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ABSTRACT

The migration of Mexican immigrants to the U.S. is one of the largest bilateral migration flows in the world and remittances from these immigrants represent a crucial source of income for Mexican households. As the United States tightens controls on illegal migration, this may impact both migration durations and remittances. Tighter borders increase crossing costs, often because migrants need to pay smugglers (coyotes). Using data from the Mexican Migration Project, we find that higher crossing costs increase the probability of remitting, the remittance rate and the duration of stay as undocumented workers pay off the crossing debt. If immigrants did not incur these crossing debts then more of their earnings could be spent in the United States or by their households in Mexico on productive activities and durations in the U.S. might be lessened at the margin. This suggests some potential gain to both the U.S. and Mexican economies through expanding guest worker programs and consequently reducing the hiring of coyotes.

Keywords: Remittances, Migration, Mexico, Coyote, Border
JEL: O15, J61, F22, F24
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INTRODUCTION AND BACKGROUND

The flow of Mexican immigrants to the United States is one of the largest bilateral migration flows in the world. There are an estimated 11.4 million Mexican immigrants currently in the United States, accounting for 30% of all immigrants in the U.S (Terrazas, 2010). Mexicans also comprise 62% of the illegal immigrant population in the United States (Hoefer, Rytina and Baker, 2011). This has been a source of concern among policy makers and has resulted in tighter immigration laws such as the controversial law passed by the state of Arizona requiring police to detain anyone who they "reasonably suspect" may be an illegal immigrant (Archibold, 2010).

Each migration flow has its own particular characteristics and the Mexico-U.S. flow is no exception. Mexico-U.S. migration is characterized by three stylized facts: short durations, cyclicality and increasing costs. Mexican immigrants tend to stay in the United States for only a year or two. Consistent with previous work such as Reyes (1997) and Gitter et al (2008), 61% of the immigrants in our sample had migration durations of one year or less and 74% two years or less. Among immigrants from Latin America, Mexicans were found to have the lowest probability of becoming permanent residents in the United States (Riosmena, 2010). The Mexico-U.S. migration flow is also much more male dominated than other flows from Latin America (Cerruti and Gaudio, 2010; Donato,

2010). The Mexico-U.S. migration flow is typically motivated by economic opportunity and/or family networks, not a desire to escape a repressive regime (Alvarado and Massey, 2010). Hence economics drives Mexican-US migration.

The economic opportunity provided by migration to the United States follows two cycles: the business cycle and the seasonal cycle. Agricultural workers are often illegal and their work in the U.S. is linked to the growing season. When the growing season ends and work becomes scarce, they typically return home to Mexico. And of course, the business cycle matters regardless of occupation. The recent increase in U.S. unemployment reduced the number of Mexican immigrants in the U.S. in both 2009 and 2010 as more returned home to Mexico (Hoefer et al, 2011).

Research has found that the majority of unemployed illegal immigrants (71%) return home to Mexico within several months (Reyes, 1997). This cyclical migration was recognized (and encouraged) by the Bracero program the United States ran from 1942-1964 (Orrenius, 2001). This was system of short-term, repeating guest worker visas for Mexican immigrants. Mexican workers regularly cycled back and forth across the border and the rate of illegal immigration from Mexico was relatively low. As expected, undocumented workers from Mexico began to increase after the Bracero system was eliminated. Workers who could previously enter and work legally in the United States began to enter illegally.

Cyclical employment in the U.S. is particularly important to Mexican immigrants, given their generally low level of education and income. The Mexico-U.S. migration flow is not a "brain drain" migration phenomenon, the average level of education in our sample is only six years. Rather, cyclical employment helps immigrants achieve goals back in their households in Mexico. While only 14% of immigrants in the sample own land in Mexico, 47% own a home (MMP, 2010). This is not surprising as one of the purposes of working in the United States is often to help purchase a home back in Mexico (Durand et al, 1996).

A substantial change in the economics of migration has occurred in the last 25 years. Since the 1986 Immigration Reform and Control Act, the United States has increased border enforcement. While the number of Mexican immigrants entering the United States has still risen significantly over this timeframe, so have the costs of entry. Illegal border crossings pose significant dangers from both criminals and the elements. Eschbach et al (1999) and Cornelius (2001) discuss the dangers faced by people attempting to cross the border. In particular, some studies have found that these policies are leading more Mexicans to hire smugglers (called coyotes) to cross the border (Singer and Massey, 1998). [1] In our sample we find the percentage of migrants hiring a coyote to be 38%. However, this belies a change over time. For migrations occurring prior to 1986 the coyote hire rate was 29%, rising to 50% in the 1990s and then 62% in the 2000s. Not surprisingly, the cost of hiring coyotes has continued to rise, even after having tripled during the 1990s (Massey, 2007). In our sample, the average cost of hiring a coyote rose from $325 (pre-1986) to $1,121 (1990s) to $1,674 after 2000. This is a heavy burden for Mexican immigrants and their families to pay and it dramatically affects the economics of cyclical migration, raising the need to remit payments back home to help pay off debt.

Remittances sent to Mexico from immigrants working in the U.S. totaled $21.5 billion in 2009 (Coronado and Canas, 2010). Even with a declining rate of remittances in 2010, they still represent one of the largest sources of foreign exchange for Mexico.

Research has shown these remittances have significant impacts on household and community welfare in Mexico (de la Garza and Orozco, 2002; Durand et al, 1996; Funkhouser, 1992; Jones, 1998). Research has shown that remittances impact productivity and agricultural investments in rural Mexico (Quinn, 2009; Taylor and Lopez-Feldman, 2010). Remittances may even lower infant mortality rates in rural Mexico (Hamilton et al, 2009). But, from the perspective of policy makers in the host country (USA), it is desirable to keep funds from being remitted so that they can be saved or spent on U.S. consumables and services. U.S. states now accept Mexican identification (matricula) cards as identification which allows illegal immigrants to open bank accounts. This was codified with a change in U.S. law in 2001 (Handlin, Krontoft, and Testa, 2002). Increasingly, research has focused on ways such as this to keep immigrants' earnings in the United States (Amuedo-Dorantes and Bansak, 2006).

While trying to keep earnings within the country, U.S. policy makers have also been increasing border controls and enforcement. Since the passage of the Immigration Reform and Control Act (IRCA) of 1986, the U.S. has increased the number of border watch hours by an average of 10% per year (Mexican Migration Project, 2010). Research has begun to focus on how these border policies are changing the way migrants cross into the United States and how long they stay in the United States. Reyes (2001) employs a dummy variable to test the impact of the 1986 Immigration Reform and Control Act (IRCA) and finds that IRCA increases migration duration. Using a logistic analysis with Mexican Migration Project (MMP) data, Reyes finds that border enforcement may be increasing migration duration for documented workers (but not in their full model of undocumented workers). This is consistent with the results of Massey and Espinosa (1997). Using data from a later timeframe, they find that the impact of IRCA on duration fades within a few years after passage.[2] Using data from the 1970s (pre-MMP), Kossoudji (1992) analyzes the impact of factors on migration durations based on whether or not the migration ended voluntarily and found that hiring a coyote to cross leads to a longer duration for voluntarily ended migrations.

This paper will examine issues surrounding the use of coyotes, migration duration and remittances. Since immigrants often need to borrow from family or friends to pay a coyote, more Mexican immigrants arriving in the U.S. do so with debts owed to people back home. It is reasonable to hypothesize that the increased hiring and cost of coyotes have both direct and indirect impacts on remittances. The direct impact operates through remittance rates as a form of debt repayment. The indirect effect works through migration duration since immigrants who hire coyotes may stay longer in the United States in order to pay off the debt. So, immigrants who have significant debts to repay back home will not only remit at a higher rate but will also stay longer to earn enough to pay back the loan. These joint effects may run counter to U.S. policy makers desires for immigrants to spend or save more while in the United States. This is especially true if immigrants have an earnings goal in mind when undertaking migration, the "target income" theory (Berg, 1961; Hill, 1987). Coyote use and the resulting debt is not the only reason for remitting. Others include supplementing family income in Mexico, or investing in businesses or land purchases back home (Agarwal and Horowitz, 2002; Amuedo-Dorantes and Pozo, 2006; Mitra, 2004; Poirine, 1997; Rapoport and Docquier, 2006). Paying off debt may increase the amount of time it takes for the immigrant to achieve these other goals.

This paper models these effects using data from the Mexican Migration Project and two different empirical methodologies. Distinctions are also made between remittance rates and total remittances. The first methodology is Heckman selection which evaluates the probability of remitting as well as the level of remittances (rate and total). The second methodology uses the selection term generated from the Heckman to estimate remittances (rate and total) jointly with migration duration. The analyses find evidence to support the hypotheses that hiring a coyote makes immigrants more likely to remit and to stay longer in the United States. Results also suggest that the more a person pays for a coyote, the greater the remittance (both as a rate and total). These results imply that reforming the immigration system to allow for more guest worker visas would reduce coyote use (and costs through falling demand) and thus help to keep more immigrant earnings in the United States and reduce migration durations.

The purpose of this section was to introduce the paper and to give the necessary literature background for the analyses. For some wider surveys on Mexican migration readers are directed to Durand and Massey (1992), Massey at el. (1994), Bijak (2006), Hanson (2006) and de Haas (2007). The paper will proceed with the next section constructing a theoretical model which incorporates the hypotheses and effects discussed above. This is followed by discussions of the data set and variables and the empirical methodologies. Results are then presented and the implications for the literature and policy conclude the paper.

THEORETICAL MODEL AND HYPOTHESES

This model is intended as a framework to examine the relationship between crossing costs, migration duration and remittances. As the focus of the paper is empirical, readers not interested in the theoretical model can skip forward to the next section without loss of continuity. Consistent with the empirical work, the emphasis of the model is on remittances. For the purposes of this model, the individual is assumed to already be in the United States at time *t*, when the decisions regarding remittances and consumption are being made. The migrant is assumed to earn utility both from his own consumption in the United States in time *t* ($C_{u,t}$) and from his household's consumption back in Mexico in time *t* ($C_{m,t}$). While we are calling it "consumption" in the Mexican household, the money from remittances could be spent on many different uses. Utility is modeled as a Cobb-Douglas function with the weight on U.S. consumption of (*1-k*) and on Mexican consumption of *k*. It is represented as

$$U_t = C_{u,t}^{1-k} C_{m,t}^{k} \quad (1)$$

The migrant earns income (I_t) working in the United States in time *t*. The migrant can spend money in the United States ($C_{u,t}$). We will assume that the immigrant can save a portion of his income in the U.S., (S_t).[3] These savings are income being put aside (in the U.S.) for another use in future time periods. The immigrant can also send money to Mexico as remittances (R_t). Part of the remittances goes to the household for consumption ($C_{m,t}$). The price of U.S. consumption is normalized to 1 and for Mexican consumption is $P_{m,t}$. The other part of remittances goes to repay the Mexican household for any money borrowed to cover crossing costs. The total debt incurred from crossing

costs is denoted *D*. The migrant repays a percentage (*b*) of this debt each time period. So, the remittances that the migrant sends can be decomposed into money going towards the home household's consumption and repayment of debt. The budget constraint in time *t* for the immigrant is

$$C_{u,t} + P_{m,t}C_{m,t} + bD + S_t = I_t \tag{2}$$

Putting together the utility function and budget constraint forms the constrained maximization Lagrangian expression:

$$L_t = C_{u,t}^{1-k}C_{m,t}^{k} - \lambda(I_t - C_{u,t} - P_{m,t}C_{m,t} - bD - S_t) \tag{3}$$

The first order conditions (FOC) from this maximization are:

$$(1-k)C_{u,t}^{-k}C_{m,t}^{k} + \lambda_t = 0 \tag{4a}$$
$$kC_{u,t}^{(1-k)}C_{m,t}^{(k-1)} + \lambda_t = 0 \tag{4b}$$
$$C_{u,t} + P_{m,t}C_{m,t} + bD + S_t - I_t = 0 \tag{4c}$$

Solving the FOC along with budget constraint yields the equilibrium values of $C_{m,t}$,

$$C_{m,t} = \frac{(I - bD - S_t)}{\left(\frac{1-k}{k}\right) + P_{m,t}} \tag{5}$$

This equilibrium value can be differentiated with respect to *k*, I_t and *D*:

$$\frac{\partial C_{m,t}}{\partial k} = (I_t - bD - S_t) - \left(P_{m,t} - 1\right) > 0 \tag{6a}$$
$$\frac{\partial C_m}{\partial I_t} = k \tag{6b}$$
$$\frac{\partial C_{m,t}}{\partial D} = -bk < 0 \tag{6c}$$

We can express remittances in time *t* as

$$R_t = P_{m,t}C_{m,t} + bD \tag{7}$$

Differentiating remittances with respect to *D* yields

$$\frac{\partial R}{\partial D} = \frac{\partial C_{m,t}}{\partial D} + b = -bk + b = b(1-k) > 0 \tag{8}$$

Equation 8 can be determined to be greater than zero. This means that remittances rise with an increase in crossing debt. In the case that *k=0*, $\frac{\partial R_t}{\partial D} = b$. In this case, any change in debt is entirely reflected in remittances because all remittances are used for debt repayment. In the case that *k=1* (all value on Mexican consumption), $\frac{\partial R_t}{\partial D} = 0$. In this case

all remittances are going to Mexican consumption so any increase in debt repayment causes a countervailing fall in Mexican consumption.[4] The model also yield the derivative $\frac{\partial R_t}{\partial I_t} = \frac{\partial C_{m,t}}{\partial I_t} = k > 0$. The prediction is that remittances will increase with a rise in income.

Remittances Over Time

The debt (*D*) from crossing the border is incurred once (at the beginning of the migration). So, it is a fixed number, after the migration. The proportion (*b*) is paid off each time period. So, in *1/b* time periods the value of *D* will be equal to zero. In time period *(1/b) +1*, remittances will be spent entirely on Mexican home consumption, $R_{\left(\frac{1}{b}\right)+1} = P_{m,\left(\frac{1}{b}\right)+1} C_{m,\left(\frac{1}{b}\right)+1}$. Thus, we expect that as migration duration increases the importance of debt repayment in remittances will fall. Whether or not remittances continue to rise with income over time will depend on the value of *k*. While modeled as a constant here, if *k* were to fall over time then remittances could decrease with migration duration even with debt repayment ending. As discussed in the previous section, migrants often borrow a large amount of money relative to their income and remittances for purposes of financing border crossings. Also, the majority (74%) of Mexican migrants stay for less than two years in the United States. The combination of a large debt with short migration durations makes debt repayment an important factor motivating remittances.

The model yields the following testable hypotheses:

(H1) $\frac{\partial R_t}{\partial D} > 0$. Remittances are predicted to rise with an increase in crossing costs. Empirically, remittances will be modeled as both a rate and as a total. The increase in crossing costs will be modeled as the hiring and cost of coyote.

(H2) $\frac{\partial R_t}{\partial I_t} > 0$. Remittances are predicted to rise with an increase in income.

(H3) Migration duration will have a negative impact on remittance rates. Assuming that *k* is either constant or decreasing, remittance rates will fall with crossing debts eventually being paid off.

DATA AND VARIABLES

The data are taken from the 1987-2008 Mexican Migration Project (MMP, 2010) which is run jointly by the University of Guadalajara and Princeton University. Each year the MMP samples at least 200 households from 3-5 different (non-repeating) Mexican communities. The data set is cross-sectional in that different communities are surveyed each year. Interviewers collect information about individuals who are present in the household and individuals who are not present because of migration.

The data set is useful because it contains detailed migration histories of heads of households. This includes information on whether coyotes were used in migrating. The data set also contains a number of personal, household, community and national level variables. There are three dependent variables used in our analysis: remittances per month (the remittance rate), total remittances over the duration of the migration, and the

migration duration (in months). These are all defined for the immigrant's last U.S. trip. Remittances are defined as the real (inflation-adjusted) peso value received by a Mexican household from the immigrant while he/she was working in the U.S.

TABLE1. DESCRIPTIVE STATISTICS FOR KEY VARIABLES IN THE ANALYSIS.

Name	Mean	Std. Dev.	Minimum	Maximum
Coyote hired last trip	0.38	0.49	0	1
Cost of coyote if hired (real pesos)	1545.43	4975.28	0	142710
Remittances per month (real pesos)	1406.17	4276.42	0	105051.4
Total remittance last trip (real pesos)	29636.48	116619.90	0	2974973
Duration of last trip (months)	36.53	66.92	1	570
Education (years)	5.64	4.00	0	28
Documented last trip (=1 if yes)	0.39	0.49	0	1
English skills (=4 if fluent)	1.32	1.38	0	4
Have savings account in U.S. (=1 if yes)	0.63	0.48	0	1
Access to banks in U.S. (=1 if yes)	0.84	0.37	0	1
Own land in Mexico (=1 if yes)	0.14	0.35	0	1
Own home in Mexico (=1 if yes)	0.47	0.50	0	1
Own business in Mexico (=1 if yes)	0.03	0.17	0	1
Male LF participation rate in home community	0.71	0.08	0.10	1.00
Female LF participation rate in home community	0.16	0.08	0.02	0.93
% making below minimum wage in home community	0.48	0.20	0.04	0.96
% making over twice minimum wage in home community	0.22	0.13	0.01	0.70
Exchange rates (pesos/$)	3.40	3.61	0.01	11.23

Note: home community refers to the immigrant's home in Mexico. Other variables used in the analysis but not included in the table are discussed in the Data and Variables section of the paper. This includes variables such as age, family in the U.S., previous migration experience, and border enforcement variables.

Some of the individual level variables in the analysis include the individual's years of education, whether the individual is proficient in English and two dichotomous variables for whether the immigrant had access to banking or had a bank account in the United States. Note that the financial sophistication of the immigrant has been a recent focus in the remittance literature (Amuedo-Dorantes and Bansak, 2006). There are also variables for the individual's age, age squared, and number of previous trips to the United States. The number of previous U.S. trips is the number of previous trips not counting the migration used in the duration analysis. The documentation variable is equal to one if the immigrant's migration is legal and zero otherwise. There are three variables for family members in the United States (siblings, mother and father). As noted in the tables, some of the individual level variable results are not shown for reasons of brevity but full results are available on request.

There are three dichotomous variables to capture whether the immigrant's household owns a business, land or house in Mexico as these have been found to impact remittances (Amuedo-Dorantes and Pozo, 2006). There are four community level

independent variables used including the male and female labor force participation rates, the poverty level proxied by the percentage of the labor force earning less than minimum wage, and the percentage of the labor force earning twice the minimum wage.

There are several national level variables. The peso/dollar exchange rate is included as a control for currency fluctuations. There is a dummy variable equal to one if the last migration occurred after 1986, to account for the Immigration Reform and Control Act.[5] Also included are the Mexican and U.S. unemployment rates (as business cycles impact migration durations).[6] Finally, there are two border enforcement variables, the number of line watch hours by the INS (later Homeland Security) at the time of migration and the number of deportations.

EMPIRICAL METHODOLOGY

A joint estimation model with Heckman selection is used to test hypotheses surrounding the impact of crossing debt, income and migration duration on the rate of remittances and total remittances. Migration duration, remittance rates and total remittances were treated as endogenous in the system, each a function of a vector of control variables. Because many of these exogenous variables were the same in each equation, it was reasoned that error terms across the equations were probably correlated, thus requiring a 3SLS estimation for efficiency. The second stage Heckman results (for remittance rates and total remittances) are included in the Appendix. As a 3SLS is required in this case, the body of the paper uses the 3SLS results. However, the 3SLS still requires the selection correction term from the Heckman's first stage (probit) equation.

The use of Heckman selection was important because the remittance variable is a classic example of a censored variable. Some migrants may choose not to remit because the size of their remittances are very small relative to the transactions costs incurred (or for other reasons). The dependent variable in the remittance equation is thus observed only if the probability of remitting is greater than zero. The probability of remitting is captured in the Heckman selection equation which contains at least some variables which influence the probability of remitting rather than the actual observed remittances. If selection hazard is present, it can be shown that the error terms in the selection equation and the actual regression equation are correlated. If they are not correlated standard regression techniques can be used. Hence a test of whether Heckman selection is appropriate is a Wald test for testing the null that the correlation coefficient is zero (the test statistic is distributed χ^2).

From the Heckman estimation procedure we can obtain a variable which corrects for the selection hazard called a *nonselection hazard (nshazard)* variable (Heckman (1979)[7]. This variable can be added as a regressor in the remittance equations in the 3SLS system. Hence our estimation approach is in two-stages. Stage one is estimating the Heckman probit (selection) equation and retrieving the nshazard variable. Stage two is estimating the two-equation system using 3sls with the nshazard variable include in the regressor list.

We view the three equations below, estimated in the two stages, as jointly telling a story about remitting behavior. Equation 9 is the probit (selection) that generates the selectivity correction term then included as a control in Equations 10a, 10b, 11a and 11b. Equations 10a and 10b are jointly estimated using 3SLS.

$$ProbRemit_j = \boldsymbol{z_j}\tau + \mu_{3j} \quad (9)$$

$$Duration_j = \boldsymbol{x_j}\boldsymbol{\beta} + \mu_{1j} \quad (10a)$$

$$RemitRate_j = \boldsymbol{y_j}\boldsymbol{\gamma} + \pi 1 * Duration_j + \pi 2 * nshazard_j + \mu_{2j} \quad (10b)$$

Where **z,** ***x*** and **y** are the vectors of exogenous control variables in Equations 9, 10a and 10b, [8]respectively. The Heckman nonselection hazard variable is represented as *nshazard* and the error terms as μ. The dependent variables in Equations 9-10b are the probability of remitting migration duration and the remittance rate, respectively. The 3SLS is also run with total remittances as the dependent variable, rather than the remittance rate (see 11b below).

$$RemitTotal_j = \boldsymbol{y_j}\boldsymbol{\gamma} + \pi 1 * Duration_j + \pi 2 * nshazard_j + \mu_{2j} \quad (11b)$$

RESULTS

The empirical results are consistent with the paper's hypotheses regarding the importance of coyote usage on remittances. The results of the probit analysis on the likelihood to remit are in Table 2. The Wald tests for the appropriateness of Heckman selection all pass, i.e. the null hypothesis that $\rho = 0$ is rejected in all instances. The joint estimation results of migration duration and remittance rates (while controlling for selection hazard from the probit) are in Table 3. The results from the similarly structured joint estimation with total remittances (rather than rates) are in Table 4.

The probit analysis in the selection equation (Equation 9) yields interesting results. The probit finds that hiring a coyote increases the likelihood of being a remitter. If the migrant borrows crossing costs from family or others back home, the migrant has debt obligations to be paid back and is therefore more likely to remit. Examination of the impact of coyote costs on the actual remittance flow is, however, complex. Higher coyote costs have both direct and indirect impacts. Coyote costs are positive and significant in terms of migration duration. When controlling for duration, coyote costs still have a positive and significant effect on the remittance rate. This suggests that higher crossing costs result in higher debt which raises both the remittance rate and migration duration. Together these result in a higher total remittance flow.

Immigrants, of course, take on debt back home for reasons other than border crossing (e.g .buying land, business investments, household consumption). Regardless of the source, migration duration should have a negative impact on the remittance *rate*, since the longer an individual has been working in the U.S. and sending money back to Mexico the more likely debt has been paid off or target goals for the household met. Also, the longer an immigrant is in the United States the greater are their expenses in the U.S. The vast majority of Mexican immigrant durations in the sample (74%) are less than two years and 85% are less than five years. These results hold for the entire sample (as presented in this paper) and also for the subsample of migrations lasting less than five years (results available on request).

The probability that a migrant will remit is positively related to whether the migrant has a bank account in the US, is already saving and speaks English. These are

proxies for the migrant's level of financial sophistication. The greater a migrant's familiarity and ease with financial institutions (banks, Western Union, etc), the greater likelihood of sending money back home (Amuedo-Dorantes and Bansak, 2006; Quinn, 2005).

Our proxies for income (education, documentation, English skills) have interesting results. We find that education (our income proxy) has a negative impact on duration and that duration has a negative effect on the rate of remittances. Therefore, increases in income (cet.par.) should cause shorter durations and shorter durations in turn cause higher remittance rates. Total remittances will rise if the higher remit rate exceeds the shorter duration. The other two income proxies (documentation and English skills) have significantly positive impacts on duration. Here total remittances will rise if the longer durations outweigh the lower remittance rate. Note that education and documentation are negatively related to the probability of being a remitter, which is logical as these factors result in lower crossing debt and is consistent with the literature (Amuedo-Dorantes, Bansak and Pozo, 2005; Fairchild and Simpson, 2008).[9] With documentation, the immigrant has no need to hire expensive coyote services. Higher educated immigrants are also less likely to hire a coyote for crossing (Singer and Massey, 1998). There did not appear to be a strong income effect for either remittance rates or total remittances as education was insignificant in each case. English skills was positively related to remittance rates but documentation negatively related to total remittances.

Having land back in Mexico is positively related to all measures of remittances. Two of the four home community variables are significant. Higher earnings in the home community are negatively related to both remittance rates and total remittances while the male labor force participation rate is positively related to both. Immigrants in the post-IRCA period appear to remit at higher rates but with lower totals per trip. Devalued pesos result in higher remittance rates, totals and likelihood of remitting. This is consistent with immigrants' U.S. earnings (and therefore remittances) having more value during these time periods.

As discussed above, migration duration is negatively related to remittance rates. In determining the factors that impact migration duration, several variables were found to be significant. Increased enforcement measures (IRCA, border patrol, deportations) had a significant negative effect on migration duration. Migration duration increased with English skills and documentation. Also as predicted, higher U.S. unemployment rates were negatively related to duration. Mexican unemployment rates were positively related to migration duration, as expected, but were insignificant. Education was found to be negative and significant with regards to migration duration. This is not unexpected since the premium to education is likely higher in Mexico than in the Unites States.[10]

CONCLUSIONS

The paper's results provide evidence that the usage and cost of coyotes cannot be ignored in analyzing remittances. Current U.S. immigration policies and enforcement result in large numbers of illegal immigrants, many of whom resort to hiring coyote smugglers to cross the U.S. border. The debts incurred through this transaction increase both immigrant time in the United States and remittances sent back to Mexico. This represents a sub-optimal outcome for all involved (except the smugglers). If immigrants did not

incur these crossing debts, more of their earnings could be spent or saved in the United States or spent by their households in Mexico on productive activities.

This is especially important for the majority of Mexican immigrants who are short-term, cyclical immigrants. For this group of Mexican immigrants, a large scale increase of the guest worker program (similar to the previous Bracero program) would dramatically reduce the amount of coyote usage (and its costs for those who still use it). This would result in a lower remittance flow and thus more money staying in the U.S. economy and/or increased remittances available for development in Mexican communities. Reinforcing the cyclical nature of this migration flow would have other benefits for the U.S. economy via the labor market. Expanding the guest worker program would allow Mexican workers to undertake less expensive migrations so more Mexicans will be able to return home during the off-season. This would reduce the number of unemployed Mexican immigrants in the United States. Reducing the number of unemployed Mexican immigrants would help to reduce government deficits, labor market pressures and social problems.

Beyond the impact on duration, there are direct benefits to the United States from reducing demand for coyote services by Mexican immigrants. Coyotes represent a breach in American border security. Drug gangs have been increasingly involved in human smuggling (Meyer, 2009). Gangs such as the Zetas profit from human smuggling through coyote fees, kidnapping and ransoming would-be migrants and by using migrants as drug mules. The violence and criminal activities of these gangs have reached the point where the U.S. Department of Homeland Security has become heavily involved (Carroll, 2011). The Department of Homeland Security is increasingly concerned about the possibility of terrorists crossing the U.S. border through the use of coyotes (Padgett, 2003). Allowing for more legal migration through an expanded guest worker visa system such as the previously implemented Bracero program would reduce the profitability of these criminal enterprises.

In addition to policy matters, the paper also has implications for the literature. The empirical results suggest that coyote use affects the migrant's behavior in a complex manner and should be modeled as such. In particular, it is important to control for the impact of coyotes on migration duration and remittance selection, not just on remittances themselves. This enables researchers to capture both the direct and indirect impacts of coyotes on remittances. This paper helps to bring together the work being done on coyotes and migration duration with the literature on remittances.

TABLE 2. DECISION TO REMIT: SELECTION PROBIT (*ProbRemit)*

Coyote Hired	0.17
	(.06)***
Coyote Cost	7.75
	(7.66)
Education	-0.03
	(.006)***
Documentation	-0.16
	(.05)***
English skills	0.02
	(.02)
Saved Money in U.S.	0.20
	(.04)***
U.S. Bank Account	0.33
	(.06)***
Land in Mexico	0.13
	(.06)**
House in Mexico	0.19
	(.05)***
Business in Mexico	-0.03
	(.12)
Exchange Rate	0.09
	(.01)***
Post-IRCA	-0.13
	(.07)*
Number of Observations	4500
Prob>Chi-Squared	0.00

Notes: Coefficients with standard errors in parentheses.
*,** and *** denotes significant at 10, 5 and 1% level.

TABLE 3. 3SLS ANALYSIS. MIGRATION DURATION AND REMIT RATE

	Migration Duration	Remittance Rate
Coyote Hired	9.33	127.80
	(1.93)***	(234.08)
Coyote Cost	0.005	0.30
	(.001)***	(.14)**
Education	-0.81	14.74
	(.20)***	(27.25)
Documentation	20.59	-143.93
	(1.87)***	(203.61)
English skills	11.29	228.30
	(.55)***	(80.62)***
Migration Duration	-	-11.65
		(5.48)**
Land in Mexico	-	867.20
		(203.06)***
House in Mexico	-	55.58
		(167.20)
Business in Mexico	-	-250.76
		(381.86)
Post-IRCA	-22.45	-760.75
	(3.27)***	(238.83)***
LF Participation Rate - Male	-	2307.05
		(1407)*
LF Participation Rate - Female	-	1168.42
		(1191.24)
% Earning Below Minimum Wage	-	-549.38
		(5923.08)
% Earning Twice Minimum Wage	-	-2659.18
		(1034.68)***
Border Line Watch Hours	-2.62	-
	(.57)***	
# of Deportations	-8.61	-
	(4.14)**	
U.S. Unemployment Rate	-225.29	-
	(138.58)*	
Mexican Unemployment Rate	122.16	-
	(98.37)	
Exchange Rate	-	537.18
		(49.52)***
Nshazard variable		714.07
		(1108.63)
Number of Observations	4500	4500
Prob > Chi-Squared	0.00	0.00

Notes: duration equation includes age, age squared, previous trips, U.S. and Mexican unemployment and line watch hours in years two and three, lagged line watch hours, family in U.S. and agricultural worker dummy. Coefficients are listed with standard errors in parentheses. *,** and *** denotes significant at 10, 5 and 1% level.

TABLE 4. 3SLS ANALYSIS. MIGRATION DURATION AND TOTAL REMITTANCES

	Migration Duration	Total Remittances
Coyote Hired	9.36	-7379.17
	(1.93)***	(6666.32)
Coyote Cost	0.004	10.62
	(.001)***	(4.11)***
Education	-0.81	1033.83
	(.20)***	(771.33)
Documentation	20.67	-14336.17
	(1.87)***	(5771.00)**
English skills	11.35	-1133.36
	(.55)***	(2277.32)
Migration Duration	-	589.14
		(155.76)**
Land in Mexico	-	17120.52
		(5769.26)***
House in Mexico	-	-5386.58
		(4805.74)
Business in Mexico	-	7269.29
		(10844.18)
Post-IRCA	-23.51	15158.15
	(3.28)***	(6498.72)**
LF Participation Rate - Male	-	91462.65
		(39986.32)**
LF Participation Rate - Female	-	10537.00
		(33855.02)
% Earning Below Minimum Wage	-	-12898.07
		(16823.60)
% Earning Twice Minimum Wage	-	-61434.69
		(29412.35)**
Border Line Watch Hours	-2.85	-
	(.57)***	
# of Deportations	-9.66	-
	(4.15)**	
U.S. Unemployment Rate	-229.53	-
	(139.07)*	
Mexican Unemployment Rate	106.04	-
	(98.72)	
Exchange Rate	-	8794.78
		(1307.33)***
Nshazard		-5376.03
		(31813)
Number of Observations	3910	3910
Prob > Chi-Squared	0.00	0.00

Notes: duration equation includes age, age squared, previous trips, U.S. and Mexican unemployment and line watch hours in years two and three, lagged line watch hours, family in U.S. and agricultural worker dummy. Coefficients are listed with standard errors in parentheses. *,** and *** denotes significant at 10, 5 and 1% level.

APPENDIX

TABLE A1. TOTAL REMITTANCES AND RATE WITH SELECTIVITY CORRECTION

	Remittance Rate	Total Remittances
Coyote Hired	-418.57	-10187.11
	(235.49)*	(7479.14)
Coyote Cost	0.94	24.02
	(.30)***	(8.25)***
Education	89.95	2153.14
	(23.12)***	(774.10)***
Documentation	-1.62	-14769.37
	(.77)**	(7075.69)**
English skills	123.24	2691.75
	(52.27)**	(1562.36)*
Migration Duration	-1.62	380.47
	(.77)**	(44.47)***
Land in Mexico	1169.93	22308.99
	(381.27)***	(9755.26)**
House in Mexico	256.48	-9047.16
	(181.31)	(5346.21)*
Business in Mexico	-78.51	11564.69
	(334.38)	(18130.37)
Post-IRCA	2213.98	61116.01
	(157.97)***	(4892.92)***
LF Participation Rate - Male	1461.17	83098.91
	(1463.39)	(37376.45)**
LF Participation Rate - Female	4211.62	92922.81
	(1682.28)**	(42984.86)**
% Earning Below Minimum Wage	-1874.01	-36434.76
	(787.87)**	(24343.67)
% Earning Twice Minimum Wage	-2890.30	-79171.19
	(1534.07)*	(43440.76)*
Number of Observations	4500	4500
Prob > Chi-Squared	0.00	0.00

Notes: Coefficients with standard errors in parentheses. *,** and *** denotes significant at 10, 5 and 1% level.

ENDNOTES

[1] Readers interested in a description of coyote smugglers are directed to Spener (2001).
[2] Orrenius and Zavodny (2001) find that the impact of IRCA on the number of illegal immigrants also faded a few years after the bill's passage.
[3]As remittances sent back to Mexico are the focus of the paper's empirical work, we are not going to model the theoretical process behind savings (essentially it will be treated as an exogenous variable). However, for theoretical completeness it is important to include it as a factor in the budget constraint.
[4] k=1 is intended to show what occurs in the model as it approaches near this point, this end point is only a theoretical possibility.
[5] The paper's results were robust to the inclusion of year dummies. However, we chose to use the IRCA variable instead as it was more consistent with the literature and the theory regarding border enforcement effects.
[6] Using the output gap to measure the business cycle would have been preferred but it was not available for Mexico for all the years in the study.
[7] This is commonly known as the inverse Mills' ratio.
[8] **z** contains the exogenous variables: *coyote hired, coyote cost, ,education, documentation , English skills, Saved Money in US, US Bank account, Land in Mexico, House in Mexico, Business in Mexico, Exchange rate, Post-IRCA*
x contains the exogenous variables: *coyote hired, coyote cost, education, documentation, English skills, Post-IRCA, Border Line Watch Hours, # of deportations, US unemployment rate, Mexican unemployment rate*
y contains the exogenous variables: *coyote hired, coyote cost, education, documentation, English skills, Land in Mexico, House in Mexico, Business in Mexico, Post-IRCA, LF Participation Rate-Male, LF Participation Rate-Female, % earning below Minimum Wage, % earning twice Minimum wage, Exchange Rate*
[9] This is not a universal result in the literature as some work such as Bollard et al 2009 find education to have a positive impact on remittances.
[10] This may result from lower average levels of education in Mexico (scarcity), pooling effects and/or a lack of language skills. As the average level of Mexican immigrants' education in the United States is low, potential American employers may engage in a pooling equilibrium in their view of Mexican immigrants lowering the return for highly educated immigrants. Also, highly educated Mexican immigrants without proficient English skills would be unable to get a full return from their education in Mexico. Quinn and Rubb (2006) provide a discussion of these issues.

REFERENCES

Agarwal, R. and A.W. Horowitz. 2002. "Are International Remittances Altruism or Insurance? Evidence from Guyana using Multiple-Migrant Households." *World Development,* 30, 2033-2044.

Alvarado, S.E. and D.S. Massey. 2010. "In Search of Peace: Structural Adjustment, Violence and International Migration." *Annals of the American Academy of Political and Social Science,* 630: 137-161.

Amuedo-Dorantes, C., Bansak, C., and S. Pozo. 2005. "On the Remitting Patterns of Mexican Immigrants: Evidence from Mexican Survey Data." *Federal Reserve Bank of Atlanta Economic Review,* 37-58.

Amuedo-Dorantes, C. and C. Bansak. 2006. "Money Transfers among Banked and Unbanked Mexican Immigrants." *Southern Economic Journal,* 73, 374-401.

Amuedo-Dorantes, C. and S. Pozo. 2006. "Remittance Receipt and Business Ownership in the Dominican Republic." *The World Economy,* 29, 939-956.

Archibold, R.C. 2010. "Arizona Enacts Stringent Law on Immigration." *New York Times, April 23.* Accessed April 26, 2010 at http://www.nytimes.com/2010/04/24/us/politics/24immig.html.

Berg, E.J. 1961. "Backward Sloping Labor Supply Functions in Dual Economies: The African Case." *Quarterly Journal of Economics,* 75: 468-492.

Bijak, J. 2006. "Forecasting International Migration: Selected Theories, Models and Methods." *CEFMR Working Paper* 4/2006.

Bollard, A., McKenzie, D., Morten, M., Rapoport, H. 2009. "Remittances and the Brain Drain Revisited." *World Bank Policy Research Paper,* 5113.

Carroll, S. 2011. "Raid Exposes Gang's Reach." *Houston Chronicle,* May 7.

Cerruti, M. and M. Gaudio. 2010. "Gender Differences between Mexican Migration to the United States and Paraguayan Migration to Argentina." *Annals of the American Academy of Political and Social Science,* 630: 93-113.

Cornelius, W.A. 2001. "Death at the Border: Unintended Consequences of U.S. Immigration Control Policy." *Population and Development Review.* 27: 661-685.

Coronado, R. and J. Canas. 2010. "Cross-Border Flows Slowed by U.S. Slump." *Southwest Economy, Federal Reserve Bank of Dallas.*

De Haas, H. 2007. "Remittances, Migration and Social Development: A Conceptual Review of the Literature." *Social Policy and Development Programme Paper,* 34, United Nations Research Institute for Social Development.

De la Garza, R. O. and M. Orozco.2002. 'Binational Impact of Latino Remittances', in *Sending Money Home* (Lanham: Rowman & Littlefield Publishers, Inc.).

Donato, K.M. 2010. "U.S. Migration from Latin America: Gendered Patterns and Shifts." *Annals of the American Academy of Political and Social Science,* 630: 78-92.

Durand, J. and D. Massey. 1992. "Mexican Migration to the United States: A Critical Review." *Latin American Research Review,* 27:3-42.

Durand, J., W. Kandel, E. A. Parrado and D. S. Massey.1996. "International Migration and Development in Mexican Communities," *Demography*, 33, 2, 249– 64.

Eschbach, K., Hagan, J., Rodriguez, N., Hernandez-Leon, R. and S. Bailey. 1999. "Death at the Border", *International Migration Review,* 33**:** 430-454.

Fairchild, S.T. and N.B. Simpson. 2008. "A Comparison of Mexican Migrant Remittances Across Regions." *Contemporary Economic Policy,* 26, 360-379.

Funkhouser, E. 1992. 'Migration from Nicaragua: Some Recent Evidence', *World Development,* 20, 1209–18.

Gitter, S.R., Gitter, R.J. and D. Southgate. 2008. "The Impact of Return Migration to Mexico." *Estudios Economicos,* 23: 3-23.

Hamilton, E.R., Villarreal, A. and R.A. Hummer. 2009. "Mother's, Household and Community U.S. Migration Experience and Infant Mortality in Rural and Urban Mexico." *Population Research and Policy Review,* 28: 123-142.

Handlin, E., Krontoft, M. and W. Testa. 2002. "Remittances and the Unbanked." *Chicago Federal Reserve Letter,* 175a, 1-4.

Hanson, G.H. 2006. "Illegal Migration from Mexico to the United States." *Journal of Economic Literature,* 44: 869-924.

Heckman, J. 1979. "Sample selection bias as a specification error." *Econometrica,* 47, 153–61.

Hill, J.K. 1987. "Immigrant Decisions Concerning Duration of Stay and Migratory Frequency." *Journal of Development Economics,* 25: 221-234.

Hoefer, M., Rytina, N. and B.C. Baker. 2011. "Estimates of the Unauthorized Immigrant Population Residing in the United States: January 2010." *Office of Immigration Statistics, Department of Homeland Security.*

Jones, R. C. 1998. "Introduction: The Renewed Role of Remittances in the New World Order,"*Economic Geography*, 74, 1–7.

Kossoudji, S.A. 1992. "Playing Cat and Mouse at the U.S.-Mexican Border." *Demography*. 29:159-180.

Massey, D.S. 2007. "Understanding America's Immigration Crisis." *Proceedings of the American Philosophical Association,* 151, 309-327.

Massey, D.S. and K.E. Espinosa. 1997. "What's Driving Mexico-U.S. Migration: A Theoretical Empirical and Policy Analysis." *American Journal of Sociology.* 102:939-999.

Massey, D.S., J. Arango, G. Hugo, A. Kouaouci, A. Pellegrino, J.E. Taylor. 1994. "An Evaluation of International Migration Theory: The North American Case." *Population and Development Review,* 20: 699-751.

Mexican Migration Project (MMP). 2010. Population Studies Center, Princeton University. Princeton, NJ. http://mmp.opr.princeton.edu.

Meyer, J. 2009. "Drug Cartels Raise the Stakes on Human Smuggling." *Los Angeles Times,* March 23.

Mitra, A. 2004. "What Motivates Transfer of Resources: Altruism or Principle of Exchange?" *Journal of Developing Areas,* 37, 31-48.

Orrenius, P.M. 2001. "Illegal Immigration and Enforcement Along the U.S.-Mexico Border: An Overview." *Federal Reserve Bank of Dallas Economic and Financial Review*.

Orrenius, P.M. and M. Zavodny. 2001. "Do Amnesty Programs Encourage Illegal Immigration? Evidence from the Immigration Reform and Control Act (IRCA)." *Federal Reserve Bank of Atlanta Working Paper 2001-19.* Atlanta, GA.

Padgett, T. 2003. "People Smugglers Inc." *Time.com,* August 12.

Poirine, B. 1997. "A Theory of Remittances as an Implicit Family Loan Arrangement." *World Development,* 25, 589-611.

Quinn, M.A. 2005. "Remittances, Savings and Relative Rates of Return." *Journal of Developing Areas,* 38, 1-43.

Quinn, M.A. 2009. "Estimating the Impact of Migration and Remittances on Agricultural Technology." *Journal of Developing Areas,* 43: 199-216.

Quinn, M.A. and S. Rubb. 2006. "Mexico's Labor Market: The Importance of Education-Occupation Matching on Wages and Productivity in Developing Countries." *Economics of Education Review,* 25: 147-156.

Rapoport, H. and F. Docquier. 2006. "The Economics of Migrants' Remittances" in *Handbook of the Economics of Giving, Altruism and Reciprocity, Volume.2,* Elsevier.

Reyes, B.I. 1997. "Dynamics of Immigration: Return Migration to Western Mexico." *Public Policy Institute of California*, San Francisco, CA.

Reyes, B.I. 2001. "Immigrant Trip Duration: The Case of Immigrants from Western Mexico." *International Migration Review.* 35:1185-1204.

Riosmena, F. 2010. "Policy Shocks: On the Legal Auspices of Latin American Migration to the United States." *Annals of the American Academy of Political and Social Science,* 630: 270-293.

Singer, A. and D.S. Massey. 1998. "The Social Process of Undocumented Border Crossing Among Mexican Migrants." *International Migration Review,* 32: 561-592.

Spener, D. 2001. *Smuggling Mexican Migrants Through South Texas: Challenges Posed by Operation Rio Grande, Global Human Smuggling in Comparative Perspective,* The Johns Hopkins University Press, Baltimore, MD.

Taylor, J.E. and A. Lopez-Feldman. 2010. "Does Migration Make Rural Households More Productive? Evidence from Mexico." *Journal of Development Studies,* 46: 68-90.

Terrazas, A. 2010. "Mexican Immigrants in the United States." *Migration Policy Institute,* accessed online at www.migrationpolicy.org