Why the Change in Mexico-to-U.S. Migration? A Dynamic Panel Analysis

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I. Introduction

Migration from Mexico to the United States appears to be in decline. Research from the Pew Hispanic Center indicates that the net migration from Mexico has fallen to zero or even reversed (Passel, Cohn, and Gonzalez-Barrera, 2012). Douglas Massey purports that Mexico-U.S. migration has reached a new point in history, and we will see decreasing migration trends into the future (Ellingwood, 2011). Researchers have advanced several potential reasons for the observed migration decline but little statistical evidence on which might be true. Explanations for the fall in migration include improved educational and economic opportunities in Mexico, decreased family sizes due to falling birth rates, increased violence along the border, intensified U.S. border enforcement, and economic recession in the United States.

Theory suggests that a change in any one of these factors can have a different impact on migration depending on the underlying reasons that individuals or families participate in migration. Families that send migrants to the United States to establish social capital to facilitate future migration likely respond to changes in the upfront costs and returns to migration differently than families that send migrants to raise capital or savings for future periods or to diversify risk. In the theoretical section of this paper, we show that which of these motivations dominates household decision-making is an important determinant of how policy and economic factors are likely to affect migration rates. Consequently, we cannot decipher migration dynamics without rigorous empirical analysis.

Determining which policy and economic factors dominate migration decisions has major implications for understanding and predicting future migration. Some of these factors result in permanent shifts in migration dynamics, while the influences of others may be transient. For example, a finding that the decline in migration is due primarily to expanding educational and employment opportunities in Mexico would suggest that recently observed changes in Mexico-to-U.S. migration may be enduring. In contrast, impacts of changes in U.S. economic conditions could reverse once the economy improves. If increased border enforcement is to blame for the drop in migration, changes in immigration policies are more likely to influence Mexico-to-U.S. migration.

We investigate the migration response to economic and policy shocks using nationally representative panel data from rural Mexico. The Mexico National Rural Household Survey (Spanish acronym ENHRUM) provides detailed migration histories from 1980 through 2010 for a representative sample of rural households. We combine these data with time series of national economic and border policy indicators and run separate regressions for migration to farm- and nonfarm-work to uncover differential impacts of push and pull factors across sectors.

Section II reviews some of the economic literature describing the decision to migrate. In Section III we present a two-period theoretical model of migration. In Section IV we describe our data, and in Section V we lay out the empirical framework for answering the question: What factors explain the observed changes in migration over time? Section VI presents a discussion of our findings, and Section VII concludes.

II. Literature on Migration Determinants

Economic models of migration decisions have evolved over the years from individual cost-benefit analyses to more complex household decision-making models in which it is posited that migration is a vehicle to overcome local market failures. In the traditional neoclassical model of labor migration individuals maximize own expected net utility with respect to the location of work, and utility is a maximized function of income or consumption (see Harris and Todaro, 1970, for example). In this framework an individual will migrate if expected earnings in the destination location, net of migration costs, exceed expected earnings at home. Although the neoclassical model is a useful tool for preliminary analysis, it does not adequately describe empirical findings that individuals share earnings with their households of origin through remittances or fail to migrate even when expected earnings at the destination exceed earnings at home.

Most recent studies in the development economics literature explicitly or implicitly depict migration as a collective decision made by the household through internal bargaining. Households may strive to maximize expected utility, a function of both expected income and its variance, in sending-area economies where formal insurance or credit markets do not exist. Stark and Levhari (1982) were at the forefront of developing what became known as the New Economics of Labor Migration (NELM) model. They noticed that rural-to-urban migration occurred even when expected income in the rural economy was greater than the expected income in the city, and they concluded from this observation that the motivation for migration may not be income maximization but rather risk aversion. In agricultural production, there is high stochastic variability in inputs such as rainfall and weather conditions each period. Without access to a formal insurance market, households may engage in migration to diversify risk. In this context, migration depends on the risk-taking or risk-loving properties of the household decision-makers.

There is further evidence that households use migration as a means to alleviate liquidity and risk constraints in the absence of fully functioning credit markets. A panel-data analysis by Taylor and Lopez-Feldman (2010) finds that households in rural Mexico with historical access to U.S. migrant labor markets have higher incomes and more productive land, suggesting that households engage in migration as a means to invest in productive assets at home. In this context, migration may be a temporary response to credit constraints: Once the household accumulates sufficient capital, migrants may cease to perform this financial role.

Since the benefits of migration depend on the earnings potential of household members in both destination and home labor markets, migration likely varies with economic conditions at either location, migrants' human capital, the returns to skills at either location, and the costs of migration. Orrenius and Zandovny (2005) use data from the Mexican Migration Project (MMP) to measure the hazard rate of migrating to the United States for the first time. They find that the probability that an individual migrates to the United States decreases with Mexican real wages, increases with U.S. real wages, and decreases as border patrol policies become more stringent and smuggler fees rise. They also find that migrants typically come from the middle of the education distribution. Remittance studies suggest that the returns to education are higher in Mexico than in the U.S. labor markets to which rural Mexicans migrate, mostly without legal authorization. Meanwhile, the up-front costs of migrating may prohibit those with very low education from migrating. Mora and Taylor (2005) find that education is positively associated with migration from rural Mexico to nonfarm jobs in Mexico, but not to nonfarm jobs in the United States or agricultural jobs in either country. Consequently, an increase in the education of Mexicans will have an indeterminate and sector-specific effect on migration rates ex-ante.

Much of the recent literature concerning Mexico-U.S. migration focuses on the costs of crossing the border and obtaining work in the U.S., which increase with border enforcement. Beginning in the early 1990s the United States substantially increased its expenditures on border protection. Border patrols became more visible as the U.S. implemented "Operation Hold the Line," which focused on a twenty-mile stretch of border in El Paso in 1993, and "Operation Gatekeeper," which increased border enforcement personnel in San Diego by 150% over four years beginning in 1994 (Gathmann, 2004). More than seventy miles of border have been fenced since the early 1990s, surveillance methods have become more technologically advanced, and the number of border patrol agents has increased dramatically, from 3,965 in 1993 to 12,349 in 2006 (Cornelius and Salehyan, 2007). The literature is mixed on the impact of border enforcement on net migration, however.

Cornelius and Salehyan (2007) focus on qualitative interviews to assess how potential migrants perceive border patrol and the risks of migration. They find that individuals are aware that border patrol has increased. They also find that those who are most aware of the dangers of migration are more likely to be planning to migrate. There is clearly an endogenous relationship between these two variables, since the individuals who are planning to migrate are also more likely to research the associated dangers and risks. This study's findings suggest that increases in border patrol do not deter undocumented migration.

When border enforcement increases, theory suggests that incoming migrants on the margin should be deterred from migration, but migrants residing in the United States may be less likely to return to Mexico because they fear that they will not be able to again cross back into the United States in the future. Angelucci (2011) finds that border enforcement negatively affects the inflow of migrants, with the magnitude of the effect increasing in enforcement, and it negatively affects the outflow of migrants with the marginal effect on migrant outflow decreasing or constant. Since the marginal impact of border enforcement on migrant inflows is increasing in enforcement and the marginal impact on outflows is decreasing or constant, Angelucci finds that the net effect is negative. He further finds that the skill selection of migrants increases as border enforcement increases. When border enforcement rises, the cost of migration rises, thus decreasing the expected returns to migration. Therefore, only potential migrants with high expected returns to migration will in fact migrate. One weakness of this study is that it uses MMP data, which is not nationally representative of Mexico. Angelucci weights the observations, but it is noted that the MMP targeted surveys towards communities with historically high rates of migration. Results may differ at the national level as we will explore using nationally representative data of rural Mexico.

One of the potential reasons that heightened border enforcement shows a relatively weak impact on migration in these studies may be due to the persistent effects of social capital in the destination country, which counter the effects of border enforcement. Empirical evidence suggests that knowing other migrants in the destination is a strong determinant of migration. Social capital theory emphasizes the importance of networks as a self-perpetuating dynamic where migration of one individual increases the destination network for another individual inducing that individual to move and then expanding the network for other potential migrants. Massey and Riosmena (2010) point out that the neoclassical theory of migration, NELM, and social capital theory are not mutually exclusive, and the dominant mechanism determining migration is likely heterogeneous across individuals and over time. It is of great import for modeling, however, to understand the multiple motivations that determine migration because different motivations imply different marginal impacts of changes in economic conditions and policies.

Moreover, omitting key variables from the analysis is likely to bias findings with respect to other variables.

In their empirical analysis of migration, Massey and Riosmena compare evidence of the three theories discussed above. They find that Mexican migrants are more likely to return home than are other Latin American migrants. This, they argue, suggests that Mexicans migrate to provide insurance or credit for their households rather than strictly to maximize their own income. They also confirm findings from past studies that networks are important determinants of migration, and they conclude that increases in border patrol and access to legal entry have little if any impact on migration. Increases in deportations, on the other hand, were found to increase the probability of migrating. The authors cite this as evidence that potential migrants fear that migration will become more difficult in the future when they see deportations rise. These findings inform our theoretical model, below, which considers impacts of remittances on households' investment in productive assets at home as well as the impact of migration on the costs of migration in subsequent periods as networks expand and strengthen.

III. Theoretical Model

We propose a simple theoretical model to motivate our dynamic econometric analysis. Households choose how many migrants to send to the United States each period in order to maximize expected consumption (and thus, utility of expected consumption). In this model, migration is a tool to overcome credit constraints as well as a means of increasing current consumption. We capture the credit effects of migration by making wages at home an increasing function of the number of household members that migrated in the previous period. This could be the outcome of using remittances to invest in productive capital at home where labor and capital are complements in production. Alternatively, the household might use remittances to invest in education or to acquire skills that improve expected wages in the future period.

Migrants in the previous period also generate a network of social capital, which reduces the net cost of migration for subsequent migrants from the same household. This is consistent with findings that social networks are important factors increasing the probability of migrating (see, for example, Massey and Riosmena (2010), Taylor and Lopez-Feldman (2010), Orrenius and Zandovny (2005), and Richter and Taylor (2008)).

The model parameters are defined as follows:

L_{ht} is the number of workers that work in Mexico in period *t*.

m_t is the number of household members that migrate in period *t* net of the previous migrants that return to Mexico.

$\bar{L} = L_{ht} + \sum_{j=1}^{t} m_j$, where $\bar{L}$ is the total number of workers in the household.

We assume that the marginal cost of migration is increasing in the marginal cost of crossing the border, *c,* and in the marginal cost of finding work, dm_t, net the marginal effect of social capital, $n(m_{t-1})$, which is concave and increasing in the number of migrants the household had in the previous period. The cost of migration is then

$$c(m_{t-1}, m_t) = \begin{cases} cm_t + \frac{1}{2} dm_t^2 - n(m_{t-1})m_t \ if \ m_t \geq 0 \\ 0 \ otherwise \end{cases}$$

Properties of the network function are

$n'(m_{t-1}) > 0$

$n''(m_{t-1}) < 0$

$n(0) = 0$

We normalize the model by asserting that migration is zero in period t=0. $\omega(m_{t-1})$ is the reservation income in Mexico, that is the income an individual can earn either on his farm or working for local wages. We assume that the reservation income is concave and increasing in the number of migrants working in the U.S. in the previous period. That is,

$\omega'(m_{t-1}) > 0$

$\omega''^{(m_{t-1})} < 0$

W is the expected U.S. earnings per migrant in each period.

$0 < \delta < 1$ is the discount rate

Consider the case where $m_2 > 0$, so $c(m_1, m_2) = cm_2 + \frac{1}{2}dm_2^2 - n(m_1)m_2$

Then the household solves the maximization problem

$$\max_{m_1, m_2} \omega(0)(\bar{L} - m_1) + Wm_1 - cm_1 - \frac{1}{2}dm_1^2$$

$$+ \delta\left[\omega(m_1)(\bar{L} - m_1 - m_2) + W(m_1 + m_2) - cm_2 - \frac{1}{2}dm_2^2 + n(m_1)m_2\right]$$

subject to $m_1 \geq 0$

We assume that the objective function is concave by the concavity of the earnings function $\omega(m_{t-1})$ in Mexico and the convexity of the migration cost function $c(m_1, m_2)$. Assuming interior solutions so that we can do comparative statics, the First Order Conditions reduce to

$$W + \delta\omega'(m_1)(\bar{L} - m_1 - m_2) + \delta W + \delta n'(m_1)m_2 = c + dm_1 + \omega(0) + \delta\omega(m_1)$$

and

$$W = \omega(m_1) + c + dm_2 - n(m_1)$$

The marginal benefit of migration in each period is equal to the marginal cost of migration.

We can then form the Jacobian of the First Order Conditions and perform comparative statics to predict how changes in the cost of migration affect the number of migrants in each period. Under the assumption of an interior solution, we look at what happens to m_1 and m_2 when the cost of crossing the border, c, increases. The sign of the marginal effect of c on $m_1$depends on the marginal returns to earnings at home in Mexico in period two and the marginal returns to networks in period two from m_1. If the marginal returns to first period migration from improved second period earnings in Mexico are large enough, then increasing the cost of border crossing could lead to greater migration in period one. If, on the other hand, the primary benefits of first period migration accrue through network improvement for future migrants, first period migration will decrease with the cost of crossing the border. If the cost of finding work in the U.S. is sufficiently high, first period migration will always decrease with the cost of border crossing. For second period migration, a sufficient condition for m_2 to always decrease in c is $\geq \frac{1}{2}$, which simply states that households do not discount the future too much. This is a relatively weak assumption, since $\delta < \frac{1}{2}$ would indicate a very high discount rate.

This exercise in comparative statics demonstrates that migrant responses to policy changes that affect the costs of crossing the border and finding work depend critically on the primary motivations for migration. If households participate in migration primarily to invest in raising the marginal productivity of labor in Mexico, they will send more migrants to the U.S. in the initial period and decrease migration in the second period in response to increased border crossing costs. Conversely, if their primary motivation for migration is to invest in future migration networks, then migration will decrease in both periods. When the returns to migrants for future migration increase, initial migration will increase only if the marginal returns to first period migration for network development are large relative to the marginal returns for labor productivity in Mexico.

It is not clear ex-ante how changes in factors shaping migration, such as the enforcement of immigration laws, education in Mexico, household demographics, and economic conditions in the two countries, will affect migration. As we can see from the simple theoretical exercise above, households' responses to many variables depend on whether households plan to send migrants to the U.S. in the future, whether the primary objective of migration is to invest in labor productivity in Mexico or in migrant networks in the U.S., and how much households discount the future. Hence, the motivations of migrant-sending households are critical for how households respond to changes in economic and policy variables, and we might further expect these changes to differ across employment sectors. To understand the impacts of changing political, economic, and demographic variables on migration, we need to empirically examine the dynamic relationship between these variables and migration to different employment sectors over time using empirical methods.

IV. Data

The data on individual migration histories for our analysis come from a nationally representative sample of rural Mexican households. A unique feature of the Mexico National Rural Household Survey (Spanish acronym *ENHRUM*) is that it includes information on individuals and households before and after the 2008 recession. ENRHUM contains survey rounds for 872 households from 2003, 2008, and 2011 with detailed information on migration destinations, whether the migrant worked in the agriculture or non-agriculture sector, and employment status (wage-earner or self-employed) for all family members of the household head, his/her spouse, all others living in the household during the survey, and all children of the household head and spouse living outside the household. The data further include migration histories for all years between 1980 and 2010 so that we can examine the migration decisions of individuals over time. We also have data on background characteristics such as the highest grade of school completed and the number of children and elderly in the household. We will control for these background characteristics in our analysis. To examine the economic push and pull factors, we use annual national U.S. and Mexican GDP data published by the USDA. We investigate the impacts of immigration policy using data from the Department of Homeland Security on the number of border patrol agents employed each year. Figure 1 shows that the number of border patrol agents has increased dramatically over the past three decades. A list of summary statistics of all the data is in Table I

V. The Empirical Model

We estimate dynamic models of three migration outcomes: Mexico-to-U.S. migration, migration to U.S. farm jobs, and migration to U.S. nonfarm jobs. The first migration variable is equal to one if individual *i* migrated to the United States in year *t* and zero otherwise; the second is equal to one if the individual migrated to U.S. farm work in year *t*; and the third is equal to one if the individual migrated to U.S. nonfarm work in year *t*. Our sample only includes working-age adults between the ages of fifteen and sixty-five, which is the standard procedure in labor migration research. The most basic dynamic model regresses the dependent variable on its lag and a time trend:

(1a) $y_{it} = \alpha y_{it-1} + \gamma t + \varepsilon_{it}$

Equation (1a) captures the basic trends and inertia of migration over time, where y_{it} is the dependent variable, t is the time trend, and ε_{it} is the error term. The coefficient on the lagged dependent variable indicates the persistence of migration, that is, the extent that migration in one year influences the decision to work in the U.S. in subsequent years. The coefficient on t indicates how quickly the probability of migration is changing over time and the direction of the change. Since the individual decision to migrate is correlated for individuals across years, we cluster the error terms by individual. This model allows us to analyze the overarching trends in migration before including additional time-varying control variables.

Recent reports of a decline in migration suggest that the time trend may not be linear. Visually, we see that migration growth in our sample slowed after the first survey round (see Figure 2). A critical question for policy makers and economic agents that depend on migrants is whether and the trend turned downward before the recession. We therefore estimate a second dynamic model with a quadratic time trend. To be certain that the "great recession" of 2008-2009 does not bias the trend, we also regress on a dummy variable, REC_t, equal to one in years 2008 and 2009 and zero otherwise. This gives us equation (1b):

(1b) $y_{it} = \alpha y_{it-1} + \gamma_1 t + \gamma_2 t^2 + \sigma REC_t + \varepsilon_{it}$

The marginal effect of time in this model is $\gamma_1 + 2\gamma_2 t$. If the quadratic time trend appears to be a good fit, we can use the estimated model to identify the year in which the trend turns negative.

The time trend terms in (1a) and (1b) capture the effects of all time-varying variables, observable and unobservable, on migration. The second model we estimate attempts to "unpack" this trend by including individual and household characteristics, such as age, education, and the number of working age adults and dependents in the household. We run a regression with a vector X_{it} of individual characteristics in year *t*. We also include a variable for lagged village networks, denoted N_{it-1}. The network variable is equal to the number of working-age migrants from the individual's village in year *t-1*. This provides a reasonable proxy for social capital in the United States. Since the villages in our sample are rural and isolated, it is unlikely that networks extend beyond the village. Anecdotal evidence from the field supports this assertion; migrants are rarely assisted by past migrants in other villages. We further include state fixed effects for the individual's home state, denoted θ_s, to prevent unobserved differences in migration patterns across Mexican states from confounding our results. The specifications for this model are written in equation (2a; linear trend) and (2b; quadratic trend and recession dummy):

(2a) $y_{it} = \alpha y_{it-1} + \gamma_1 t + \beta_1 X_{it} + \beta_2 N_{it-1} + \theta_s + \varepsilon_{it}$

(2b) $y_{it} = \alpha y_{it-1} + \gamma_1 t + \gamma_2 t^2 + \sigma REC_t + \beta_1 X_{it} + \beta_2 N_{it-1} + \theta_s + \varepsilon_{it}$

Finally, we examine how lagged macro variables, including the U.S. and Mexican GDPs and border enforcement, proxied by the number of U.S. border patrol agents, affect the likelihood that individuals from rural Mexico migrate to the United States. We do not explicitly control for the great recession, because it is highly correlated with changes in GDP. We estimate this model first using only state fixed effects, then again using individual fixed effects. The individual fixed effects estimator makes it possible to test the robustness of findings to unobserved factors influencing individuals' migration propensities. By using the within variation estimator, we can examine how variation in macro variables over an individual's lifetime affects his/her decision to migrate. We do not include a time trend in this model, because time is perfectly collinear with individuals' age . These specifications can be written as:

(3a) $y_{it} = \alpha y_{it-1} + \gamma_1 t + \gamma_2 t^2 + \beta_1 X_{it} + \beta_2 N_{it-1} + \beta_3 Z_{it-1} + \theta_s + \varepsilon_{it}$

(3b) $y_{it} = \alpha y_{it-1} + \beta_1 X_{it} + \beta_2 N_{it-1} + \beta_3 Z_{it-1} + \theta_i + \varepsilon_{it}$

In models (3a) and (3b), Z_{it-1} is the vector of time-varying macro variables. The vector θ_i represents individual fixed effects in model (3b). The advantage of individual fixed effects is that it absorbs all unobserved, time-invariant individual characteristics that may bias our estimated coefficients of interest. The coefficients on time-varying individual characteristics may change when we include individual fixed effects; however, the effects of time-invariant explanatory variables cannot be included in an individual fixed-effects model.

VI. Findings

We estimate the models using OLS, accounting for serial correlation within individuals across years by clustering standard errors at the individual level. It is known that coefficients estimated using linear probability models are biased, but the bias is relatively small in long panels and lead to the correct sign (Judson and Owen, 1999). Judson and Owen show that the bias in the Least Squares Dummy Variables (LSDV) estimator, that is the least squares estimator with fixed effects, is negligible with panels of T=30 or longer. All of our specifications have panels of thirty years, suggesting that marginal effects should be accurate. Table II displays the regression results for all migration to the United States, Table III shows migration to U.S. farm work, and Table IV shows migration to U.S. nonfarm work.

We first look at the time trends for each dependent variable. We find a positive time trend for each of the dependent variables when we restrict the trend to be linear (column (1a) in each table). The time trend is much larger in magnitude for migration to the nonfarm sector than it is for migration to farm work. This suggests that migration to farm work has been fairly flat from 1980 through 2010, growing at a slow pace. When we allow the time trend take a quadratic form, we find a negative coefficient on the squared term. This coefficient is significant for all migration, but not for migration to either sector estimated separately. The estimation of the quadratic time trend in column (2b) of Table 1 for all migration predicts that the marginal effect of time on migration will turn negative in year 2030. This suggests that the great recession may be largely responsible for the recent downturn in migration and it will be helpful to begin unpacking the time trend by including time-varying controls.

Next we estimate the time trends while controlling for individual and household characteristics, networks, and the great recession, first with a linear time trend (column (2a)) and then with a quadratic time trend (column (2b)). The linear time trend with controls on household characteristics is negative in all specifications, though not significant for migration to nonfarm work. When we add a quadratic term and control for the recession in column (2b), we find a significant negative coefficient on time squared. The marginal effect of time becomes negative after 1999 for pooled Mexico-U.S. migration, after 2000 for farm labor migration, and after 1998 for nonfarm migration. This finding is of great interest because networks are a persistent factor in migration growth. Because of networks, migration is a self-perpetuating process (Massey et al., 2005). The migration of one individual increases the network for others at home, potentially tipping the scale in favor of migration for more individuals who, in turn, expand the network further. The finding of a negative time trend controlling for networks suggests that a sudden negative shock to migration that reduces network size could lead to more rapid declines in migration. Since migration decreased during the recession, reducing network size, Mexico already may be experiencing the onset of a negative migration dynamic similar to other countries that have experienced a “migration transition” (de Haas, 2010). The time trends become less significant once we control for macro economic variables (column 3a).

We are also interested in how individual and household characteristics, changes in the economy, and changes in U.S. immigration policy affect migration. Men are more likely to migrate than women, significant in all specifications of the model. In general, it appears that the probability of migration increases with age, but at a decreasing rate (indicated by the negative coefficient on age-squared), as in a conventional human capital model. There is a positive coefficient on the number of working-age adults living in the household. This coefficient is significant in most specifications, but not for migration to the farm sector. This suggests that there are labor constraints for families in rural Mexico; households send migrants to the United States when they have a larger supply of household labor. Conversely, the coefficient on the number of dependents in the household is negative, and generally significant. The more children or elderly that the household is looking after, the less likely individuals are to migrate. This does not appear to apply for migrants to the farm sector however.

Migration is increasing in education in our sample and is significant in most specifications. Education has a much smaller effect for migrants to the farm sector and is only significant for farm migrants in models (3a) and (3b). Since most of the individuals in our sample have no more than a primary school education (mean years of schooling is 6.24), this is consistent with previous studies that show that migrants select from the middle of the education distribution and does not test to see whether the propensity to migrate decreases for very highly educated individuals.

As previously mentioned, the propensity to migrate increases with the size of village networks, creating a strong inertia of migration over time. The coefficients on own lagged migration also indicate a strong persistent force of migration. One who migrated the previous year is much more likely to work in the U.S. the following year. This is significant across all specifications.

The macro indicators of economic impacts and border policy have significant impacts on migration as well. Individuals are more likely to migrate when the U.S. GDP was higher the previous year, and they are less likely to migrate when the Mexican GDP was higher the previous year. When the U.S. economy is strong, potential migrants expect to find more work hours and better-paying jobs in the U.S., and when the Mexican economy is strong, there are more work opportunities for the marginal migrants at home in Mexico, deterring them from migration.

The coefficient on lagged border patrol agents is negative in most specifications and significant for all types of Mexico-to-U.S. migration when we include individual fixed effects. Combining this finding with the relatively large coefficients on networks, U.S. and Mexico GDPs, and household characteristics suggests that increases in U.S. border policy significantly deter potential migrants on the margin; however, it does little to stop the flow of migration, which is influenced by many other factors.

VII. Conclusion

In this paper we examine several potential factors shaping the decision to migrate and how their influences differ across sectors of immigrant employment. Many explanations have been offered to explain changes in the rates of migration within the past decade, including demographics, education, economic conditions, U.S. immigration policy, and violence along the border. Our analysis uses nationally representative data from households in rural Mexico to investigate the direction and relative importance of each of these potential factors.

Consistent with other studies, our analysis finds that Mexico-U.S. migration is slowing down and will likely turn downward in the near future. When we allow the time trends in our models to take a quadratic form, we find that the marginal effects of time on Mexico-U.S. migration, for farm and nonfarm migrants, are predicted to turn negative in the near future. When we estimate a quadratic time trend while controlling for time-varying household characteristics and village networks, our model suggests that the marginal effect of time on migration already turned negative, as far back as year 2000 or earlier.

We analyze the impacts of several demographic characteristics of migrants and non-migrants, including gender, education, and household size. Consistent with past studies, we find that men are more likely to migrate than women. Education has a positive impact on the probability of migration to both the farm and nonfarm sectors. Since the majority of individuals in our sample have relatively few years of completed schooling (the mean is 6.24 years), this is compatible with the finding from previous studies that migrants come primarily from the middle of the education distribution. The impacts of household size on migration are ambiguous. Individuals from households with fewer dependents demonstrate a higher probability of migration, while individuals with more working-age adults in their household show a higher probability of migration. Lower birthrates lead to fewer dependents in the short-run and fewer working-age adults in the long-run; thus, it would seem that their impact is varying over time, tilting towards negative in the long run.

We find significant impacts of migration networks and national policy shocks. We measure migration networks by the number of migrants from the same village working in the United States the previous year. Strong network effects instill a high degree of inertia in migration dynamics since each individual who migrates contributes to the network. Networks effects are significant across employment sectors. A healthy U.S. economy, reflected in the U.S. GDP, creates an important positive pull factor drawing migrants from rural Mexico into the United States. In contrast, individuals are less likely to migrate when the Mexican economy is strong.

We also find significant impacts of U.S. border patrols. This suggests that migration policy enforcement deters potential migrants at the margin and influences migration dynamics. The relatively large impacts of other factors, however, suggest that many migrants remain undeterred even as the costs of border crossing rise. If households use migration as an investment tool, it is possible that the returns to migration via increased investment at home are large enough to make discounted future benefits of remittances greater than the costs of crossing the border.

Our findings indicate that that Mexico-U.S. migration dynamics are changing in both the farm and nonfarm sectors. Increased border enforcement and growing economic opportunities in Mexico deter Mexico-U.S. migration to both farm and nonfarm work. Since migration is increasing with U.S. GDP, migration may recover as the U.S. economy rebounds from the great recession. However, migration depends heavily on networks, which diminished during the recession, and network effects tend to reinforce a negative trend in migration as the expansion of networks slows.

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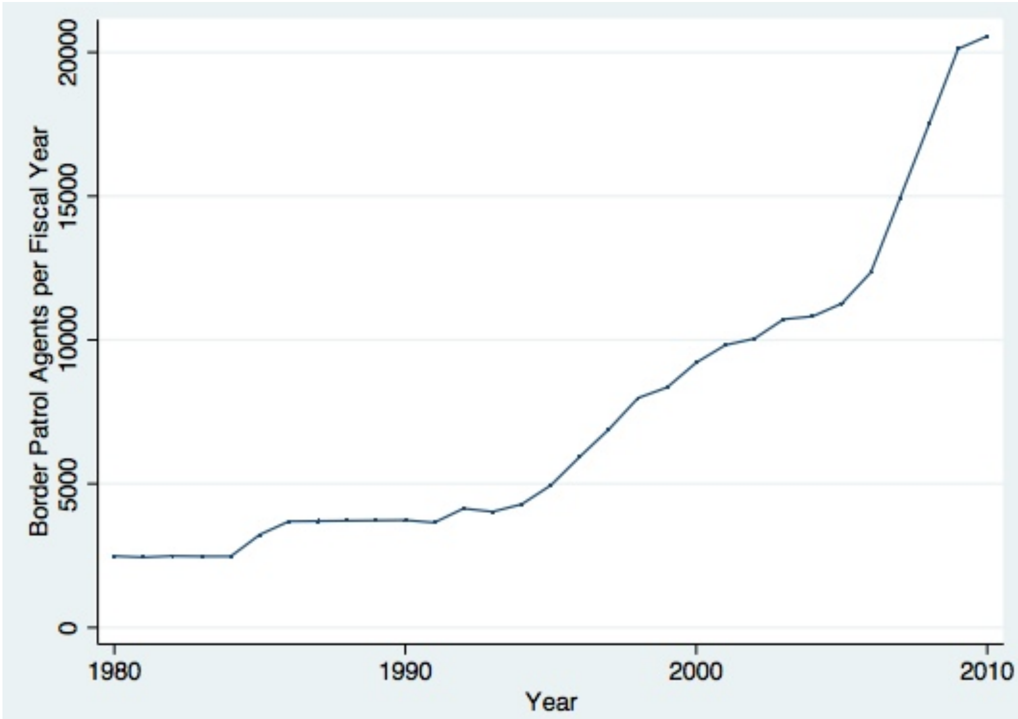
Table 1. Summary Statistics

Years	1980-2010			
Number of Households	872			
Observations (person-years)	111,253			
Variable	**Mean**	**SD**	**Min**	**Max**
Number of working-age adults in Household	6.31	3.33	3.33	17
Number of Dependents in Household	2.49	2.07	0	18
Men	0.49	0.50	0	1
Years of Education*	6.24	4.28	0	22
US village network	5.00	7.86	0	48
Mexico GDP**	708.75	154.79	460.5	935.6
US GDP	10,219.2	2374.77	5834	13,206
Border Patrol Agents	1,235,174	281,823.6	752,329	1,814,729

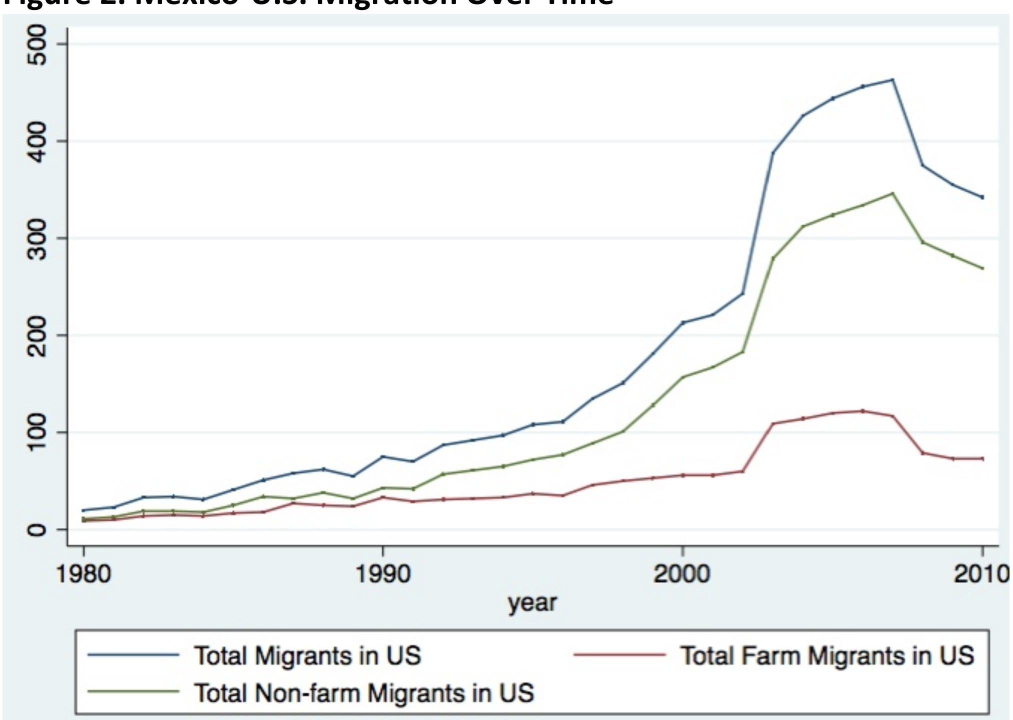
*There are only 95,925 observations of years of education due to missing values.
**Mexico and U.S. GDP is reported in billions of U.S. 2005 dollars.

Figure 1. Number of Border Patrol Agents Over Time



Data Source: Department of Homeland Security and Massey and Pren (2012).

Figure 2. Mexico-U.S. Migration Over Time



Data Source: ENHRUM

Table II. Mexico-U.S. Migration

Specification	(1a)		(1b)		(2a)		(2b)		(3a)		(3b)	
Lagged US work	0.872	***	0.872	***	0.852	***	0.852	***	0.852	***	0.692	***
	148.6		148.67		133.63		133.55		133.4		75.74	
time	3.2E-04	***	8.4E-04	***	-1.1E-04	**	1.1E-03	***	4.8E-04	*		
	8.41		6.48		-2.12		6.94		1.72			
time squared			-8.3E-06	**			-2.6E-05	***	-2.1E-05			
			-2.03				-5.51		-1.44			
Recession			-0.016	***			-0.018	***				
			-7.13				-7.61					
Age					2.4E-04		2.3E-04		2.4E-04		1.7E-03	***
					1.53		1.47		1.48		4.39	
Age Squared					-6.3E-06	***	-6.0E-06	***	-6.0E-06	***	-2.0E-05	***
					-3.08		-2.93		-2.95		-6.05	
Working-Age Adults in Household					5.2E-04	***	4.9E-04	***	4.9E-04	***	-9.5E-04	
					3.69		3.47		3.49		-1.5	
Dependents					-5.4E-04	***	-5.8E-04	***	-5.8E-04	***	-1.3E-03	***
					-2.88		-3.08		-3.09		-2.56	
Male					1.5E-02	***	1.4E-02	***	1.5E-02	***		
					16.37		16.37		16.38			
Education					7.4E-04	***	8.1E-04	***	8.0E-04	***	7.7E-03	***
					6.69		7.23		7.14		11.45	
Lagged US Network					9.1E-04	***	9.7E-04	***	9.5E-04	***	5.9E-04	***
					9.9		10.47		10.17		3.76	
Lagged US GDP									6.5E-06	***	7.6E-06	***
									5.16		5.12	
Lagged Mexican GDP									-7.3E-05	***	-7.9E-05	***
									-4.17		-5.49	
Lagged Border Patrol Agents									-7.0E-07	*	-1.7E-06	***
									-1.74		-8.13	
Constant	2.9E-03	***	-1.9E-03	***	-8.7E-03	***	-1.9E-02	***	-2.0E-02	**	-6.0E-02	***
	4.24		-2.06		-2.68		-5.68		-2.33		-9.6	
State FE					yes		yes		yes			
Individual FE											yes	
Observations	105389		105389		90798		90798		90798		90798	
Clusters	5728		5728		5005		5005		5005		5005	

t-statistics are listed below the coefficients. * indicates that the coefficient is statistically significant at the 10% level, ** at the 5% level, and *** at the 1% level.

Table III. Migration to U.S. Farm Work

Specification	(1a)		(1b)		(2a)		(2b)		(3a)		(3b)	
Lagged US farm	0.832	***	0.832	***	0.818	***	0.818	***	0.818	***	0.688	***
	78.49		78.48		73.22		73.16		73.12		50.74	
time	4.8E-05	**	1.7E-04	**	-4.4E-05	*	2.9E-04	***	2.1E-04			
	1.96		2.35		-1.67		3.41		1.19			
time squared			-1.0E-06				-6.8E-06	***	2.6E-06			
			-0.45				-2.59		0.32			
Recession			-5.8E-03	***			-6.6E-03	***				
			-4.01				-4.23					
Age					-1.8E-06		-5.4E-06		-5.0E-06		3.7E-04	
					-0.02		-0.06		-0.05		1.56	
Age Squared					-9.7E-07		-8.7E-07		-8.8E-07		-4.0E-06	**
					-0.83		-0.74		-0.75		-1.97	
Working-Age Adults in Household					-3.3E-05		-4.3E-05		-4.2E-05		-2.6E-04	
					-0.42		-0.54		-0.53		-0.79	
Dependents					-3.2E-05		-4.5E-05		-4.3E-05		9.7E-06	
					-0.29		-0.4		-0.39		0.04	
Male					0.006	***	0.006	***	0.006	***		
					12.73		12.73		12.73			
Education					4.9E-05		7.1E-05		6.7E-05	**	2.0E-03	***
					0.95		1.37		1.29		6.45	
Lagged US Network					2.9E-04	***	3.1E-04	***	3.0E-04	***	3.8E-06	
					5.82		6.15		6.08		0.04	
Lagged US GDP									2.0E-06		3.14E-06	***
									2.31		3.17	
Lagged Mexican GDP									-4.0E-05		-4.0E-05	***
									-3.4		-4.09	
Lagged Border Patrol Agents									-3.6E-07		-5.1E-07	***
									-1.52		-4	
Constant	2.0E-03	***	6.8E-04		9.4E-04	***	-2.0E-03		5.7E-03		-1.2E-02	***
	4.15		1.17		0.51		-1.1		1.25		-3.64	
State FE					yes		yes		yes			
Individual FE											yes	
Observations	105389		105389		90798		90798		90798		90798	
Clusters	5728		5728		5005		5005		5005		5005	

t-statistics are listed below the coefficients. * indicates that the coefficient is statistically significant at the 10% level, ** at the 5% level, and *** at the 1% level.

Table IV. Migration to U.S. Nonfarm Work

Specification	(1a)		(1b)		(2a)		(2b)		(3a)		(3b)	
Lagged US Nonfarm	0.859	***	0.859	***	0.846	***	0.846	***	0.846	***	0.700	***
	121.12		121.19		113.83		113.88		113.77		68.86	
time	3.3E-04	***	6.8E-04	***	-7.3E-05		8.0E-04	***	2.6E-04			
	9.36		5.93		-1.58		5.92		1.06			
time squared			-5.8E-06				-2.1E-05	***	-2.5E-05	*		
			-1.57				-4.8		-1.89			
Recession			-0.010	***			-0.011	***				
			-4.71				-4.94					
Age					3.2E-04	**	3.1E-04	**	3.2E-04	**	1.2E-03	***
					2.31		2.26		2.27		3.81	
Age Squared					-6.4E-06	***	-6.2E-06	***	-6.2E-06	***	-1.5E-05	***
					-3.61		-3.49		-3.5		-5.39	
Working-Age Adults in HH					5.5E-04	***	5.3E-04	***	5.3E-04	***	-6.0E-04	
					4.52		4.35		4.35		-1.09	
Dependents in HH					-5.4E-04	***	-5.6E-04	***	-5.7E-04	***	-1.2E-03	***
					-3.21		-3.36		-3.38		-2.75	
Male					9.8E-03	***	9.8E-03	***	9.8E-03	***		
					12.73		12.72		12.73			
Education					7.0E-04	***	7.5E-04	***	7.5E-04	***	5.7E-03	***
					6.87		7.27		7.2		9.56	
Lagged US Network					7.4E-04	***	7.8E-04	***	7.6E-04	***	5.5E-04	***
					8.92		9.39		9.07		3.99	
Lagged US GDP									4.6E-06	***	4.4E-06	***
									4.47		3.55	
Lagged Mexican GDP									-3.3E-05	**	-3.9E-05	***
									-2.12		-3.19	
Lagged Border Patrol Agents									-3.4E-07		-1.2E-06	***
									-0.93		-6.42	
Constant	9.4E-04		-2.3E-03	***	-1.1E-02	***	-1.8E-02	***	-2.8E-02	***	-4.7E-02	***
	1.55		-2.88		-3.79		-6.17		-3.57		-8.42	
State FE					yes		yes		yes			
Individual FE											yes	
Observations	105389		105389		90798		90798		90798		90798	
Clusters	5728		5728		5005		5005		5005		5005	

t-statistics are listed below the coefficients. * indicates that the coefficient is statistically significant at the 10% level, ** at the 5% level, and *** at the 1% level.