Li *IZA Journal of Migration* (2016) 5:2
DOI 10.1186/s40176-016-0051-5

IZA Journal of Migration
a SpringerOpen Journal

ORIGINAL ARTICLE Open Access

The determinants of Mexican migrants' duration in the United States: family composition, psychic costs, and human capital

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Abstract

This paper analyzes the determinants of migration duration focusing on family composition and human capital. A utility maximization model is built to show that migrants face a trade-off between avoiding psychic costs from leaving family members and accumulating wealth to support their consumption. The empirical analysis on Mexican men's US experience carried out using the hazard model shows that marriage and children, which imply a heavier financial burden, are negatively associated with migrants' duration in the USA. Fathers with more young children under age 12 stay even shorter, because taking care of them is time intensive.

Jel codes: F22; O15; J12

Keywords: Family composition, Psychic costs, Human capital, Cox proportional hazard model

1 Introduction

Economic incentives, including the wage differentials and the difference in living costs, determine the length of migration duration (Dustmann 2003b; Reyes 2001). In the meantime, psychic costs, which exist throughout migrants' stay in the host country, also play a critical role.

People genuinely enjoy the company of family members and friends. Traveling to a new place and leaving familiar surroundings involve psychic costs, which are different from monetary costs and difficult to measure. The psychic costs of most economic migrants come from staying abroad without the company of their family members. Also, the migration decision could be a family decision (Mincer 1978). The relationships between family composition, psychic costs, and the length of migration duration, which have not been widely researched, merit further exploration.

Dustmann (2003a) reports that parents' return intentions respond differently to children's gender. Bijwaard and van Doeselaar (2014) indicate that divorce and remarriage increase return of family migrants from less-developed countries and decrease return from developed countries. The model in Dustmann (2003a) presumes children travel with their parents, but this is not a very common case for temporary economic migrants, such

as many Mexican migrants in the USA. Economic migrants seeking for economic opportunities in the host country account for a big proportion of migrant population, while they are not discussed by Bijwaard and van Doeselaar (2014).

My paper contributes to the literature by showing that, facing a trade-off between low psychic costs and high household consumption levels, migrants make duration decisions based on their marital status, the number of children, and the age and the gender of children. Most economic migrants are not financially desperate and they value family time as they do wealth, thus family composition plays a role at least as important as economic motivations. The empirical study, employing the hazard model (survival analysis) to analyze the determinants of migration duration of male Mexican migrants in the US, supports my hypotheses. Marriage and children shorten migrants' foreign experience. Different from family migrants in Netherlands (Bijwaard and van Doeselaar 2014), Mexican migrants stay longer in the USA if they are divorced, single or in a consensual union, compared to married migrants. Different from immigrant in Germany (Dustmann 2003a), Mexican fathers' US duration does not differ significantly by the gender of children, although it seems that fathers prefer to return sooner from the USA for the presence of sons, rather than daughters.

The fact that human capital affects individual's psychic costs and wage rates provides a new perspective on the relationship between education level and migration duration, which differs by country of origin in the literature (Dustmann and Görlach 2014). Regarding Mexico-US migration, the empirical results indicate the existence of a threshold year of schooling: the length of migration increases as years of schooling rise from low levels to around 11 years, and then declines as years of schooling increase to levels above the threshold.

Other determinants, including migrants' legal status and economic conditions, are also considered. The remainder of the paper is organized as follows. Section 2 develops hypotheses and builds a utility maximization model to analyze how family composition and human capital affect migration duration. Section 3 shows the Mexican Migration Project (MMP) data and the empirical strategy—the hazard model. Section 4 displays results. Section 5 is a summary and discussion.

2 Hypotheses and utility maximization

Many migrants move to the destination for economic opportunities rather than family reunion. Their family members usually wait in the home country because of the higher living costs in the destination, especially when migrants plan to return. As migrants accumulate human capital and host country currency, they have to deal with the psychic costs associated with leaving their families at the same time, which decrease their utility in the host country. Therefore, they face a trade-off between offering financial support to the family and avoiding psychic costs.

2.1 Optimal duration

A simple model can be developed to illustrate the relationships among psychic costs, family composition, and optimal migration duration. Following Dustmann (2003b), assume migrants enter a more developed country at time point 0 and standardize their life span to 1. They decide to stay in the host country for a time period, t, to maximize their lifetime utility, U. I bring family members to the framework and consider a family unit

consisting of a migrant and N other family members.[1] Suffering psychic costs from being separated from family members, the migrant's utility in the host country discounts at a discounting factor $s(N)$. It also denotes the percentage of utility that the migrant finally obtains; $0 \leq s(N) \leq 1$. As more family members present in the household, the percentage decreases: $s'(N) < 0$. The lifetime utility becomes:

$$U = t\nu(C_f, \alpha)s(N) + (1-t)\nu(C_h, \beta) \tag{1}$$

where ν is the utility function for migrants. C_f indicates the migrant's consumption in the host country (foreign country), and C_h is the migrant's consumption in the home country. α and β give the preference of this migrant for consumption in the host country and home country, respectively. It is assumed that migrants enjoy consumption in the home country more: $\beta > \alpha$. Marginal utilities are positive: $\nu'_f(C_f, \alpha) > 0$ and $\nu'_h(C_h, \beta) > 0$. Diminishing marginal utility suggests that $\nu''_f(C_f, \alpha) < 0$ and $\nu''_h(C_h, \beta) < 0$ (Dustmann 2003b).

Migrants maximize their lifetime utility with respect to C_f, C_h, and t, subject to the inter-temporal budget constraint:

$$tw_f + (1-t)w_h - tC_f - (1-t)pC_h - p\hat{C}_h N = 0 \tag{2}$$

where w_f and w_h indicate wage rates in the host country and home country, respectively; p denotes the price for consumption in the home country, relative to the host country. If consumption in the foreign country is more costly than consumption in the home country, $p < 1$. Migrants give a fixed amount of money to each family member, $\hat{C}_h$. For example, if a migrant has several children in the home country, the costs of raising each child could be roughly fixed, although later we will see that the costs of raising children change by their age and gender.

Solving the utility maximization problem with the budget constraint, the First Order Conditions (FOCs) are

$$\nu(C_f, \alpha)s(N) - \nu(C_h, \beta) + \lambda(w_f - w_h - C_f + pC_h) = 0 \tag{3}$$

$$\nu'(C_f, \alpha)s(N) - \lambda = 0 \tag{4}$$

$$\nu'(C_h, \beta) - p\lambda = 0 \tag{5}$$

where λ denotes the marginal utility of wealth: $\lambda > 0$.

Equation (3) is the equilibrium condition, which determines the optimal migration duration. $w_f - w_h - C_f + pC_h > 0$, because an additional unit of time in the host country increases a migrant's lifetime wealth (Dustmann 2003b). $\nu(C_h, \beta) - \nu(C_f, \alpha)s(N) > 0$, this suggests that the forgone utility of staying a further unit of time abroad is positive because migrants cannot consume goods in the home country ($\beta > \alpha$) and they miss family members. Combining these FOCs with Eq. (2), the optimal duration in the host country can be solved.

Comparative statistics with respect to the model parameters are the following:

$$\frac{\partial t}{\partial N} = \frac{-s'(N)}{\Delta^2}\left[\frac{t\nu(C_f, \alpha) + t\nu'(C_f, \alpha)\Delta}{s(N)\nu''(C_f, \alpha)} + \frac{(1-t)p^2\nu(C_f, \alpha)}{\nu''(C_h, \beta)}\right] + \frac{p\hat{C}_h}{\Delta} \tag{6}$$

$$\frac{\partial t}{\partial w_f} = -\frac{\lambda}{\Delta^2}\left[\frac{t}{s(N)\nu''(C_f, \alpha)} + \frac{(1-t)p^2}{\nu''(C_h, \beta)}\right] - \frac{t}{\Delta} \tag{7}$$

$$\frac{\partial t}{\partial w_h} = \frac{\lambda}{\Delta^2}\left[\frac{t}{s(N)v''(C_f,\alpha)} + \frac{(1-t)p^2}{v''(C_h,\beta)}\right] + \frac{(t-1)}{\Delta} \tag{8}$$

where $\Delta = w_f - w_h - C_f + pC_h > 0$.

Then $\frac{\partial t}{\partial w_h} < 0$, the higher the wage rates in the home country, the shorter the migrants would stay in the host country. But the sign of $\frac{\partial t}{\partial w_f}$ is ambiguous. If the wage rates in the host country are higher, the income effect encourages migrants to return sooner, but the substitution effect suggests migrants to stay longer in the host country to enjoy the wealth (Dustmann 2003b).

The focus is on the sign of $\frac{\partial t}{\partial N}$. The first part on the right hand side of Eq. (6) is negative, since $s'(N) < 0$ and $\Delta > 0$, while the formula in brackets is negative because of the diminishing marginal utility assumption. The second part, $\frac{p\hat{C}_h}{\Delta}$, is positive. If the financial costs of supporting family members in the home country, $\hat{C}_h$, are sufficiently high, $\frac{\partial t}{\partial N}$ could be positive, migrants would stay longer in the host country to accumulate money for family members' consumption. When the absolute value of marginal discounting factor, $s'(N)$, is high enough, $\frac{\partial t}{\partial N}$ could be negative: an extra family member leads to a great decrease in the entire utility in the host country, migrants return sooner.

In the above model, these family members refer to children appropriately, because they are assumed to have zero income. In fact, changing the setup of the model does not change the implication greatly as I include adult family members' income.

Assume family members have an income, w_m, in the home country (m is short for member). Relax the assumption of a fixed amount of financial support to family members. Assume family members' consumption at home, C_m, affects migrants' lifetime utility. Then migrants make decisions over C_m, as well as t, C_f, and C_h, to maximize the utility function:

$$U = tv(C_f,\alpha)s(N) + (1-t)v(C_h,\beta) + v(C_m,\gamma)N \tag{9}$$

with the budget constraint:

$$tw_f + (1-t)w_h + w_mN - tC_f - (1-t)pC_h - pC_mN = 0, \tag{10}$$

then,

$$\frac{\partial t}{\partial N} = \frac{-s'(N)}{\Delta^2}\left[\frac{tv(C_f,\alpha) + tv'(C_f,\alpha)\Delta}{s(N)v''(C_f,\alpha)} + \frac{(1-t)p^2v(C_f,\alpha)}{v''(C_h,\beta)} + \frac{p^2v(C_f,\alpha)N}{v''(C_m,\gamma)}\right] + \frac{pC_m - w_m}{\Delta}. \tag{11}$$

Again, the term in brackets is negative and the sign of $\frac{\partial t}{\partial N}$ is ambiguous. If these family members can fully financially support themselves, $w_m - pC_m > 0$, then $\frac{\partial t}{\partial N} < 0$, migrants with more family members have shorter stays. Once the migrants need to offer financial support to these family members, $w_m - pC_m < 0$, migrants with more family members may have to stay longer, suffering the psychic costs, if $\frac{\partial t}{\partial N} > 0$.

Combining Eqs. (6) and (11), the number of family members can be divided into i different groups, g_i, based on their income and consumption. The sign of $\frac{\partial t}{\partial N_{g_i}}$ is decided by the change in utility caused by psychic costs and the financial conditions of family members in each group. Regarding the family composition, migrants face a trade-off between avoiding high psychic costs and improving household consumption.

2.2 Marital status

Hypothesis 1: Unmarried migrants stay longer in the destination country than married migrants.

In Eq. (11), when the migrants are unmarried, $N = 0$ and $w_m - pC_m = 0$, then $\frac{\partial t}{\partial N}|_{N=0} < 0$. Married migrants whose spouses earn more than their consumption face $w_m - pC_m > 0$, then $\frac{\partial t}{\partial N}|_{N=1} < 0$. Married migrants ($N = 1$) will stay shorter than unmarried migrants ($N = 0$).

If married migrants' spouses cannot afford to live on their own, $w_m - pC_m < 0$, the sign of $\frac{\partial t}{\partial N}|_{N=1}$ is ambiguous. If it is negative, hypothesis 1 holds. If it is positive, there is a $N^* \in (0, 1)$ satisfying $\frac{\partial t}{\partial N}|_{N=N^*} = 0$, then the effect of marriage on the length of duration is an empirical question.

The fact that most migrants are males rather than females, especially in Mexico-US migration, is consistent with the model to some degree. Traditionally, men support the family financially while women do most of the housework (Becker 1985). This labor division in a family suggests a low labor market participation of women. Married women with their husbands supporting the family financially may not migrate ($w_m - pC_m > 0, t = 0$), while married men, compared to women, are more willing to migrate to accumulate human capital and wealth ($w_m - pC_m < 0, t > 0$).

2.3 Children

2.3.1 Number of children

Hypothesis 2: With more children in the home country, migrants have shorter migration stays than those with fewer children do.

Migrants with no child face zero psychic costs from being concerned about their children: in Eq. (6), $\frac{\partial t}{\partial N}|_{N=0} < 0$. When $N > 0$, the sign of $\frac{\partial t}{\partial N}$ is ambiguous. The higher the costs of raising a child, the greater $\frac{p\hat{C}_h}{\Delta}$ is. Once these costs are high enough to make $\frac{\partial t}{\partial N} > 0$, one more child in the family implies a longer migration duration of the parent.

However, the costs of raising children are actually not fixed because of the economies of scale in raising children. The marginal money costs and time costs of raising children are diminishing (Holmes and Tiefenthaler 1997; McClements 1977): $\frac{\partial(p\hat{C}_h)}{\partial N} < 0$. Then the greater the N, the more likely that $\frac{\partial t}{\partial N}$ is negative.

2.3.2 Age of children

Hypothesis 3: Migrants who are parents of younger children (babies or primary-school-age children) return sooner than migrants whose children are older.

The money and time costs of raising children change by children's age. Adult children are supposed to be financially independent: $w_m - pC_m = 0$ in Eq. (11). They are not the main reason for the psychic costs of migrants: $s'(N) = 0$ when N represents adult children. Then $\frac{\partial t}{\partial N(\text{Adult Children})} = 0$, these adult children would not affect their parents' migration duration theoretically. In reality, the duration will be affected due to parents' concern for adult children and the money flows between them. If adult children help to take care of migrants' younger children, migrants may stay abroad longer because of the reduced psychic costs.

Young children need both financial support and companionship from parents. Generally, among children under 18, older children are more expensive than younger ones,

excluding child labor in some poor countries. According to the annual report of Expenditures on Children by families from the United States Department of Agriculture (USDA), the annual expenditures overall in the United States on a child aged 12–17 years is about 10–20 %[2] per year higher than that on a child aged 0–11 years.[3] Specifically, the difference in consumption on food and health care captures the expenditure gap between younger children and older ones, while the expenditures on education do not change much by children's age. However, in Mexico, the costs of secondary school are about 35 % higher than primary school (Wolff and Gurría 2005), thus the costs of raising a younger child may be much lower than an older child: $p\hat{C}_{\text{Little Children}} < p\hat{C}_{\text{Older Children}}$.

In the meantime, migrants' psychic costs change by the age of their children. Time costs are directly related with these psychic costs, since spending time with children is an efficient way for parents to build a close bond with them and reduce psychic costs. Parents' time spent with their children usually decreases as their children grow up (Bittman 1999).[4] Babies need to be taken care of all the time; primary school-aged children are not quite involved in heavy homework load compared with high school-aged children. They may have higher demand for parents' time, resulting in lower discounts for migrants compared to older children, $\frac{\partial(s'(N))}{\partial(\text{Age of the Additional Child})} > 0$. Their parents return sooner.

In sum, raising younger children is time intensive, while raising children in secondary school is money intensive. Migrants with older children may stay longer in the host country than migrants who have younger children at home.

2.3.3 Gender of children

Hypothesis 4: Children's gender affects parents' migration duration. The effects change by the home country.

Dustmann (2003a) finds that migrants traveling with daughters stay shorter abroad than migrants traveling with sons, because migrants may want daughters to preserve traditions in the home country while sons to pursue future economic careers in the host country. However, the story may vary by country because of different cultures. For example, with a dowry culture, the difference in the costs of raising a child by gender may highly depend on price and dower of the future bride.

Mexico has a patriarchal culture (Massey et al. 2006), thus parents may intend to spend more money and time on their sons than daughters. Their US duration may differ by the gender of children.

2.3.4 Family migration decisions

The model above assumes that migrants travel alone, while family members may travel with them to the host country. Balancing the lower psychic costs and heavier financial burden due to migrating family members, how migrants make migration duration decisions is an empirical question.

In Mexico, males, who are more economically active, dominate the migration flow to the USA. Their wives usually travel to the USA for family reunion reasons, rather than economic motivations. In the meantime, to avoid the risky change in occupation, wives without a well-paid job in Mexico may have more incentives to travel because of the lower opportunity costs, compared to those with a good job. The negative selection and females' lower labor force participation rate imply that the possible income decline from these

spouses traveling may not be economically significant. When the increase in utility from the companionship is higher than the decrease in utility from increased living costs and declined income of their wives, migrants traveling with wives stay longer abroad than those with wives waiting in the home country. Once their wives can get a good job in the host country, the migrants would stay even longer.

Children, without an income for the family, would bring migrants a much heavier financial burden than migrating spouses if children live in the host country. The amount of money spent on children is supposed to be larger than that on spouses, because parents invest in their children, rather than just offer them basic financial supports. If the psychic costs associated with children are the same as the psychic costs associated with spouses, migrants traveling with children but without spouses may have a shorter stay than migrants traveling with spouses but without children, since supporting a child in the host country is more costly.

When migrants travel alone, to reduce psychic costs, they may make multiple trips, leading to a longer total duration. Furthermore, family composition may change by migrants' experience in the host country.

In addition, people may make marital decisions, fertility decisions, and migration decisions simultaneously. If they decide to stay long in the host country, they may prefer to be single or have no children. The causality between family composition and migration duration is unclear.

2.4 Human capital

The above model also suggests that human capital, which mainly affects migrants' earnings, would be an important determinant of migration duration. The higher the education level (E), the greater the wage rates: $\frac{\partial w_i}{\partial E} > 0, i = f \ or \ h$. The effect of education level on the migration duration can be expressed as

$$\frac{d\,t}{d\,E} = \frac{\partial t}{\partial w_f}\frac{\partial w_f}{\partial E} + \frac{\partial t}{\partial w_h}\frac{\partial w_h}{\partial E}. \tag{12}$$

The sign of $\frac{d\,t}{d\,E}$ is ambiguous, because $\frac{\partial t}{\partial w_h} < 0$ in Eq. (8) while the sign of $\frac{\partial t}{\partial w_f}$ in Eq. (7) is uncertain. When $\frac{\partial t}{\partial w_f} < 0$, $\frac{d\,t}{d\,E} < 0$. Migrants with more years of schooling return to their home country sooner.

When $\frac{\partial t}{\partial w_f} > 0$, the sign of $\frac{d\,t}{d\,E}$ depends on the comparison of the absolute values of the two components on the right-hand side of Eq. (12). The value of $\frac{\partial w_f}{\partial E}$ may be highly related to the matching of migrants' job search in the host country. Low-educated migrants are usually undereducated for their jobs compared to native workers, while high-educated migrants are often overeducated (Chiswick and Miller 2008).[5] An extra year of schooling improves the matching in labor market for undereducated migrants, while it impairs the matching for overeducated migrants. Also, Mincer Equation implies that $\frac{\partial^2 w_f}{\partial E^2} < 0$ (Mincer 1974) if E represents labor market experience. Then it is quite possible that $\frac{\partial w_f}{\partial E}|\text{undereducated} > \frac{\partial w_f}{\partial E}|\text{overeducated}$ or $\frac{\partial w_f}{\partial E}|\text{low } E > \frac{\partial w_f}{\partial E}|\text{high } E$. When $\frac{d\,t}{d\,E}|\text{low } E > 0 > \frac{d\,t}{d\,E}|\text{high } E$, there is probably a threshold education level for migrants. The length of migration increases as education levels rise up from low values to the threshold and then declines as education levels climb to values beyond the threshold.

However, if $\frac{dt}{dE}|\text{low } E < 0 < \frac{dt}{dE}|\text{high } E$, the threshold may still exist, but the story on each side may change.

Human capital would also be associated with migrants' psychic costs. For example, better host country language skills, which raise migrants' earnings in the host country (Chiswick 1998; Dustmann and Van Soest 2002), help migrants to adapt to the new environment at the same time, probably leading to lower psychic costs.

2.5 Other determinants

The higher the costs of migration are, the longer time period in the host country is needed to achieve a positive net present value of migration (Chiswick 1999). A longer distance between the origin and destination, usually suggesting more expensive trips in time if not also in money, leads to fewer trips and a longer duration for each trip. In addition, the legal status of migrants is highly correlated with migration costs and economic opportunities in the host country, influencing the migration stay.

Other determinants of Mexican migrants' US duration include migrants' characteristics, exchange rates, economic conditions, and immigration policies. How migrants get a job abroad reflects their abilities and social connections. The exchange rates have both an income effect and substitution effect: if US Dollars are more valuable compared with Mexico Pesos, the income effect of higher exchange rates suggests migrants to return sooner, since the US Dollars they earn in the host country give more pesos in Mexico; however, the substitution effect attracts migrants to stay longer for more expensive currency. Furthermore, if the unemployment rates are high in the US but low in Mexico, migrants may return sooner because finding a job may be more difficult in the US than in Mexico. Regarding the US immigration policy, Immigration Reform and Control Act (IRCA), which was enacted in 1986 in the US, reformed the US immigration law. Requiring employers to attest to their employees' migration status and making it illegal to knowingly hire or recruit illegal migrants, the IRCA affects migrants' job opportunities in the US.

3 Data and empirical strategy

3.1 Data source

The data for the empirical study are from the Mexican Migration Project (MMP), which is a unique source of data on the contemporary Mexican immigration to the United States.[6] It is specially designed to capture the experiences of those who transit back and forth between Mexico and the US. Each year, the MMP randomly samples households in 3–5 communities located throughout Mexico when seasonal migrants tend to return home. Following completion of the Mexican surveys, interviewers travel to destination areas in the US to survey 10–20 out-migrant households from the same communities. Although the MMP is not strictly representative of migrants in Mexico, it offers data with a high degree of representativeness at the community level, and it provides information on the labor history of migrants and detailed information on their first and last US trips.

To capture unobserved heterogeneity among individuals, I focus on migrants' all US trips. In addition, to explore possible determinants, I study the duration of migrants' first and last US trips due to their better records, especially the last trip.[7]

My sample includes male migrants aged 15–65 who were household heads surveyed during the years 1982–2013, dropping females because of its small proportion. Excluding

observations that have missing values for key variables in the analysis, I get 5374 migrants' 17,052 trips to the US; 4894 migrants for the last US trip; 3729 migrants for the first US trip.

Empirically, the main questions can be rephrased as: How does the family composition affect Mexican migrants' duration in the US? What is the relationship between migrants' migration duration and their education level? How do other determinants influence the migration duration?

3.2 Hazard model

Return migrants' duration in the US is known and certain (uncensored observations), while the duration of migrants who have not yet returned from their current trip in the US is not completed (censored observations). Apparently, ordinary least squares (OLS)-related specifications are not applicable mainly because they do not distinguish between censored and uncensored observations. Therefore, to test my hypotheses, I use the hazard models, which are widely used in the literature of migration (Aydemir and Robinson 2008; Bijwaard 2010; Bijwaard and van Doeselaar 2014; Bijwaard et al. 2014; Dustmann and Weiss 2007; Kırdar 2009; Orrenius and Zavodny 2005).[8] The following is an explanation for the Cox proportional hazard model that I borrow from Cleves (2008).

Let T be a non-negative random variable indicating time until return. It has a probability density function, $f(t)$, and a cumulative distribution function $F(t) = Pr(T \leq t)$. Then the hazard function, *h(t)*, represents the instantaneous possibility of return conditional on stay in the host country to time *t*,

$$h(t) = \lim_{t \to 0^+} \frac{Pr(t \leq T \leq (t + \Delta t) | T \geq t)}{\Delta t} = \frac{f(t)}{S(t)}$$

where $S(t) = 1 - F(t)$ is the the survival function, showing the probability that T is at least as great as a value *t*.

Define the cumulative hazard function, $H(t) = \int_0^t h(u)du$, then $S(t) = \exp(-H(t))$.[9]

3.3 Explanatory variables and interpretation

In this paper, the hazard function depends on a vector of explanatory variables X with unknown coefficients β. The hazard function is factored as

$$h(t|X) = h(t) \exp(\beta' X),$$

the possibility of return is allowed to vary with exogenous variables. I focus on the family composition, education level, and some other determinants of migrants' hazard rate to return or migration duration. The definition of variables of interests is in Table 1. All explanatory variables, except for *Spouse Visit* and *English Proficiency*[10], are measured upon migrants' arrival in the USA for each trip. The aim is to avoid the the time-variance and endogeneity of these variables. Also, these variables are relatively stable over time. More specific information about how the Cox model is estimated is shown in Appendix.[11]

The sign of the coefficient indicates how an explanatory variable affects the hazard rate. The hazard ratio (HR) can be calculated by exponentiating the coefficient. If β is positive, $\text{HR} = \exp(\beta > 0) > 1$, then one unit increase in variable X increases the hazard by $\text{HR} - 1$ and therefore decreases the migration duration. If the coefficient β is negative, $\text{HR} = \exp(\beta < 0) < 1$, then one unit increase in variable X decreases the hazard by

Table 1 Definition of variables

Variables	Definition
Duration of each (the last) US trip (months)	Individual's duration for each (the last) US trip
Entire US duration (months)	Individual's entire US duration for all US trips
Age (years)	Individual's age at the time of migration
Years of schooling	Individual's year of schooling at the arrival year of each (the last) US trip
Consensual union	Dichotomous variable = 1 if individual is in a consensual union at the arrival year of each (the last) US trip
Never married	Dichotomous variable = 1 if individual has never married before the arrival year of each (the last) US trip
Once married not now	Dichotomous variable = 1 if individual has once married but is not married at the arrival year of each (the last) US trip
Currently married	Benchmark Dichotomous variable = 1 if individual is married at the arrival year of each (the last) US trip
Num. of children	Number of children at the arrival year of each (the last) US trip
Num. of children under 18	Number of children under 18 at the arrival year of each (the last) US trip
Number of adult children	Number of children over 18 at the arrival year of each (the last) US trip
Num. of adult daughters	Number of daughters over 18 at the arrival year of each (the last) US trip
Num. of adult sons	Number of sons over 18 at the arrival year of each (the last) US trip
Num. of daughters under 18	Number of daughters under 18 at the arrival year of each (the last) US trip
Num. of sons under 18	Number of sons under 18 at the arrival year of each (the last) US trip
Num. of children aged 0–4	Number of children aged 0–4 at the arrival year of each (the last) US trip
Num. of children aged 5–8	Number of children aged 5–8 at the arrival year of each (the last) US trip
Num. of children aged 9–12	Number of children aged 9–12 at the arrival year of each (the last) US trip
Num. of children aged 13–16	Number of children aged 13–16 at the arrival year of each (the last) US trip
Num. of children aged 17–18	Number of children aged 17–18 at the arrival year of each (the last) US trip
Num. of children under 18 traveling	Number of children under 18 traveling with their parents at the arrival year of each (the last) US trip
Num. of children under 18 waiting	Number of children under 18 staying in the home country at the arrival year of each (the last) US trip
Num. of adult children traveling	Number of children over 18 traveling with fathers at the arrival year of each (the last) US trip
Num. of adult children waiting	Number of children over 18 staying in the home country at the arrival year of each (the last) US trip
Num. of sons under 18 traveling	Number of sons under 18 traveling with fathers at the arrival year of each (the last) US trip
Num. of daughters under 18 traveling	Number of daughters under 18 traveling with fathers at the arrival year of each (the last) US trip
Num. of sons under 18 waiting	Number of sons under 18 staying in the home country at the arrival year of each (the last) US trip
Num. of daughters under 18 waiting	Number of daughters under 18 staying in the home country at the arrival year of each (the last) US trip
Spouse traveling with	Dichotomous variable = 1 if migrant's wife travels with him at the arrival year of each (the last) US trip

Table 1 Definition of variables *(Continued)*

Spouse visited	Dichotomous variable = 1 if migrant's wife visits him in each (the last) US trip
Spouse waiting	Benchmark: no wife or wife not traveling with them at the arrival year of each (the last) US trip and not visiting
Number of US trips	Individual's accumulated number of US trips before each (the last) US trip
Green card or citizenship	Dichotomous variable = 1 if individual holds green card or citizenship when entering the US in each (the last) US trip
Visa	Dichotomous variable = 1 if individual holds a legal visa when entering the US in each (the last) US trip
Travel illegally	Benchmark: no green card, citizenship, nor legal visa
English proficiency (0–4 scale)	Host country language proficiency, 4 indicates the highest English proficiency
IRCA[a]	Dichotomous variable = 1 if individual migrated after 1986
Searched job	Dichotomous variable = 1 if individual gets a job by searching in each (the last) US trip
Contracted job	Dichotomous variable = 1 if individual gets a contracted job when enter the US in each (the last) US trip
Recommended job	Benchmark: dichotomous variable = 1 if individual gets a job by others' recommendation when entering the US in each (the last) US trip
Other job	Dichotomous variable = 1 if individual gets a job in other ways when entering the US in each (the last) US trip
No job	Dichotomous variable = 1 if individual does not have a job in each (the last) US trip
Distance between Mexico and the US (km)	Distance between the states in Mexico and the states in the US
Difference in unemployment rate (US-Mexico)	Unemployment rate at the arrival year in the US-unemployment rate at the arrival year in Mexico
Exchange rate	Exchange rate (USD/Mexican Peso)
Monthly wage in the US (Dollars)	Individual's monthly wage in the US (real)

[a]The Immigration Reform and Control Act (IRCA), enacted November 6, 1986, also known as Simpson-Mazzoli Act, is an Act of Congress which reformed United States immigration law. It was an attempt to solve the immigration problem during 198

$1 - HR$ and increases the duration. The statistical significance of the coefficient indicates the statistical significance of these changes in the migration duration.

3.4 Descriptive statistics

Tables 2 and 3 show the summary statistics for migrants' all US trips and their last US trip, respectively.

In Table 2, the first pair of columns are for the entire sample, in which most of the male household heads (94 %) are married when they migrate. The average number of children under age 18 is 3.02,[12] and average number of children under age 18 who wait in the home country when their fathers travel is 2.97: most of the males travel without children. Also, the average number of sons (1.48) and daughters (1.44) under age 18 are almost the same.[13] On average, the number of children aged 0–4 has the highest mean value among different child age groups. Also, most male migrants move without spouses traveling together (96 % of trips).

Table 2 Summary statistics of MMP male household heads' all US trips

	Entire sample		Uncensored		Censored	
	Mean	STD	Mean	STD	Mean	STD
Duration of each trip (months)	17.79	37.98	14.12*	28.53	71.16	86.81
Age (years)	34.11	9.69	34.16*	9.70	33.37	9.55
Years of schooling	4.27	3.43	4.11*	3.36	6.58	3.62
Consensual union (%)	4	20	4*	19	10	30
Never married (%)	1	11	1*	10	5	21
Once married but not now (%)	0.4	6	0.4*	6	1	11
Currently married (%)	94	23	95*	22	84	36
Num. of children under 18	3.02	2.34	3.07*	2.36	2.24	1.82
Num. of adult children	0.60	1.62	0.60	1.63	0.51	1.49
Num. of daughters under 18	1.44	1.41	1.46*	1.42	1.12	1.26
Num. of sons under 18	1.48	1.43	1.51*	1.45	1.05	1.09
Num. of children aged 0–4	0.96	0.96	0.99*	0.97	0.61	0.75
Num. of children aged 5–8	0.83	0.97	0.84*	0.98	0.55	0.77
Num. of children aged 9–12	0.69	0.97	0.70*	0.98	0.48	0.77
Num. of children aged 13–16	0.53	0.91	0.54*	0.92	0.41	0.74
Num. of children aged 17–18	0.21	0.48	0.21	0.48	0.18	0.44
Num. of children under 18 traveling	0.05	0.33	0.04*	0.29	0.13	0.63
Num. of children under 18 waiting	2.97	2.33	3.03*	2.35	2.11	1.81
Num. of adult children traveling	0.04	0.28	0.04*	0.26	0.08	0.46
Num. of adult children waiting	0.56	1.54	0.57*	1.56	0.43	1.32
Num. of sons under 18 traveling	0.03	0.22	0.03*	0.21	0.07	0.39
Num. of daughters under 18 traveling	0.02	0.17	0.01*	0.15	0.06	0.34
Num. of sons under 18 waiting	1.45	1.42	1.49*	1.44	0.98	1.07
Num. of daughters under 18 waiting	1.42	1.41	1.44*	1.42	1.06	1.24
Spouse traveling with (%)	3	17	3*	16	8	27
Spouse visited (%)	1	11	1*	9	6	24
Spouse waiting (%)	96	20	97*	18	86	35
Number of US trips	6.18	6.57	6.36*	6.66	3.53	4.20
Green card or citizenship (%)	25	43	25*	43	34	47
Visa (%)	15	35	16*	36	3	16
Travel illegally (%)	60	49	60*	49	63	48
IRCA (%)	39	49	36*	48	82	39
Distance between Mexico-US (km)	1418	375	1415*	375	1462	374
US unemployment rate	6.07	1.47	6.09*	1.48	5.81	1.23
Mexico unemployment rate	4.55	1.66	4.62*	1.67	3.78	1.33
Exchange rate	2.60	3.43	2.36*	3.27	5.50	3.99
Num. of observations	17,052		15,954 (94%)		1098 (6 %)	

Source: Data are from the MMP. They cover 143 communities which were surveyed from 1982–2013
STD standard deviation
*Difference between means (uncensored and censored) is significant at the .05 level. Variables *US Unemployment Rate*, *Mexico Unemployment Rate*, *Exchange Rate*, have missing values, thus fewer observations

Some indicators are only available for the last US trip. In Table 3, the average English proficiency for the entire sample is 1.24 which is between 1 (Do not speak, but understand some) and 2 (Do not speak, but understand much).[14] Two percent of migrants have no job, suggesting that most of the sample work to earn money in the USA.[15]

The second pair of columns in Tables 2 and 3 is for the finished US trips (Uncensored), and the last pair of columns is for the unfinished trips (Censored). In Table 3, the second

Table 3 Summary statistics of MMP male household heads' last US trip

	Entire sample		Uncensored		Censored	
	Mean	STD	Mean	STD	Mean	STD
Duration of the last US trip (months)	30.73	58.41	19.33*	38.63	70.18	89.74
Age (years)	34.70	10.03	35.10*	10.08	33.32	9.76
Years of schooling	5.27	3.81	4.90*	3.78	6.54	3.65
Consensual union (%)	7	26	7*	26	9	29
Never married (%)	2	15	1*	11	6	23
Once married but not now (%)	1	8	1	7	1	10
Currently married (%)	90	30	91*	28	84	36
Num. of children under 18	2.70	2.15	2.84*	2.22	2.22	1.82
Num. of adult children	0.66	1.72	0.69*	1.77	0.55	1.53
Num. of daughters under 18	1.31	1.33	1.37*	1.36	1.10	1.22
Num. of sons under 18	1.31	1.63	1.38*	1.33	1.05	1.10
Num. of children aged 0–4	0.79	1.29	0.84*	0.91	0.62	0.76
Num. of children aged 5–8	0.71	0.90	0.75*	0.93	0.55	0.76
Num. of children aged 9–12	0.60	0.89	0.64*	0.92	0.47	0.76
Num. of children aged 13–16	0.50	0.87	0.53*	0.90	0.40	0.75
Num. of children aged 17–18	0.21	0.48	0.22*	0.49	0.17	0.43
Num. of children under 18 traveling	0.07	0.43	0.06*	0.35	0.13	0.62
Num. of children under 18 waiting	2.63	2.16	2.78*	2.22	2.09	1.81
Num. of adult children traveling	0.07	0.42	0.07	0.40	0.09	0.48
Num. of adult children waiting	0.59	1.58	0.62*	1.63	0.46	1.37
Num. of sons under 18 traveling	0.05	0.28	0.04*	0.24	0.08	0.40
Num. of daughters under 18 traveling	0.03	0.22	0.02*	0.18	0.06	0.32
Num. of sons under 18 waiting	1.26	1.28	1.35*	1.32	0.97	1.07
Num. of daughters under 18 waiting	1.28	1.33	1.35*	1.36	1.05	1.21
Spouse traveling with (%)	7	26	5*	23	13	34
Spouse visited (%)	2	13	1*	9	5	22
Spouse waiting (%)	91	29	94*	24	82	39
Number of US trips	3.97	4.96	3.97	5.04	3.97	4.65
Green card or citizenship (%)	22	41	16*	36	42	49
Visa (%)	11	31	14*	34	3	16
Travel illegally (%)	67	47	71*	45	55	50
English proficiency	1.24	1.33	0.99*	1.21	2.11	1.38
IRCA (%)	61	49	55*	50	81	40
Searched job (%)	26	44	25*	43	29	45
Contracted job (%)	12	32	15*	35	3	16
Recommended job (%)	59	49	58*	49	65	48
Other job (%)	1	8	0	7	1	10
No job (%)	2	16	3	16	2	15
Distance between Mexico-US (km)	1401	409	1385*	417	1455	372
US unemployment rate	5.91	1.31	5.94*	1.33	5.82	1.24
Mexico unemployment rate	4.08	1.52	4.18*	1.57	3.76	1.32
Exchange rate	4.30	3.99	3.95*	3.93	5.37	3.97
Monthly wage in the US ($)	1063.59	1175.25	961.76*	857.78	1419.42	1864.64
Num. of observations	4894		3797 (78 %)		1097 (22 %)	

Source: Data are from the MMP. They cover 143 communities which were surveyed from 1982–2013
STD standard deviation
* Difference between means (uncensored and censored) is significant at the .05 level. Variables *US Unemployment Rate*, *Mexico Unemployment Rate*, *Exchange Rate*, *Month Wage in the US* have missing values, thus fewer observations

and last pairs of columns are for return migrants and migrants who are still in the USA at the time of survey (Stayer), respectively. On average, return migrants and stayers differ significantly in many variables: return migrants have a shorter migration duration, have fewer years of schooling, are more likely to be currently married, and have more children under age 18. It seems that migrants with more family members are more likely to return to Mexico. Also, compared with stayers, return migrants tend to be illegal migrants, have lower English proficiency, travel before IRCA, and live in Mexican communities which are closer to their destinations.

4 Hazard model results

4.1 All US trips

The basic results of applying the Cox hazard model to all US trips are presented in Table 4 in which the hazard ratios are reported.[16] Errors are clustered at individual level.[17]

4.1.1 Marital status and children

In Table 4, using the *Currently Married* as the benchmark, *Consensual Union*, *Never Married*, and *Once Married but Not Now* have a hazard ratio which is significantly less than 1. Migrants in these three categories, compared with the currently married, have a lower hazard rate (possibility of return) and a longer duration in the USA. Compared to marriage, consensual union may require less commitment, thus married men may feel more responsible for the family and more obligated to return. Never married men have the lowest hazard, and thus the longest stay. The divorced or separated or widowed migrants in the category *Once Married but Not Now* have a shorter stay than never married migrants, but the difference is not significant.

In Table 4 column (2), one more child under 18 increases fathers' hazard by 1.90 %, leading to a shorter stay in the USA. Though an extra child causes additional financial burden on migrants and encourages them to extend the length of stay, the increased psychic costs drive them to return sooner. Adult children's influence is barely significant.

Table 4 column (3) groups children under 18 by gender. One more son under 18 increases fathers' hazard of returning significantly, while daughters do not have a significant effect though the hazard ratio is greater than 1. Although the difference in hazard ratio (coefficient) is not statistically significant under the Wald test, it may reflect the patriarchal culture in Mexico to some degree. Migrants with sons may feel more of a responsibility to return home to mentor sons than daughters.

In addition, column (4) splits number of children under 18 by age. The number of children aged 0–12 has a hazard ratio which is significantly greater than 1 and different from the hazard ratios of children aged 13–18.[18] Fathers with more children aged 0–12 have shorter stays, when other variables, including *Age*, remain constant. Raising younger children (aged 0–12) is relatively more time intensive and less money intensive.

4.1.2 Other determinants

The results for *Schooling* are consistent across specifications. In Table 4 column (1), one more year of schooling decreases the hazard rate (possibility of return) by 5.35 %.[19]

Table 4 Cox model results for male household heads' duration among all US trips

	(1)	(2)	(3)	(4)
Age	1.002	0.979**	0.980**	0.977**
	(0.007)	(0.010)	(0.010)	(0.010)
Age squared	1.000	1.000	1.000	1.000*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
School	0.945***	0.946***	0.946***	0.949***
	(0.011)	(0.011)	(0.011)	(0.011)
School squared	1.002*	1.002*	1.002*	1.002*
	(0.001)	(0.001)	(0.001)	(0.001)
Consensual union	0.764***	0.764***	0.764***	0.768***
	(0.037)	(0.037)	(0.037)	(0.037)
Never married	0.633***	0.638***	0.636***	0.670***
	(0.080)	(0.082)	(0.082)	(0.086)
Once married but not now	0.675**	0.687**	0.683**	0.705**
	(0.117)	(0.118)	(0.117)	(0.118)
Num. of children under 18		1.019**		
		(0.008)		
Num. of adult children		0.975*	0.974*	0.978
		(0.015)	(0.015)	(0.015)
Num. of daughters under 18			1.008	
			(0.012)	
Num. of sons under 18			1.027**	
			(0.011)	
Num. of children aged 0–4				1.069***
				(0.013)
Num. of children aged 5–8				1.024**
				(0.012)
Num. of children aged 9–12				1.031***
				(0.012)
Num. of children aged 13–16				0.989
				(0.013)
Num. of children aged 17–18				1.007
				(0.021)
Num. of previous US trips	1.045***	1.045***	1.045***	1.045***
	(0.003)	(0.004)	(0.004)	(0.004)
Green card/citizen	0.883***	0.890***	0.889***	0.894***
	(0.035)	(0.035)	(0.035)	(0.036)
Visa	2.118***	2.135***	2.134***	2.125***
	(0.092)	(0.092)	(0.092)	(0.091)
IRCA	0.913***	0.923***	0.922***	0.941**
	(0.023)	(0.024)	(0.024)	(0.024)
Mex US dist	0.9998***	0.9998***	0.9998***	0.9998***
	(0.00003)	(0.00003)	(0.00003)	(0.00003)
Log pseudolikelihood	−139,830.5	−139,815.33	−139,815.18	−139,784.66
Num. of obs	17,052	17,052	17,052	17,052

Source: Data are from the MMP. They cover 143 communities surveyed from 1982–2013
***Significant at 0.01; **significant at 0.05 level; *significant at 0.1 level. Standard errors are reported in parentheses

In addition, having illegal migrants as the benchmark, green card holders or citizens in the USA are expected to stay longer in the USA, because they have gotten the necessary certification to stay legally in the USA as long as they want. Migrants

with legal visas stay shorter than illegal migrants, probably because it is more costly for illegal migrants to cross the border, and they are more willing to extend the US experience to earn sufficient money to cover the higher costs. Also, most of the visa holders get the visa because of contracted jobs. When the contract ends, the migrants have to go home. They cannot make duration decisions as freely as illegal migrants.

4.2 Last US trip

Studying migrants' last US trip helps to understand the selection among migrants on observable variables. The basic results from the Cox hazard model for the male Mexican migrants in their last US trip are presented in Table 5. Migrants stay shorter when they are married, have more children under 18, especially children aged 0–12 and boys.

4.2.1 Human capital

In Table 5 column (1), one more year of schooling decreases the hazard rate (possibility of return) by 8.48 %.[20]

Figure 1 shows the relationship between the hazard of returning and years of schooling, which is a U-shaped graph. The bottom of the graph lies at around 11 years, indicating that duration is an inverted U function with respect to years of schooling with the peak at 11 years. In their last US trip, 92 % migrants have years of schooling under or equal to 11: among those with 11 or fewer years of schooling, the hazard of returning decreases as years of schooling increase. Thus, more educated migrants stay longer in the USA. Migrants with very low education levels may have difficultly to find a good job and fulfill their expectations in the USA, feeling disappointed, so they may return sooner. Among migrants with 11 or more years of schooling, more educated ones stay shorter. It may be easier for them to achieve their targets of earnings in the USA, or get better-paid jobs upon returning because of the lower supply of high educated people in Mexico than the USA. Figure 2 shows the similar graph using the sample with all US trips.

Occupation, which is highly correlated with schooling, is not included in this study, mainly because migrants' occupations in the USA are time-variant and highly endogenous. Having variables for migrants' occupations before migration in the specifications (not shown here), migrants who have Mexican jobs in manufacturing and service sectors stay longer than migrants who are unemployed or have jobs in sales or transportation sectors in Mexico. Migrants who have a professional job in Mexico have the shortest stay. This is consistent with the analysis for schooling. The most educated migrants with professional jobs and the least educated migrants with no job return sooner.

In Table 5 columns (2)–(5), overall, with higher English proficiency, migrants are more likely to stay longer in the USA. The average level of migrants' English proficiency is low.[21] Most of the migrants who have better English skills (more human capital) may adapt to the new environment better, receiving higher wage rates and suffering less psychic costs. In the meantime, longer durations suggest migrants' longer exposures to English (Chiswick 1978), improving their language skills.[22]

Table 5 Cox model results for male household heads' duration in the last trip (selected variables)

	(1)	(2)	(3)	(4)	(5)
Schooling	0.911***	0.957***	0.958***	0.959***	0.961***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)
Schooling squared	1.004***	1.003***	1.003***	1.003***	1.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Consensual union	0.813***	0.823***	0.824***	0.824***	0.825***
	(0.046)	(0.049)	(0.049)	(0.049)	(0.049)
Never married	0.431***	0.456***	0.458***	0.460***	0.470***
	(0.062)	(0.065)	(0.066)	(0.067)	(0.069)
Once married but not now	0.552***	0.584***	0.586***	0.588***	0.604***
	(0.087)	(0.094)	(0.095)	(0.095)	(0.098)
Num. of children under 18			1.019**		
			(0.010)		
Num. of daughters under 18				1.010	
				(0.015)	
Num. of sons under 18				1.033**	
				(0.015)	
Num. of children aged 0–4					1.030
					(0.024)
Num. of children aged 5–8					1.053**
					(0.024)
Num. of children aged 9–12					1.054**
					(0.025)
Num. of children aged 13–16					0.990
					(0.027)
Num. of children aged 17–18					1.007
					(0.042)
Total num. of US trips	1.053***	1.059***	1.060***	1.060***	1.060***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Distance (Mexico-US)	0.9996***	0.9996***	0.9996***	0.9996***	0.9996***
	(0.00004)	(0.00005)	(0.00005)	(0.00005)	(0.00005)
IRCA	1.027	1.078*	1.095**	1.095**	1.115***
	(0.039)	(0.042)	(0.044)	(0.044)	(0.045)
English proficiency		0.714***	0.714***	0.715***	0.715***
		(0.011)	(0.011)	(0.011)	(0.011)
Searched job		0.930*	0.931*	0.929*	0.930*
		(0.035)	(0.035)	(0.035)	(0.035)
Contracted job		1.552***	1.556***	1.556***	1.554***
		(0.109)	(0.109)	(0.109)	(0.109)
Other job		0.694	0.708	0.710	0.718
		(0.166)	(0.168)	(0.169)	(0.168)
No job		1.516**	1.519**	1.506**	1.529**
		(0.299)	(0.304)	(0.303)	(0.308)
Log pseudolikelihood	−28,839.38	−28,539.58	−28,535.69	−28,534.58	−28,528.17
Num. of obs	4894	4894	4894	4894	4894

Source: Data are from the MMP. They cover 143 communities surveyed from 1982–2013
***Significant at 0.01; **significant at 0.05 level; *significant at 0.1 level. Standard errors are reported in parentheses

4.2.2 Other determinants

Tables 4 and 5 show different results for *IRCA*. The possible reason is that migrants who travel before IRCA are different with migrants who travel after IRCA in unobservable factors.

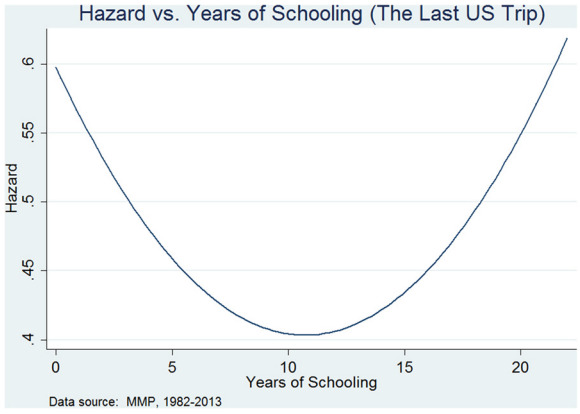

Fig. 1 The relationship between hazard of return and years of schooling is U shaped: migrants with less than 11 years of schooling are more likely to stay in the USA as the years of schooling increases. For migrants whose years of schooling is above 11 years, they are more willing to return as they have more years of schooling. From Table 2, the average years of schooling is 5.27. Also, 92 % of migrants have years of schooling under or equal 11 in the last US trip; so generally, the rate of returning decreases as the education level goes up, and migrants will stay longer in the USA

In Table 5, migrants without a job return sooner than migrants who get their job by recommendation (benchmark), which probably suggests a stronger social network. Also, contracted migrants have to return when they finish their contract; their choices are more limited than migrants who get a job by recommendation or searching by themselves. Migrants who get the job by searching may have higher transferable abilities or higher English proficiency, and they should be able to find jobs by themselves even if they lose the first job in the USA, thus they may have longer stays compared with the benchmark.

After adding exchange rate and unemployment rates in the analysis, Table 6 reports that the substitution effect from a higher exchange rate outweighs its income effect: migrants are willing to stay longer in the USA. The unemployment rate in Mexico or the USA has either a statistically insignificant or an economically insignificant effect on the migration

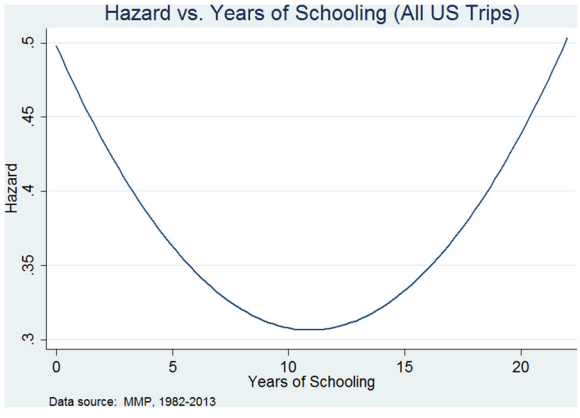

Fig. 2 The relationship between hazard of return and years of schooling is U shaped. From Table 1, the average years of schooling is 4.27. Also, 95 % of observations have years of schooling under or equal 11 in the first US trip; so generally, the rate of returning decreases as the education level goes up, and migrants will stay longer in the US

Table 6 Cox results for male household heads' duration - economic conditions (selected variables)

	All US trips	Last US trip	
	(1)	(2)	(3)
US annual unemployment rate	1.005	1.000	0.984
	(0.009)	(0.018)	(0.021)
Mexico annual unemployment rate	0.876	1.000***	1.000
	(0.749)	(0.00001)	(0.00001)
Exchange rate (USD/Peso)	0.957***	0.968***	0.975***
	(0.005)	(0.007)	(0.008)
Monthly wage in the US			0.999***
			(0.0001)
Wage squared			1.000***
			(3.17e−08)
Log pseudolikelihood	−97,534.874	−24,786.22	−19,546.70
Num. of obs	12,520	4370	3548

Source: Data are from the MMP. They cover 143 communities which were surveyed from 1982–2013
***Significant at 0.01; **significant at 0.05 level; *significant at 0.1 level. Standard errors are reported in parentheses

duration. Also, this table shows that higher wage rates in the USA are associated with longer stays.

Though not shown here, the robustness check with migrants' first US trip shows consistent results with Table 5.

4.3 Robust check with the total duration

In Table 7, I use the total US duration as the dependent variable. Independent variables are measured in migrants' first US trip. All results are consistent with the previous results. Migrants who are married, have more sons under 18 return sooner.

Table 7 Cox results for male household heads' total duration (selected variables)

	(1)	(2)	(3)	(4)	(5)
Consensual union	0.896	0.920	0.924	0.925	0.925
	(0.062)	(0.063)	(0.063)	(0.064)	(0.063)
Never married	0.637***	0.662***	0.679***	0.679***	0.686***
	(0.072)	(0.084)	(0.086)	(0.086)	(0.088)
Once married but not now	0.796	0.804	0.807	0.795	0.808
	(0.140)	(0.148)	(0.154)	(0.154)	(0.157)
Num. of children under 18			1.026**		
			(0.012)		
Num. of daughters under 18				1.005	
				(0.020)	
Num. of sons under 18				1.046***	
				(0.018)	
Num. of children aged 5–8					1.043*
					(0.026)
Total num. of US trips	0.932***	0.932***	0.931***	0.931***	0.931***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Log pseudolikelihood	−23,467.27	−23,221.83	−23,218.50	−23,217.32	−23,214.52
Num. of obs	3614	3614	3614	3614	3614

Source: Data are from the MMP. They cover 143 communities surveyed from 1982–2013
***Significant at 0.01; **significant at 0.05 level; *significant at 0.1 level. Standard errors are reported in parentheses

Number of US Trips is a time-invariant variable in Table 4 (*Num. of Previous US Trips*) for each trip and Table 5 (*Total Num. of US Trips*) for the last US trip . Even having more trips before, migrants experience shorter stays in the each trip.[23] Though migration duration of each trip is shorter, Table 7 shows that the total duration is longer for migrants with more trips.

Furthermore, Table 7 shows that having the same number of US trips, longer distances between migrants' home in Mexico and their destinations in the USA give a longer stay. This is consistent with Tables 4 and 5.

4.4 Adult children take care of young children

Table 8 adds the interaction terms between variables for adult children and children under 18 into regressions. The interaction terms between *Num. of Sons under 18* and *Num. of Adult Children* in columns (1) and (4) have a hazard ratio which is significantly less than 1. Adult children do not have a direct effect on their fathers' migration duration. But they may take care of their younger siblings by spending more time, rather than money, with them. Their caring decreases their fathers' psychic costs and lengthens the duration. However, this only holds true for sons.

The help offered by adult children to look after little children aged 0–4 matters significantly in columns (2) and (5). Taking care of a baby requires more time. With adult children around babies, fathers in the USA take a relief and stay longer.

Adult daughters are more supposed to take care of younger brothers, columns (3) and (6) verify this. Adding the interaction term between *Num. of Adult Daughters* and variables for different age groups for children shows that fathers stay longer if their adult daughters take care of children under 4.

4.5 Traveling or waiting

Table 9 focuses on the story of family members traveling to the host country or waiting in the home country. Columns (1) and (5) split the number of children into the number of children under 18 traveling with their fathers, the number of children under 18 waiting in Mexico, the number of adult children traveling with their fathers, and the number of adult children waiting in Mexico.

Adult children have no significant effect on their father's duration in the USA, regardless of whether they travel or wait. In column (1), one more child under 18 traveling decreases the hazard of returning by 23.5 % (100 − 76.50 %), holding other variables constant, while one more child under 18 waiting in Mexico increases it by 2.33 % (102.33 − 100 %). Having children traveling with, migrants suffer lower psychic costs, which outweigh the increase in the costs of raising children in a more expensive country. Fathers with children in the USA stay longer than fathers having children waiting in the home country.

Though *Num. of Daughters Waiting* has no significant coefficient, the companionship offered by daughters in the host country has an effect as important as sons statistically. This is shown in Table 9 columns (2) and (5), which divides *Num. of Children under 18* by gender and by whether they travel or not.

In columns (3), (4), (7), and (8), I use a dichotomous variable, *Married* (Religious or Civil), to replace the set of dichotomous variables for marital status, and add variables for spouses of household head traveling or waiting. Not married men stay longer

Table 8 Cox results for male household heads' duration - interactions between adult children and children under 18 (selected variables)

	All US trips			The last trip		
	(1)	(2)	(3)	(4)	(5)	(6)
Num. of adult children	0.993	0.980		0.997	0.993	
	(0.019)	(0.019)		(0.018)	(0.019)	
Num. of adult daughters			1.031			0.967
			(0.027)			(0.031)
Num. of adult sons			0.964*			0.982
			(0.021)			(0.024)
Num. of daughters under 18	1.010		1.012	1.014		1.007
	(0.012)		(0.012)	(0.017)		(0.017)
Num. of sons under 18	1.035***		1.036***	1.045***		1.043***
	(0.012)		(0.012)	(0.016)		(0.017)
Num. of daughters under 18 × num. of adult children	0.997			0.997		
	(0.006)			(0.008)		
Num. of sons under 18 × num. of adult children	0.988*			0.984*		
	(0.006)			(0.009)		
Num. of daughters under 18 × num. of adult daughters			0.988			1.010
			(0.010)			(0.013)
Num. of sons under 18 × num. of adult daughters			0.978**	0.984*		0.978*
			(0.010)	(0.009)		(0.013)
Num. of children aged 0–4		1.074***			1.047*	
		(0.013)			(0.025)	
Num. of children aged 5–8		1.022*			1.046*	
		(0.012)			(0.025)	
Num. of children aged 9–12		1.038***			1.064**	
		(0.013)			(0.028)	
Num. of children aged 13–16		0.995			0.996	
		(0.015)			(0.033)	

Table 8 Cox results for male household heads' duration - interactions between adult children and children under 18 (selected variables) *(Continued)*

Num. of children aged 0–4 × num. of adult children		0.971**			0.918***	
		(0.014)			(0.024)	
Num. of children aged 5–8 × num. of adult children		1.007			1.029	
		(0.010)			(0.018)	
Num. of children aged 9–12 × num. of adult children		0.989			0.991	
		(0.008)			(0.015)	
Num. of children aged 13–16 × num. of adult children		0.998			0.998	
		(0.006)			(0.013)	
Log pseudolikelihood	−139,809.08	−139,778.99	−139,803.68	−28,531.94	−28,522.27	−28,510.67
Num. of obs	17,052	17,052	17,052	4894	4894	4894

Source: Data are from the Mexican Migration Project (MMP). They cover 143 communities which were surveyed from 1982–2013
*** Significant at 0.01; **significant at 0.05 level; *significant at 0.1 level. Standard errors are reported in parentheses

Table 9 Cox model results for male household heads' duration considering family members traveling or waiting (selected variables)

	All US trips				The last trip			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Consensual union	0.758***	0.757***			0.818***	0.818***		
	(0.037)	(0.037)			(0.049)	(0.049)		
Never married	0.633***	0.632***			0.454***	0.456***		
	(0.081)	(0.081)			(0.066)	(0.066)		
Once married but not now	0.690**	0.685**			0.596***	0.598***		
	(0.118)	(0.117)			(0.099)	(0.099)		
Married			1.556***	1.588***			2.108***	2.196***
			(0.164)	(0.167)			(0.243)	(0.255)
Num. of children under 18 waiting	1.023***		1.020**	1.018**	1.023**		1.017*	1.016
	(0.008)		(0.008)	(0.008)	(0.010)		(0.010)	(0.010)
Num. of children under 18 traveling	0.765***		0.808***	0.809***	0.773***		0.845***	0.833***
	(0.021)		(0.024)	(0.024)	(0.035)		(0.040)	(0.040)
Num. of adult children waiting	0.979	0.978	0.978	0.977	0.983	0.984	0.984	0.985
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Num. of adult children traveling	0.936*	0.939*	0.937*	0.931**	0.941	0.944	0.943	0.950
	(0.033)	(0.033)	(0.034)	(0.034)	(0.041)	(0.041)	(0.043)	(0.044)
Num. of daughters under 18 waiting		1.010			1.012			
		(0.012)			(0.015)			
Num. of sons under 18 waiting		1.033***			1.038**			
		(0.011)			(0.015)			
Num. of daughters under 18 traveling		0.717***			0.744***			
		(0.037)			(0.059)			
Num. of sons under 18 traveling		0.796***			0.797***			
		(0.034)			(0.054)			

Table 9 Cox model results for male household heads' duration considering family members traveling or waiting (selected variables) *(Continued)*

Spouse traveling with			0.630***	0.613***			0.589***	0.555***
			(0.039)	(0.038)			(0.041)	(0.039)
Spouse visited				0.411***				0.211***
				(0.045)				(0.032)
Total num. of US trips	1.045***	1.045***	1.045***	1.045***	1.060***	1.060***	1.059***	1.058***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Distance (Mexico-US)	0.9998***	0.9998***	0.9998***	0.9998***	0.9997***	0.9997***	0.9997***	0.9997***
	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00005)	(0.00005)	(0.00005)	(0.00005)
Log pseudolikelihood	−139,731.05	−139,729.74	−139,707.86	−139,633.21	−28,508.61	−28,507.19	−28,486.20	−28,419.71
Num. of obs	17,052	17,052	17,052	17,052	4894	4894	4894	4894

Source: Data are from the Mexican Migration Project (MMP). They cover 143 communities which were surveyed from 1982–2013
*** Significant at 0.01; **significant at 0.05 level; *significant at 0.1 level. Standard errors are reported in parentheses

than married men with wives traveling with them, and the latter ones stay longer than married men with their wives waiting in the home country. Married men with wives visiting them during the migration duration stay even longer than men with spouses traveling.

4.6 Robustness check with other survival models

When modeling a Cox proportional hazard model (and some other parametric models), an important assumption is the proportional hazards: the hazard ratio is proportional over the entire baseline. Actually, the specifications above fail the Schoenfeld Residual test globally. But Hancock and Mueller (2010) mention that if this assumption is violated, it simply means that the coefficients represent a kind of "average" effect over the period of observation, so the concerns about the violation of this assumption are often unwarranted.[24] However, this assumption may not be a problem. I utilize alternative methods to fix the specifications.

The Piecewise-Constant Exponential (PCE) model is a semi-parametric continuous time duration model as well. But it does not assume the hazard ratio is proportional. Actually, it reveals how the hazard rate varies over time. I apply the PCE model to all Cox specifications above, resulting in consistent conclusions. In addition, results from the Stratified Cox models and logit models give consistent results with the Cox model.

Though the results of the above regressions support the utility maximization model and corresponding hypotheses, the causality is not addressed if migration duration plans, marriage and fertility decisions are simultaneously determined.

5 Conclusions

This paper builds a utility maximization model to show the trade-off between avoiding psychic costs from missing family members and accumulating money to support their consumption when economic migrants make decisions on the migration duration. The Cox models are employed to study the determinants of Mexican migrants' US duration.

Empirical results suggest that single men are more likely to have longer durations than men in consensual unions, who then stay longer than married men. Fathers with more children, especially more little children and boys, have shorter stays, because taking care of these children is more time intensive. Family members traveling with migrants lengthen their migration duration.

In addition, there is a non-linear relationship between education and duration. A threshold education level may exist. Migrants stay longer as years of schooling increase from low levels to the threshold, and then stay shorter as years of schooling increases to levels above the threshold. In Mexico-US migration, the threshold is around 11 years. The empirical results could change by migration flows. Finding out the threshold education level could be meaningful to the migration policy design for both countries.

The focus of this study is on the economic migrants whose main goal of migration is wealth accumulation, meanwhile the arguments about the trade-off are still applicable to family migrants who migrate for family reunion. To decrease the psychic costs of concerning family members abroad, people may give up their current job in the home country and travel to the host country. When they hold a high paid job in the home country, they

may feel more reluctant to move; at the same time, their high income in the home country may shorten the duration of family members' migration.

Endnotes

[1]The lifetime utility function in Dustmann (2003b) is $U = tv(C_f, \alpha) + (1-t)v(C_h, \beta)$ (Some notations have been changed). There is no discounting.

[2]The precise number varies by year and by the type of family and its income.

[3]The absolute difference is about $1,200-2,500 in 2013 (Lino 2014).

[4]There is not much work reporting that time use of parents on their children by the children's age. Bittman (1999) reports that in 1987 Finnish parents' hours per week spent in face-to-face childcare decrease as the age of the youngest child increases.

[5]The Table 3 in Chiswick and Miller (2008) shows that a large proportion of foreign born workers who have years of schooling fewer than 14 were undereducated, but the proportion declined sharply when they had more than 14 years of schooling, and most of them were overeducated.

[6]The MMP is a bi-national project co-directed by Jorge Durand (University of Guadalajara) and Douglas Massey (Princeton University).

[7]Since the first US trip is also the last US trip for migrants who only have one trip, the focus is on the last US trip.

[8]Bijwaard (2010) mentions that ignoring a non-zero percentage of permanent migrants will lead to biased inference applying Hazard models, however, the MMP does not have enough information for me to distinguish permanent migrants from others.

[9]$H(t) = \int_0^t \frac{f(t)}{S(t)} du = -\int_0^t \frac{1}{S(u)} \left[\frac{d}{du} S(u)\right] du = -ln\,[S(t)]$, and $S(t) = \exp\left(-\int_0^t h(u)\mathrm{d}u\right)$.

[10]Spouse's visits happen during the household head's stay in the US. The dataset only has the English proficiency information for the last US trip, and it has not to be measured at the very beginning of the last US trip. These two variables are highly endogenous.

[11]The Cox proportional hazards model makes no assumptions about the form of *h(t)* (non-parametric part of the model). Once *h(t)* differs by individual, the hazard of trip *j* of migrants *i* is $h_{ij}(t|X) = h(t)\alpha_i \exp(\beta' X_{ij})$, a Cox regression with shared frailty can be applied, capturing individual random effect.

[12]87 % among all trips, 87 % among the uncensored trips, and 82 % among the censored trips migrants have at least one child when they move to the US.

[13]The sum of average number of sons and daughters under 18 is slightly less than the average number of children under 18, because the number of children is from "life143" original data file, in which children's gender is unknown. While number of sons (daughters) under 18 is calculated based on "pers143" data file, in which some observations have missing values for year of birth or some other relevant information, resulting in the attrition. In addition, I ignored the death of a few children because of their small proportion. Restrict to observations which have accurate record of children, a robustness check gives consistent results.

[14]In the last US trip, among male migrants, 42.44 % report "Doesn't speak nor understands;" 24.44 % report "Doesn't speak but understands a little;" 9.07 % report "Doesn't speak but understands well;" 18.65 % report "Both: speaks and understands a little;" 6.42 % report "Both: speaks and understands well."

[15]Table 3 shows the frequency of distribution for how they get a job in the US. In addition, among these migrants in their last US trip, 0.80 % have a professional job; 35.73 % are in the agriculture sector; 20.07 % are skilled workers in manufacturing; 20.26 % are unskilled workers in manufacturing; 16.98 % are in the service sector; 2.79 % are sellers; 0.95 % are in the transportation sector; 2.42 % are unemployed.

[16]Since given correct assumption of the shape of hazard rate over time a parametric model is always more efficient than other models, I use Generalized gamma model to test whether Exponential model, Weibull model, Gompertz model, Lognormal model,

Loglogistic model, and gamma model are appropriate. However none of them are applicable.

[17] To capture the individual random effects, the Cox regression with shared frailty can be applied, but it hardly shows the results given such a big dataset.

[18] The Wald test indicates that the coefficients on children aged 0-12 and children aged 13–18 are statistically significant.

[19] $(100\,\% - 94.49\,\%) - (100.16\,\% - 100\,\%) = 5.51\,\% - 0.16\,\% = 5.35\,\%$.

[20] $(100\,\% - 91.11\,\%) - (100.41\,\% - 100\,\%) = 8.89\,\% - 0.41\,\% = 8.48\,\%$.

[21] The average English proficiency for the entire sample is 1.24 which mean the average level is between 1 (Do not speak, but understand some) and 2 (Do not speak, but understand much).

[22] If I add an interaction between *English Proficiency* and *Age* in these specifications, the hazard ratio of this interaction term is greater than 1. The effect of *English Proficiency* on the duration is lower for aged migrants. But the *Schooling* does not show any significant effects on *English Proficiency*'s effects on duration when having an interaction between *English Proficiency* and *Schooling*.

[23] It is highly possible that more number of trips decrease fathers' psychic costs. In fact, the interaction between *Num. of Children (under 18) Waiting* and *Total Num. of US Trips* from the last US trip has a hazard ratio which is barely significantly less than 1, and so does the interaction between *married* and *Total Num. of US Trips*.

[24] See chapter 31 in Hancock and Mueller (2010).

Appendix

Estimating the Cox model

This is borrowed from Cleves (2008). Some notations have been changed.

The partial likelihood method cares about the ordering of the time of the migrants' return occurrence.

Let $R(t_j)$ denote the number of cases that are at risk of experiencing an event (the decision of return) at time t_j, that is, the "risk set". Given that there is an event, the probability that it is observation k (with covariates X_k) fails is

$$\frac{h_k(t_j)}{\sum_{l\in R(t_j)} h_l(t_j)} = \frac{e^{\beta' X_k}}{\sum_{l\in R(t_j)} e^{\beta' X_l}}$$

where the equality holds because the baseline hazards cancel out.

Taking the product of the conditional probabilities in the equation above yields the partial likelihood function:

$$L_p = \prod_{j=1}^{N} \left[\frac{e^{\beta' X_j}}{\sum_{l\in R(t_j)} e^{\beta' X_l}} \right]^{\delta_j}$$

where j denotes the N distinct event times. $\delta_j = 0$ if a migrant has not returned at the time of the survey (right-censored observations), $\delta_j = 1$ if the migrant has returned to Mexico (uncensored observations).

To get rid of the product term, we have

$$\log(L_p) = \sum_{j=1}^{N} \delta_j \left[\beta' X_j - \log \sum_{l\in R(t_j)} e^{\beta' X_l} \right]$$

Then we maximize the equation above with respect to β. It should be noted that censored observations enter into the calculations only because they determine the size of the risk set.

Competing interests
The IZA Journal of Migration is committed to the IZA Guiding Principles of Research Integrity. The author declares that she has observed these principles.

Acknowledgements
I am grateful to Barry Chiswick, Carmel Chiswick, Ram Fishman, and Marie Price who provided very helpful suggestions. I benefited from discussions with participants at the 2015 Society of Government Economists Conference. Also, I wish to thank the anonymous referees of the IZA Journal of Migration for valuable comments.
Responsible editor: Denis Fougère

Received: 28 September 2015 Accepted: 8 January 2016
Published online: 28 January 2016

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