

# Dynamic Decisions of Mexican Immigrants in the US.

Silvio Rendon

Alfredo Cuecuecha

Stony Brook University

Universidad Iberoamericana Puebla

Very Preliminary

February 2011

**Abstract.**- In this paper we formulate a dynamic model of migration decisions of Mexican workers, who can migrate to the US illegally or legally, try to become legal immigrants (if they are illegal), or return back to Mexico at any time. The model explains migration flows by the accumulation of location-specific human capital. This paper estimates the models behavioral parameters using data from the Mexican Migration Project (MMP), a longitudinal dataset that contains information for location, legal status, income, and several socio-demographic variables. The models predicted migration transitions are matched with the migration transitions observed in the data.

Then, this paper uses the models estimated parameters to evaluate the response of migration rates to a number counterfactual scenarios, which include possible policy interventions: (i) increasing legal and illegal migration costs from Mexico to the US, (ii) increasing the cost of becoming legal once in the US, (iii) giving Mexican immigrants a return subsidy, (iv) an improvement of the Mexican labor market and a worsening of the US labor market. Some combinations of these policies, such as increasing the cost of illegal immigration while simultaneously reducing the cost of legal immigration, are also analyzed.

**Keywords:** International Migration, Job Search, Legal Status, Human Capital, Structural Estimation.

**JEL Classification:** F22, J64, E20.

# 1 Introduction

In most scenarios the process of migration and return migration is very intense. In year 2000 Mexican migrants in the US represented above 10% of the Mexican labor force; however, more than 40% returned back to Mexico. On the other hand, these changes of location are associated with changes of legal status. Data from the Mexican Migration Project (MMP) show that most Mexicans migrate illegally to the US: around 73% of Mexican immigrants to the US are illegal. The transition from being illegal to become legal immigrant is relatively small: 7.5% of illegal immigrants become legal. Being a legal immigrant in the US is practically an absorbing state: 99.4% of legal Mexican immigrants stay legal in the US.

The general perception in some circles in the US. is that something must be done to reduce this disproportionate amount of illegal immigration into the US. Some policies, such as stricter border patrolling, more severe punishments, restricted public services access, and restricted legalization of illegal immigrants, are a matter of public discussion. These policies, however, are rarely proposed with a clear understanding of the international migration process from Mexico to the US.

This paper explains these location and legal transitions as a function of time spent in the US, a form of specific human capital that increases a Mexican immigrants' income and reinforces the probability that they stay longer in the US. The approach adopted in this paper grows out from Keane and Wolpin (1997), who explain the occupational choices of young men by an extended human capital investment model. In this paper agents' career decisions are formalized by a dynamic discrete model in which agents are in Mexico, in the US. illegally or in the US. legally and choose their location and legal status transitions depending on their human capital accumulation perspectives. Whenever they decide to change their location and legal status, they have to pay a monetary cost. Being successful, however, in changing their status is a random process. For instance, if they cross the border illegally they may get caught and be deported back to Mexico, or if they are illegally in the US., their application

to become legal immigrants may be rejected. All of these aspects are captured by the parameters of the theoretical model.

Then model is estimated to data from the MMP. The model's estimated parameters are used to evaluate the response of migration rates to several counterfactual scenarios, including policy interventions that are usually proposed in public debates.

## 2 Literature Review

This research extends our knowledge on international migration by linking it explicitly to the legal status of the migrant and his or her accumulation of human capital. Most of the research done in the subject focuses on international wage differentials and assumes that international migration goes only in one direction.<sup>1</sup> It is, however, well documented that international migration between two countries is a process whereby migrants cross borders bidirectionally.<sup>2</sup>

As mentioned above, Mexico and the US are two neighboring countries with a particularly intensive dynamics of migration and return migration.<sup>3</sup> It is argued that this migration process depends basically on international wage differentials and preferences for origin. In a previous research paper, Rendon and Cuecuecha (2007) use a model of job search, savings and migration to show that migration and return migration heavily depend not just on wage differentials or preferences, but also on job turnover and, in particular, on job-to-job transitions. To a great extent, Mexicans

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<sup>1</sup>These mechanisms are unemployment or wage differentials (Harris and Todaro 1970), expected wages, probabilities of employment and tax rates, and the probability of being deported in the destination country (Todaro and Maruszko 1987), adverse selection and poverty traps (Bencivenga and Smith 1997).

<sup>2</sup>In 1908-1910 on average 32% of immigrants to the US returned to their countries (Piore 1979). Between 1960 and 1970 half of the annual flow of immigrants to the US returned home (Warren and Peck 1980). In fact, temporary migration is important for many countries (Dustmann, 2003). Aydemir and Robinson (2006) document outmigration rates in several countries, ranging between 22% and 55%. This process is very specific to the country of destination, for example, in Canada outmigration flows go to a third country, and highly heterogeneous by country of origin (Jasso and Rosenzweig 1982).

<sup>3</sup>Available studies estimate migration rates of 11.68% (Chiquiar and Hanson 2005) and return migration rates of 42.6% (Jasso and Rosenzweig (1982) and 66% (Reyes 1997).

migrate to the US seeking mobility, which they do not totally find in their own country.

This paper explores another crucial dimension of the international migration process which is its connection to the legal status and the accumulation of human capital. Unlike in Rendon and Cuecuecha (2007), this paper assumes that agents are risk-neutral, that is, they are wealth-maximizers, but allowing them to accumulate location and legal status specific human capital in the spirit of Keane and Wolpin (1997). Thus, this is the first paper to explain international migration and legal status choices using a dynamic model of human capital accumulation. Agents accumulate US-specific human capital if they are in the US illegally, which can increase the probability to become eventually legal immigrants. This will crucially depend on how much of the human capital acquired while being illegally in the US. is transferable to the legal status.

This paper is part of a growing literature that uses dynamic models that allow for bidirectional migration over the life cycle, based on social networks (Delechat 2001, Angelucci 2002, Haslag, Guzman and Orrenious 2004, Colussi 2006), geographical search (Kennan and Walker 2006), and married couples decisions Gemici 2007). Extending the dynamic models of migration to allow for legal status differences and using them to analyze international migration of Mexicans in the US. is a meaningful theoretical extension and practical application of the theory. The result is a framework that is flexible enough to analyze a matter of public interest.

### **3 Model**

Agents maximize their expected lifetime utility without bequests by choosing their location and legal status. At each period they made their location and legal status decisions conditional on age, current location and legal status, accumulated experience in each location, and a random component observed by the individual but unobserved

by the researcher. Agents can be in Mexico or in the US and have a legal or illegal status in the US. If they are in Mexico they increase their utility by  $\psi$ , which captures preference for origin. Agents retire at age  $T = 60$ .

If they are in Mexico and have not yet acquire the legal status in the US., they can stay in Mexico or take the chance to migrate to the US. legally or illegally. Both methods of migration are similar in that prospective migrants have to pay a cost of migration and take a lottery that can result in success or in failure. One can imagine an prospective illegal immigrant paying a *coyote* to cross the border and then be caught and sent back to Mexico. For the process of legal migration, one can figure out a prospective legal immigrant paying the US. Consulate fee in Mexico, submitting several documents and then be rejected by the consular clerk at a window. The agent can choose the migration method, depending on his or her state variables.

If they are illegally in the US., they can always go back to Mexico paying the migration cost, they may decide to stay illegally in the US, in which case they face a probability of being caught and be deported back to Mexico, or they may try to become legal immigrants by paying some monetary amount, in which case they may succeed and become legal immigrants, fail and stay illegally in the US., or fail and be deported to Mexico.

If they have permission to work legally in the US., regardless of whether they are in Mexico or the US., they locate themselves in Mexico or in the US., just paying the migration cost.

Whenever they stay in one location and legal status  $k$ , they accumulate specific human capital:  $x_k(t + 1) = x_k(t) + d_k(t)$ ,  $k = 1, 2, 3, 4$ , where  $x_k(t)$  indicates the accumulated specific human capital at age  $t$  and  $d_k(t)$  indicates the location and legal status decision at age  $t$ .

Then the structure of rewards  $R_k(t)$  is given by:

$$R_k(t) = \exp(e_{k1} + e_{k2}x_1(t) - e_{k3}x_1(t)^2 + e_{k4}x_2(t) - e_{k5}x_2^2(t) + e_{k6}x_3(t) - e_{k7}x_3^2(t) + e_{k8}x_4(t) - e_{k9}x_4^2(t) + \epsilon_k),$$

where  $\epsilon \sim N(0, \Omega)$  is a random shock to earnings, realized at the beginning of period  $t$ . Generally speaking rewards at each location  $k$  depend on the accumulated experience in all locations. It will be an empirical matter to determine which location and legal status experience is transferable to other locations and legal status.

The set of state variables is  $S(t) = (\mathbf{e}, \mathbf{x}, \boldsymbol{\epsilon})$ , which contain the initial endowments of human capital in each location, the accumulated amounts of experience that results from the individual's decisions and the vector of random shocks for each location.

Then the value functions are defined in the following way, for  $t = T$  :

$$R_k(S(t), t) = R_k(t),$$

and for  $t < T$  :

$k = 1$ : Value Function for being Mexico, without permission to work legally in the US.:

$$V_1(S(t), t) = R_1(t) + \psi + \beta E_1 \max [V_1(S(t+1), t+1), W_{12}(S(t+1), t+1), W_{13}(S(t+1), t+1)],$$

The agent can stay in Mexico, try to emigrate illegally or legally.

$k = 2$ : Value function for being illegally in the US.:

$$V_2(S(t), t) = R_2(t) + \beta E_2 \max [E_1 V_1(S(t+1) - c_{21}, t+1), W_{22}(S(t+1), t+1), W_{23}(S(t+1), t+1)],$$

The agent can go back to Mexico paying the migration cost, stay put, or try to become a legal immigrant.

$k = 3$ : Value function for being legally in the US.:

$$V_3(S(t), t) = R_3(t) + \beta E_3 4 \max [V_3(S(t+1), t+1), V_4(S(t+1), t+1) - c_{34}],$$

The agent can stay in the US. or go back to Mexico, paying the migration cost.

$k = 4$ : Value for being in Mexico, with permission to work legally in the US.:

$$V_4(S(t), t) = R_4(t) + \psi + \beta E_3 4 \max [V_3(S(t+1), t+1) - c_{43}, V_4(S(t+1), t+1)],$$

The agent can stay in Mexico, or go to the US, paying the migration cost.

In these value function definitions, the following expected value functions are used:

Expected value of illegal migration from Mexico to the US:

$$W_{12}(S(t), t) = p_{12} (E_2 V_2(S(t), t) - c_{12s}) + (1 - p_{12}) (V_1(S(t), t) - c_{12f})$$

The agent may succeed and enter illegally in the US. or be caught and stay in Mexico. In both cases there are specific migration costs to be paid.

Expected value of legal migration from Mexico to the US:

$$W_{13}(S(t), t) = p_{13} (E_3 V_3(S(t), t) - c_{13s}) + (1 - p_{13}) (V_1(S(t), t) - c_{13f})$$

The agent's application may be accepted and then he or she enters legally in the US,

or be rejected and stay Mexico. In both cases there are specific migration costs to be paid.

Expected value of staying illegally in the US.

$$W_{22}(S(t), t) = p_{22}V_2(S(t), t) + (1 - p_{22})(E_1V_1(S(t), t) - c_{21})$$

The agent may be caught and sent back to Mexico, having to pay migration costs, or stay in the US. illegally.

Expected value of attempting to become a legal immigrant in the US:

$$W_{23}(S(t), t) = p_{23s}E_3V_3(S(t), t) + p_{23f}V_2(S(t), t) + (1 - p_{23s} - p_{23f})(E_1V_1(S(t), t) - c_{23})$$

The agent may succeed and become a legal immigrant, be caught stay illegally in the US. or be caught and sent back to Mexico, having to pay the associated migration costs.

In a similar fashion as in the standard search model with an arrival rate while unemployed, here it is possible to disentangle the migrational transition into a ‘voluntary’ component, that is, the decision to migrate, and an ‘unvoluntary’ component, the probability of being caught or that the legal migration application is rejected. This insight will prove important for analyzing counterfactual scenarios and the individuals’ reactions to them.

## 4 Data

The model will be estimated using data from the Mexican Migration Project (MMP). The MMP 118 consists in data from 118 Mexican communities that have been sur-



veyed since 1982. The survey changes the sampled community every year. Within the community, the survey takes a random sample of the community. The survey collects a wide range of information about the individuals, the households and the communities. In particular, it collects retrospective information about the migration history of all household members.

This information includes the costs of migration, the number of attempts, the migratory status of the individuals, whether the individual received help from a social network, and the labor history of the individuals. The data set also includes information on the first wage and the last wage that the individuals obtained in the US, as well as on the last wage that the individual obtained in Mexico.

The main advantages of using this data set is the richness in the information gathered about the migratory process, in particular we can obtain with this data set important aspects of the migration process that we are interested on like: monetary migration costs, social networks that can help reduce costs, probability of successfully crossing the border, and a measure of the wage differential for the individuals analyzed. The main disadvantages in using this data set are that the panel data is formed with retrospective information, that the survey changes every year its location, and that the data is not nationally representative of Mexico.

This research will use the information on location, legal status, age and earnings for the individuals to estimate the behavioral parameters of the model. These data allow the model to account also for unobserved heterogeneity, which will be a meaningful extension of the benchmark theoretical model.

This model does not admit an analytical solution; therefore, a numerical solution is performed by backward recursion.

## 5 Estimation

The estimation strategy is designed to recover the behavioral parameters of the theoretical model. Individuals start off their careers at age 15 in Mexico, without a permission to work legally in the US. They retire at age  $T = 60$ , but the estimation is only performed until age 45. For each parameter set the policy rules that solve the DP problem are computed and used to generate simulated individual trajectories. Then, at each iteration of the parameter computation a measure of distance between the observed and the simulated moments is constructed. The estimation is a Simulated Method of Moments (SMM) procedure in which the parameter estimates of the theoretical model are the minimizers of this function.

The parameters to be estimated are  $\Theta = \{\psi, \mathbf{c}, \mathbf{pe}, \Omega\}$ , that is, preference for origin, 9 migration costs, 5 migrational and legal status arrival rates, 16 initial location and legal status specific endowments and returns to experience, and the 4 standard deviations and 6 correlations of the location shocks. The moments used in this estimation are the cell-by-cell probability masses for the following migration and employment distributions, as well as earnings moments:

1. migration and legal status flows (30 years  $\times$  5 moments=150),
2. earnings moments in the US (2 years  $\times$  4 moments=8),
3. earnings moments in Mexico (1 year  $\times$  4 moments=4).

Thus, there are 162 moments to estimate 51 parameters. The SMM procedure relates a parameter set to a weighted measure of distance between sample and simulated moments:

$$S(\Theta) = \Delta m' W^{-1} \Delta m,$$

where  $\Delta m$  is the distance between each sample and simulated moment and  $W$  is a weighting matrix. The estimated behavioral parameters are thus  $\hat{\Theta} = \arg \min S(\Theta)$ .

The identification of the parameters of this function is given by employment and location transitions as well as wage data.

The function is minimized using Powell's method (Press et al.), which requires only function evaluations, not derivatives. Asymptotic standard errors are calculated using the outer-product gradient estimator.

## 6 Results and Policy Experiments

Once the results are obtained the usual graphical comparison of the model's predictions and the data as well as goodness-of-fit tests will be performed. It is expected a good fit of this model. Conditional on these results, the extension to allow for unobserved heterogeneity will be considered.

Then, this research uses the model's estimated parameters to evaluate the response of migration rates to a number counterfactual scenarios, which include possible policy interventions:

1. increasing legal and illegal migration costs from Mexico to the US,
2. increasing the cost of becoming legal once in the US,
3. subsidizing return migration to Mexico,
4. an improvement of the Mexican labor market and a worsening of the US labor market.

Some interesting combinations of these policies, such as

1. increasing the cost of illegal immigration while simultaneously reducing the cost of legal immigration,
2. increasing the cost of illegal immigration while simultaneously subsidizing return migration,

3. increasing the cost of legal and illegal immigration,  
are also analyzed.

## **7 Conclusions**

To be written.

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