of remittances on the wage distribution. Descriptive statistics are shown in Table 1, and data details and sources are listed in Appendix Table 1. All quarterly variables are seasonally adjusted with the exception of remittances; the state remittance series is currently too short (only 20 observations per state) to run a seasonal adjustment. As discussed below, we include time fixed effects in the regressions, and this should help control for any remaining seasonality.

Methods

We take a simple approach to examining the effect of remittances on measures of economic development within Mexican states. We regress the quarterly or annual state-level measure of economic development on real remittances received in that state. We also control for FDI, net

⁴ Mexican unemployment measures are based on data from the *Encuesta Nacional de Ocupación e Empleo* (ENOE).

international migration flows and the size of the labor force.⁵ We take the natural log of the dependent variable in the employment and wage regressions, while other outcomes (unemployment rate, wage distribution, enrollment rates) are fractions expressed as percents (multiplied by 100). Specifications include state fixed effects and, in some cases, time fixed effects:

$$Econ\ Dev_{st} = \alpha + \beta Remittances_{st} + \gamma FDI_{st} + \delta Mig_{st} + \varphi LF_{st} + \sigma_s + \tau_t + \varepsilon_{st} \quad (1)$$

where s indexes states and t indexes time (which is either annual or quarterly, depending on the dependent variable). We estimate Huber-White standard errors clustered on the state.

This simple specification has several advantages. In the fixed effects models, the state effects control for unobservable differences that are fixed over time, such as distance from the U.S. border, while the time fixed effects control for changes that are common to states, such as changes in the U.S. or Mexican economy.⁶ Ideally we would also control for time-varying, state-level measures of economic conditions that affect the outcomes of interest but are not endogenous or affected by remittances, but aside from FDI, net migration flows and labor force estimates, we cannot think of any such variables for which data are readily available. Because there are likely to be larger effects of remittances in high-migration states, we limit the sample to high-migration states in some specifications.⁷ As discussed earlier, any general equilibrium effects of remittances are more likely to appear in this sample.

Endogeneity bias is a concern because remittances increase in response to economic hardship. We address the dual causality by using U.S. wages as instrumental variables for

⁵ Migration flows are available annually only. For quarterly regressions, we divided migration flows by four.

⁶ We also tried specifications controlling for state-specific time trends in addition to state and time fixed effects but the trends wiped out all the results. The time series is presumably too short (only 5 years) and does not have the necessary power to estimate trends in addition to the other coefficients, particularly with regard to the annual data. Including state trends produces little change in goodness of fit of the regressions as measured by adjusted R^2 , which is already .99 when the state and time fixed effects are included.

⁷ The high-migration sample drops the following states: Baja California Norte, Baja California Sur, Campeche, Coahuila, Chihuahua, Nuevo León, Querétaro, Sonora, Tabasco, Tamaulipas and Yucatán.

remittances. The instrument has to be correlated with remittances but not with other Mexican economic development indicators and it should vary by Mexican state and over time. To map U.S. wages to Mexican states, we use the location choices of Mexican migrants who are in the Mexican Migration Project (MMP), a long-running survey of Mexican households that collects retrospective data on individuals' migration spells.⁸ We construct time-invariant weights based on the recent migration histories of MMP household members⁹ and multiply these weights by a measure of the wage from either the CPS or CEW. Hence, the U.S. wage for Mexican state i at time t is simply the share of workers from i who are in U.S. state j multiplied by a measure of wages in U.S. state j at time t summed over all U.S. states and the District of Columbia:

$$Wage_{it} = \sum_{j=1}^{51} ShareMigs_{ij} \times Wage_{jt} \quad (2)$$

The CPS wage is the median real weekly wage of all workers aged 18-49 in the merged outgoing rotation group files. Weekly wages under \$100 were dropped before taking the median. The CEW wage is the average real weekly wage for all workers in private-sector industries covered by unemployment insurance. Appendix Table 2 reports first stage regressions and joint F-tests. As indicated by the t-tests, both measures of U.S. wages are generally statistically significant in the first stage regression of remittances on the instruments and other exogenous variables. However, U.S. wages have greater power in the annual regressions than in the quarterly, as suggested by the F-tests.

Endogeneity bias is also a concern with regard to migration. Massive out-migration may have impacted all social and economic indicators under consideration here. In addition, as

⁸ Amuedo-Dorantes and Pozo (2009) use the same methodology to construct an instrument for household-level remittances in Mexico. We tried using wages reported in MMP as an instrument but there are too few observations in 2003-2007 to construct a state-specific earnings measure. See the MMP website <http://mmp.opr.princeton.edu/> for more detailed information on these data.

⁹ We base the location information on the first and last trips of all adult migrant workers who migrated to the U.S. in 1980 or later. For the 12 Mexican states that are not in MMP, we assigned the location distributions of the neighboring state deemed closest with regard to geographic proximity and most similar with regard to demographic profile. Details are available on request.

discussed above, migration effects confound the impacts of remittances. We use the relative sizes of male birth cohorts by state in Mexico from 1973-1977 to instrument for net state-level migration in 2003-2007. Relative birth cohorts are the number of males ages 0-1 in a state and year divided by the total number of males ages 0-1 in the country as a whole in that year. Previous work has found a high correlation between Mexican state birth cohorts and emigration to the U.S. several decades later (Hanson and McIntosh 2007). Appendix Table 2 underscores that the relative size of the birth cohort is a powerful explanatory variable in the migration equation. The coefficients on the relative size of the male birth cohort are all large and statistically significant.

Results

We find evidence that remittance flows affect economic development along a number of dimensions. Table 2 shows employment, wage and unemployment effects of remittances for the OLS and 2SLS regressions on the full sample of Mexican states in columns 1 and 2. The analysis for employment, wages and unemployment is repeated on a smaller sample of states in Table 2 columns 3 and 4. This subsample of high-migration, high-remittance states excludes states in the north and southeast of Mexico, regions where there is either little overall migration (in the wealthy states of the north) or substantial domestic migration (in the southeast, where workers migrate to the tourist areas on the Yucatán peninsula). Columns 1 and 3 control for state fixed effects while columns 2 and 4 add time fixed effects.

Before time fixed effects are added, the OLS regressions suggest remittances significantly drive up formal-sector employment and wages. While the effect on unemployment rates is consistently negative, it is far from statistically significant. Adding time effects causes

the remittances coefficient to switch signs and become statistically insignificant in both the employment and wage regressions for the high-migration sample (column 4). Presumably, good macroeconomic conditions were the omitted variable driving up employment and remittances. The negative correlation between remittances and employment that is observed in columns 2 and 4 in both the full and high-migration samples can likely be attributed to the endogenous nature of remittances and migration vis-à-vis employment growth. Low-growth years are associated with higher out-migration and more remittances. This is one of the reasons we turn to instrumental variables regressions.

Once we instrument for remittances, as shown in the second panel of Table 2, the employment and wage effects turn positive again although they are not statistically significant in the full sample with state and time fixed effects (column 2). Focusing on column 4 in the second panel, we see large positive employment and negative unemployment effects of remittances. The wage effect is positive, but the p-value is just outside the range of conventional significance levels. The theoretical framework predicts a positive wage effect, but the employment effect of remittances is theoretically ambiguous. Since the regressions control for the size of the labor force, the employment effect can be interpreted as either an increase in the relative share of formal-sector employment (since this measure only captures the formal sector) or as an increase in employment (a decline in unemployment). However, since remittances drive down unemployment as well as push up employment, we believe the latter interpretation drives the results.

The magnitudes of the coefficients suggest that an additional \$100 million in remittances in a quarter will increase formal-sector employment by 15 percent and reduce the unemployment rate by 2.78 percentage points. These are large effects. Taken at face value, the employment

regression coefficient implies a job is created for every additional \$1613 in remittances. Other recent work has suggested that one job is created in Mexico for every additional \$4431 in remittances (Zárate-Hoyos 2007). Assuming our formal-sector measure of employment is highly correlated with informal employment, our effects are likely larger because they are based on the subsample of high-migration states. Remittance effects are larger in poorer states because wages are lower and the informal sector is larger. This may partly be the reason why the regressions with the full sample of states do not identify a significant effect of remittances on labor markets. Research has shown that remittances stimulate production primarily in the agricultural, livestock, food processing and construction sectors, which tend to have relatively large informal labor markets (Zárate-Hoyos 2007).

Table 3 reports remittance effects on the wage distribution. The layout of the results is the same as in Table 2. The OLS results are in line with the effects in Table 2: remittances appear to shift the wage distribution to the right, with declines in the share of workers who are earning less than one and (perhaps) two times the minimum wage per day and significant increases in the share of workers earning more than two but less than five minimum wages per day. Remittances are generally not related to the share of workers who are top earners (more than five times the minimum wage), at least not in the presence of time fixed effects. These workers are the most likely to be formal-sector workers and the least likely to become international migrants or receive remittances.

The distributional effects of remittances are enhanced in the 2SLS specifications. As can be seen in the lower panel of Table 3, the coefficient on remittances have the same signs as in the OLS specifications but are larger in magnitude. Focusing on column 2, remittances appear to shrink the fraction of workers earning at most the minimum wage by close to two percentage

points and boost the share who earn three to five times the minimum wage by 0.84 percentage points. In the sample of high-migration states, remittances have an even larger depressing effect on the share of lowest-wage workers (−2.42 points) and are associated with a statistically significant increase of 1.25 percentage points in the share of workers who are in the middle of the wage distribution (those earning two to three times the minimum wage). The disparate OLS and 2SLS results suggest that remittances are correlated with poverty and bad times. Controlling for the endogenous timing of remittances, it should be the case that remittances raise capital and increase the marginal product of labor, pushing up wages. Moreover, since remittances primarily benefit poor households and the non-tradable sectors, such as food production and construction, it makes sense that low-wage workers benefit disproportionately.

Middle or positive selection of Mexican migrants may also help explain some of the distributional consequences of remittances with regard to wages. Workers who are most similar to the out-migrants are more likely to receive remittances and to benefit from the reduced ranks in the labor market. Thus the large increase in the share of the workers earning wages of two to three times the minimum wage in high-migration states in the 2SLS specification.

Table 4 shows the results from the school enrollment rate regressions for the full sample and the high-migration subsample. In keeping with much of the household-level evidence on remittances and schooling, we find that, without time controls, remittances appear to increase enrollment rates at almost all levels of schooling. Remittances appear to be positively and significantly correlated with higher primary, secondary and university enrollment rates in both the full sample of states and the high-migration subsample. However, once we introduce time fixed effects, the remittance coefficients become statistically insignificant. This suggests that remittances are increasing in the years during which enrollment rates are also rising. The

positive relationship is simply two concurrent trends, remittance growth (as in Figure 1) and the well-documented rise in schooling in Mexico. Our state-level regressions are not able to capture a causal relationship between remittances and schooling. Given the complexity underlying enrollment rates, including demographic composition, more detailed data are likely needed to identify the true effect of remittances on schooling.

Conclusion

A look at remittances in Mexican states suggests that they have a range of positive effects on economic development. Higher remittances are correlated with better outcomes in labor markets, although these effects are difficult to discern in states where migration is less common. In high-migration states, we find evidence that wages and employment rise with remittances while unemployment rates fall. Remittances raise wages on average, primarily by shifting the lowest-wage workers higher up the wage distribution. Two-stage least squares specifications enhance these distributional effects, suggesting endogeneity is suppressing the wage effects of remittances, perhaps because remittances respond to hardship and poor economic conditions in the home country. With regard to school enrollment, we found no effects of remittances on school enrollment rates once we controlled for time fixed effects. The beneficial schooling effects found in previous research are not apparent in data at this level of aggregation. Our failure to find enrollment effects could be due to using state- instead of household-level data or could result from our controlling for the endogeneity of remittances and migration. Our findings suggest the need for further research on the effect of remittances on enrollment. This issue is particularly important given the increases in educational attainment are likely the best source of long-term economic growth for developing countries like Mexico.

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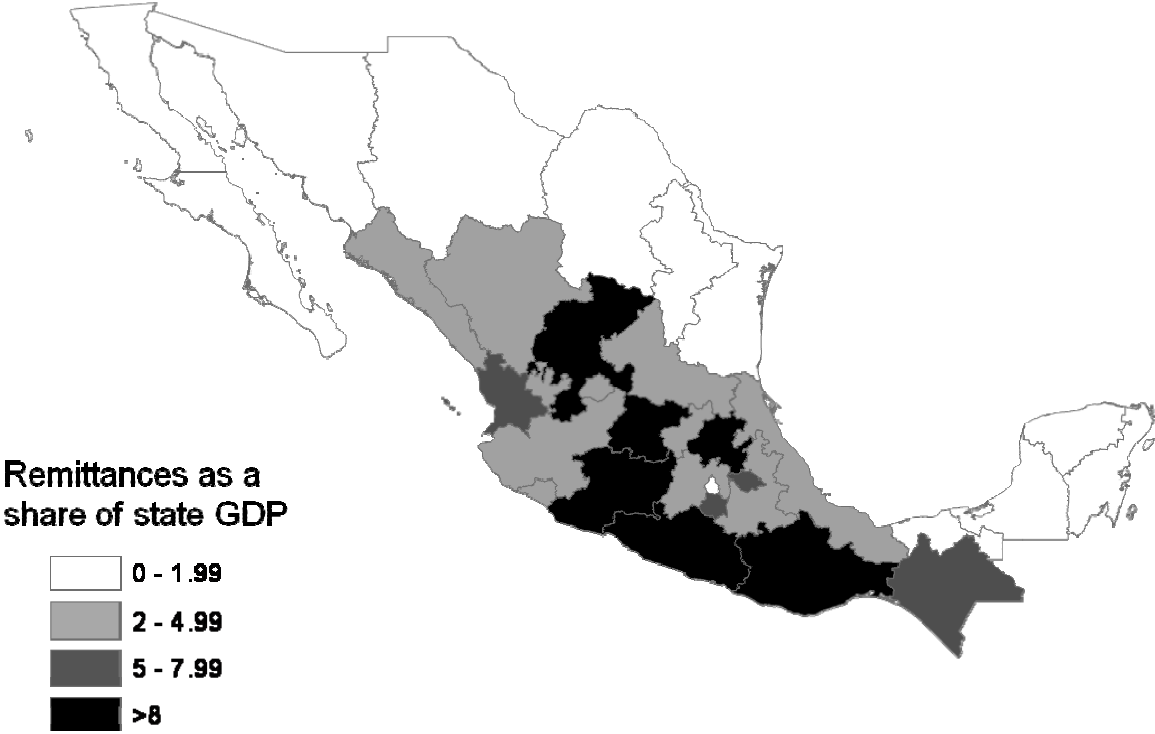
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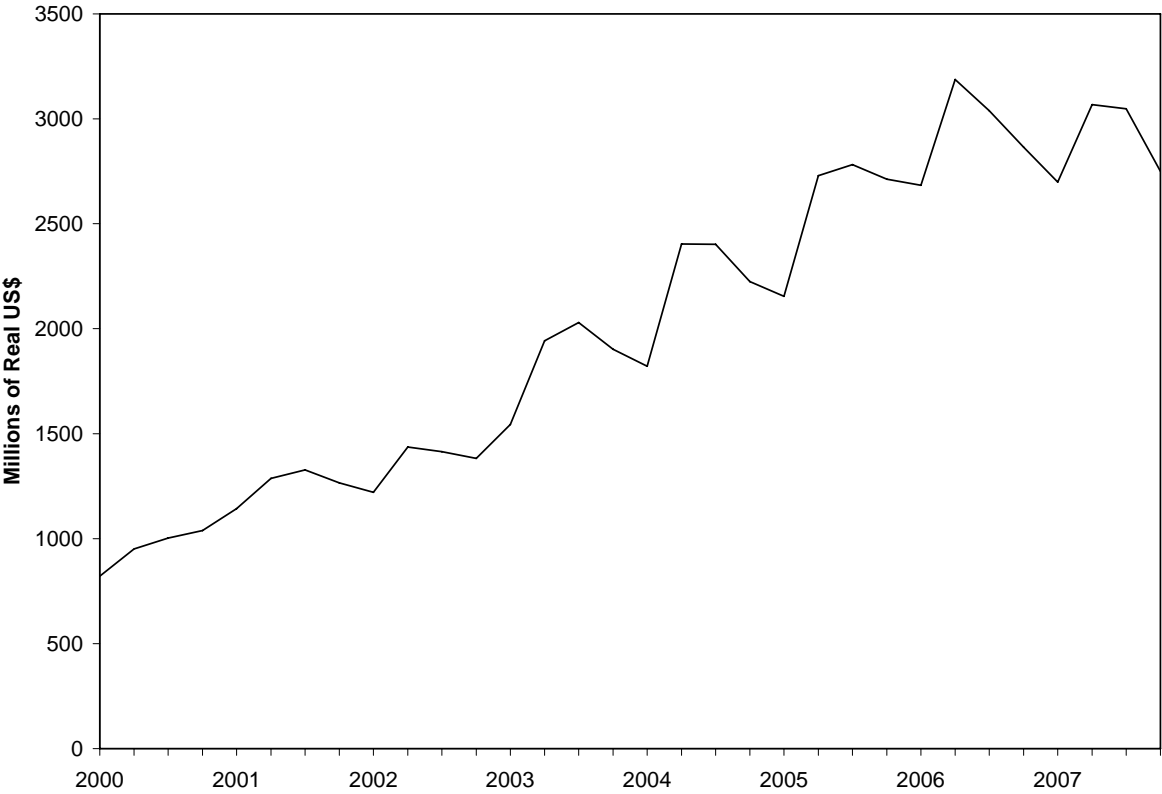
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Figure 1: Remittances as a Share of State GDP in Mexico



Source: Banco de Mexico; INEGI. 2006 remittances are divided by 2006 state GDP.

Figure 2: Remittances to Mexico, 2000-2007



Source: Banxico. Remittances are deflated using the U.S. CPI-W (1982-84=100).

Table 1: Descriptive Statistics

	Mean	S.D.	High	Low
Remittances (millions of real U.S. \$)	164.70	156.70	694.96	4.08
Employment, formal sector (in 000s)	413.71	447.34	2587.93	69.52
Wage, median formal sector (real pesos per day)	183.45	29.25	286.79	126.66
Unemployment rate	3.27	1.31	7.20	.40
Labor force, formal and informal (in 000s)	1338.47	1168.83	6153.27	208.42
Net international migration flow (in 000s)	-17.77	19.81	24.61	-68.92
FDI (millions of real U.S. \$)	165.18	573.19	8278.44	-293.13
Percent of all workers earning minimum wage or less	17.14	9.73	49.51	1.75
Percent of all workers earning 1-2 times minimum wage	25.54	5.33	35.70	9.71
Percent of all workers earning 2-3 times minimum wage	23.84	5.03	33.83	9.32
Percent of all workers earning 3-5 times minimum wage	2.61	5.26	35.87	8.67
Percent of all workers earning above 5 times minimum wage	12.87	5.22	29.93	4.31
Enrollment rate (primary school)	94.9	3.66	106.20	88.73
Enrollment rate (secondary school)	59.3	8.80	94.51	4.23
Enrollment rate (university)	3.9	.90	6.76	2.14
Enrollment rate (technical school)	2.0	.94	5.71	.70
U.S. weekly wage, CEW	885.50	77.33	1328.3	675.63
U.S. median weekly wage, CPS	617.32	24.28	679.80	556.82
Percent of males aged 0-1	3.13	2.70	12.7	.31

Note: Shown are descriptive statistics for quarterly state-level remittances, employment, unemployment rate, labor force, daily wages, FDI and weekly U.S. wages and annual wage distribution, school enrollment rates, international migration flows (inflows – outflows) and share of infant male population. Data details and sources are described in Appendix Table 1. Quarterly and annual data span 2003-2007 except for the birth cohorts, which are from 1973-1977.

Table 2: Employment and Wage Effects of Remittances

	All States		High-Migration States	
	(1)	(2)	(3)	(4)
<u>OLS</u>				
Ln(Employment)	.04** (.02)	-.03* (.02)	.05** (.01)	-.01 (.01)
Ln(Wages)	.03** (.01)	-.01 (.01)	.03** (.01)	-.00 (.01)
Unemployment rate	-.15 (.16)	-.13 (.18)	-.09 (.15)	-.21 (.21)
<u>2SLS</u>				
Ln(Employment)	.09** (.04)	.35 (.28)	.06** (.02)	.15* (.08)
Ln(Wages)	.04** (.02)	.12 (.11)	.03** (.01)	.06 (.04)
Unemployment Rate	-.91* (.55)	-2.95 (2.91)	-.98* (.58)	-2.78** (1.30)
State fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	No	Yes	No	Yes

Note: Each coefficient is from a separate regression of the quarterly state-level unemployment rate or natural log of employment or wages on remittances, FDI, net international migration and labor force. Regressions include time and state fixed effects as indicated. The second panel shows 2SLS regressions where U.S. wages are IVs for remittances and birth cohorts are the IV for net international migration. Robust standard errors are clustered on the state. Columns 3 and 4 refer to the restricted sample of high-migration states. Significance levels are denoted * $p < .1$ and ** $p < .05$.

Table 3: Wage Distribution Effects of Remittances

	All States		High-Migration States	
	(1)	(2)	(3)	(4)
<u>OLS</u>				
Share earning ≤ 1 times MW	-.99** (.47)	-.95** (.43)	-1.08* (.57)	-1.34** (.75)
Share earning 1-2 times MW	-.28 (.20)	.32 (.30)	-.39** (.18)	.23 (.28)
Share earning 2-3 times MW	.26 (.28)	.54* (.32)	.16 (.29)	.79** (.34)
Share earning 3-5 times MW	.84** (.19)	.44** (.20)	.98** (.21)	.39 (.26)
Share earning > 5 times MW	.16 (.16)	-.34 (.25)	.33** (.15)	-.07 (.20)
<u>2SLS</u>				
Share earning ≤ 1 times MW	-2.50** (.73)	-1.94** (.87)	-1.83** (.60)	-2.42** (1.15)
Share earning 1-2 times MW	-1.78* (.94)	.57 (.68)	-.79 (.55)	.71 (.71)
Share earning 2-3 times MW	.24 (.47)	.70 (.85)	-.18 (.49)	1.25* (.69)
Share earning 3-5 times MW	2.49** (.74)	.84** (.38)	2.06** (.57)	.70 (.58)
Share earning > 5 times MW	1.55** (.72)	-.18 (.43)	.75** (.30)	-.24 (.51)
State fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	No	Yes	No	Yes

Note: Each coefficient is from a separate regression of the annual share of workers earning the stated multiple of the federal minimum wage on remittances, FDI, net international migration and labor force. Regressions include time and state fixed effects as indicated. The second panel shows 2SLS regressions where U.S. wages are IVs for remittances and birth cohorts are the IV for net international migration. Robust standard errors are clustered on the state. Columns 3 and 4 refer to the restricted sample of high-migration states. Significance levels are denoted * $p < .1$ and ** $p < .05$.

Table 4: School Enrollment Effects of Remittances

	All States		High-Migration States	
	(1)	(2)	(3)	(4)
<u>OLS</u>				
Enrollment rate, primary	.16 (.20)	.00 (.26)	.35* (.17)	.14 (.25)
Enrollment rate, secondary	.43* (.22)	.00 (.21)	.45* (.25)	-.20 (.27)
Enrollment rate, university	.04** (.02)	-.02 (.02)	.05** (.02)	-.01 (.02)
Enrollment rate, technical	.02 (.04)	-.02 (.04)	.02 (.04)	-.06 (.06)
<u>2SLS</u>				
Enrollment rate, primary	1.09** (.49)	-.17 (.36)	.92** (.33)	.08 (.28)
Enrollment rate, secondary	1.45** (.52)	.51 (.51)	1.22** (.44)	.30 (.61)
Enrollment rate, university	.17** (.07)	-.03 (.06)	.11** (.05)	-.03 (.08)
Enrollment rate, technical	.11 (.09)	-.11 (.08)	.10 (.08)	-.11 (.10)
State fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	No	Yes	No	Yes

Note: Each coefficient is from a separate regression of annual state enrollment rate on remittances, FDI, net international migration and labor force. Regressions include time and state fixed effects as indicated. The second panel shows 2SLS regressions where U.S. wages are IVs for remittances and birth cohorts are the IV for net international migration. Columns 3 and 4 refer to the restricted sample of high-migration states. Robust standard errors are clustered on the state. Significance levels are denoted * $p < .1$ and ** $p < .05$.

Appendix Table 1: Data Description and Sources

Variable	Description	Frequency	Source
Remittances	Hundreds of millions of 2007 dollars, deflated by U.S. CPI-W	Quarterly	Banco de México www.banxico.org.mx
Employment	Thousands of IMSS jobs, SA; quarterly number is a monthly average	Quarterly	Secretaría de Trabajo y Previsión Social www.stps.gob.mx
Labor force	Thousands of people (ENEO)	Quarterly	INEGI, www.inegi.gob.mx
Unemployment rate	Open unemployment rate (ENEO)	Quarterly	INEGI www.inegi.gob.mx
Foreign direct investment	Millions of 2007 dollars, SA, deflated by U.S. CPI-U (SIRNIE)	Quarterly	Secretaría de Economía, www.economia.gob.mx
Wage, median daily	Wage per day in 2007 Q4 pesos, deflated by state CPI and SA; number is monthly average (IMSS)	Quarterly	Secretaría de Trabajo y Previsión Social www.stps.gob.mx
Percent of workers with earnings in given interval	Workers with earnings in the given interval over all paid workers; intervals defined by multiples of the federal minimum wage (ENEO & INEGI)	Annual	Segundo Informe http://www.informe.gob.mx

Variable	Description	Frequency	Source
Net international migration	Thousands of people; international inflows minus outflows (EMIF)	Annual	Consejo Nacional de Población www.conapo.gob.mx
Enrollment rate, elementary & middle school	Enrollment over eligible population (4-15 yrs old) (SEP)	Annual	Segundo Informe, http://www.informe.gob.mx
Enrollment rate, high school	Enrollment over eligible population (16-18 yrs old) (SEP)	Annual	Segundo Informe, http://www.informe.gob.mx
Enrollment rate, college	Enrollment over eligible population (over 18 yrs old) (SEP)	Annual	Segundo Informe, http://www.informe.gob.mx
Enrollment rate, technical school	Enrollment over eligible population (over 18 yrs old) (SEP)	Annual	Segundo Informe, http://www.informe.gob.mx
U.S. wage, median	Median weekly earnings, in 2007 Q4 dollars deflated by CPI-W (CPS-MORG)	Quarterly	Current Population Survey, Bureau of Labor Statistics, www.bls.gov
U.S. wage, mean	Average weekly wages in 2007 Q4 dollars deflated by CPI-W and SA (CEW)	Quarterly	Covered Employment and Wages, Bureau of Labor Statistics, www.bls.gov
Birth cohort, percent	Share of male population aged 0-1 living in a state, 1973-1977	Annual	Consejo Nacional de Población www.conapo.gob.mx

Variable	Description	Frequency	Source
Population	Midyear population estimate	Annual	Consejo Nacional de Población, www.conapo.gob.mx
Consumer price index, Mexico	Major city within state used as proxy for state	Quarterly	Banco de México, www.banxico.org.mx
Consumer price index, U.S.	SA, Quarterly value is monthly average	Quarterly	Bureau of Labor Statistics, www.bls.gov

Note: All variables at the state level unless otherwise noted. SA stands for seasonally adjusted.
IMSS – Instituto Mexicano del Seguro Social
ENEO – Encuesta Nacional de Ocupación y Empleo
INEGI – Instituto Nacional de Estadística, Geografía e Informática
SEP – Secretaría de Educación Pública
SIRNIE – Sistema de Información del Registro Nacional de Inversiones Extranjeras
EMIF – Encuesta sobre Migración en la Frontera Norte de México
CPS-MORG – Current Population Survey Merged Outgoing Rotation Groups
CEW – Covered Employment and Wages

Appendix Table 2: First Stage Estimates of the Effects of Remittances, Migration on Economic Development

Instrumental variable	All states (q)		All states (a)		High-mig states (q)		High-mig states (a)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Remittance Equation</u>								
Wage, CEW	-.001** (.000)	-.001* (.001)	.028** (.008)	.048** (.010)	-.001* (.000)	-.001 (.001)	.037** (.008)	.041** (.013)
Wage, CPS	-.007** (.002)	-.001 (.001)	-.046** (.016)	-.037** (.016)	-.009** (.001)	-.004** (.001)	-.067** (.241)	-.55** (.016)
F-test for joint significance	6.81 (.004)	1.76 (.189)	7.94 (.002)	11.16 (.000)	5.02 (.017)	3.36 (.055)	13.02 (.000)	6.33 (.007)
<u>Migration Equation</u>								
Birth cohort	1.44** (.116)	1.44** (.116)	5.42** (1.03)	5.67** (1.00)	1.56** (.13)	1.57** (.13)	5.88** (1.18)	6.20** (1.12)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	No	Yes	No	Yes	No	Yes	No	Yes

Note: The top panel shows estimated coefficients from first stage regressions of remittances on the real weekly wage (from CEW and CPS, respectively; see text for details) and the F-statistic for the test of joint significance of the instruments. The bottom panel shows estimated coefficients from first stage regressions of net international migration on birth cohorts. All the regressions also include FDI and labor force and state and time fixed effects as indicated. Robust standard errors (p- value for the F-test) are shown in parentheses; standard errors are clustered on the state. (q) indicates quarterly data and (a) indicates annual data. Significance levels are denoted * $p < .1$ and ** $p < .05$.