The World Economy

*The World Economy* (2012)
doi: 10.1111/j.1467-9701.2011.01425.x

# The Determinants and the Selection of Mexico–US Migrants

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## 1. INTRODUCTION

TO quantify the effect of international migration on the sending and receiving country, the starting point should be a precise measure of quantity and quality of migrants. The Mexico–US flow of migrants, the largest bilateral flow in the world, has attracted much attention. There is an active debate on whether the United States attracts Mexican workers from the low end of the Mexican distribution of skills (i.e. negative selection). Chiquiar and Hanson (2005), using US and Mexican census data, suggest this was not the case; they find that the selection of Mexican migrants has been mildly positive. Orrenius and Zavodny (2005) and McKenzie and Rapoport (2010) using data from the Mexican Population Project (MPP) have also found evidence of positive selection for Mexican migrants. On the other hand, Fernández-Huertas Moraga (2011), using longitudinal data representative of all of Mexico in the Encuesta Nacional de Empleo Trimestral (ENET; population survey for Mexico similar to the Current Population Survey in the United States), finds negative selection of migrants to the United States in terms of wages and education.[1] He argues that the US census data under-count undocumented immigrants (especially recent ones) and it ignores selection on unobservables which, of course, could bias their results in either direction. Finally, migrants to the United States may have upgraded their schooling after migration.

We thank Daniel Chiquiar for very helpful comments, suggestions, collaboration and support on this project. We also thank Douglas Nelson and two anonymous referees for helpful suggestions. Further, we are greatly indebted to the governments of Germany, Austria, Norway, Korea and Switzerland for their financial support through the Multi-Donor Trust Fund for 'Labor Markets, Job Creation, and Economic Growth'.

[1] Ibarraran and Lubotsky (2007), using the Mexican census, find negative selection of immigrants from regions with large migration networks, while regions with small or no migration networks exhibit positive selection.

However, both the MPP sample and the ENET have their own problems. MPP is only representative for rural Mexico, and the selection of workers in those areas may be different from urban parts of the country. ENET misses migration of whole families as it captures migrants from questioning other people in the household left behind.

This paper follows, and in part reproduces, Kaestner and Malamud's (2010) work on selection of Mexican immigrants. We perform a modified version of their analysis, and we introduce some new elements in this debate. As argued in Kaestner and Malamud (2010), the Mexican Family Life Survey (MxFLS), a longitudinal panel that collected data on 8,100 households in 2002 and then interviewed them again in 2005, is a very good database to study selection of migrants. This sample has several advantages when compared to the census, the Mexican Migration Project (MMP) and even the ENET. First, it constructs a sample of the 2002 Mexican population that is representative at the national and at the state level and re-samples all individuals (with a 90 per cent recontact rate) in 2005 constructing an individual-level panel. While the household was the unit of analysis in 2002, each individual was then followed even if they left the household moving to a new residence or even if they left the country. As a consequence, all the observable characteristics of people who migrated to the United States (between 2002 and 2005) as well as their wage before migrating are known. This allowed Kaestner and Malamud (2010) to analyse the selection on observables (as done in Chiquiar and Hanson, 2005) but also the selection on unobservables. We reproduce their analysis, and, in addition, we analyse skill-specific migration premia. Our approach is to merge the MxFLS data with the US American Community Survey (ACS) data between 2002 and 2005, which allows us to define a skill cell as the combination of education, age, gender and marital status. In this merged data set, we can measure the expected migration premium for Mexican workers in different skill cells. Assuming that each potential migrant looks at earnings of similar Mexican migrants in the United States, we can very precisely identify the expected migration premium for workers with different skills. This also allows us to analyse whether migration and selection respond to utility-maximising behaviour once we account for proxies of migration costs. Compared to the Mexican and US censuses, our data identify migrants directly (not by difference), and we know their pre-migration characteristics and wage. Unlike the MMP, we have a nationally representative sample, and unlike the ENET, the MxFLS includes migrants who moved the whole household to the United States. We also add to the analysis in Kaestner and Malamud (2010) by analysing the potential impact on migration of some new variables: household shocks, the initial financial wealth and debt, being a self-employed and other individual and household characteristics. We extend the analysis by studying the attributes of return migrants. The MxFLS data contain information for workers who are in Mexico in 2005 and have spent some time (more than one month) in the United States between 2002 and 2005. We know all the characteristics of these returnees. We can analyse the return behaviour of migrants, whether they respond to a return premium and where in the skill distribution returnees are selected from. While there is a large literature on migration to the United States, much less has been said about the selection and incentives of returnees. Lacuesta (2006) is the only study we are aware of that looks at the characteristics of Mexican returnees (using census data). As in any cross-section, however, he cannot observe the wages and occupation of returnees before they left and hence he uses some suggestive evidence from the MMP on rural migrants who returned. In spite of the fact that the MxFLS only identifies few returnees, because of the sample size and the short period of time analysed (2002–05), we can still use returnees' characteristics before migration and detailed information to construct measures of selection and the premium to return.

Our analysis uses a simple model of rational choice between migration and non-migration. We adapt Borjas (1987) to a context in which individuals differ by a vector of observable characteristics and decide whether to migrate to the United States, based on a comparison between earnings in Mexico and earnings of Mexicans with similar characteristics in the United States. This extension allows us to use workers in different skill cells as differentiated in terms of migration premium (earning differentials) as well as migration costs (that may depend on age, family status, education, as well as their state of residence, their assets and the presence of relatives in the United States). Similarly, we can calculate the premium to migration and return migration (differential in wage before and after return) and, in a similar way, analyse the decision to migrate and return as a function of the earnings premium and of the cost. In our analysis, the cell-specific migration premium is a fundamental determinant of migration.

Our analysis reveals three interesting results. First, confirming Borjas (1987) and Fernández-Huertas Moraga (2011), we identify the existence of a negative selection of Mexican migrants to the United States. Kaestner and Malamud (2010) characterise selection as 'intermediate', namely stronger at intermediate levels of education and of the wage distribution. This is true for our analysis as well; however, summarising the selection with only one average number (the difference in observable and unobservable wage-earning skills), we find that its value is actually negative, not zero. On average, workers who later migrated to the United States earned 23 per cent less in 2002 than workers who did not migrate. Of this difference, which is statistically significant, only a (non-significant) 5 per cent was explained by observable characteristics (hence the impossibility of detecting the negative selection in a method based only on observable characteristics). The remaining 18 per cent was because of non-observable characteristics.[2] Second, we find that the US migration earnings premium is significantly larger for less skilled workers, and as predicted by the theory, this explains part of the negative selection. Even after controlling for the migration premium, however, there is a large, negative and significant effect of having high levels of schooling (more than 12 years) on the probability of migration. We interpret this as a sign of higher costs of migrating for highly educated, and we attempt some explanations. We also find that, once we control for the migration premium, an array of factors affect migration behaviour. On the one hand, living in a state close to the US border or having some relatives in the United States increases the probability of migrating. On the other hand, higher initial assets and lower debt also make migration more likely. This is possibly a sign that fixed costs and credit constraints may limit migration opportunities for the poorest workers. We also find that households that received a significant shock in the last five years (death of household member, serious hospitalisation of a household member, unemployment or business failure, house or business lost in a natural disaster or lost total crop) had a higher probability of migrating.

Finally, we find that for returnees, the selection and premium are opposite from those for migrants: more educated workers receive higher earnings premia for returning from the United States, and the selection of migrant returnees is positive on observables and unobservables relative to migrants. While we have to be cautious as the size of the sample does not allow us to make generalisations easily, these findings, if confirmed, should stimulate the search for a more complex model of migration and return. The model in Borjas and Bratsberg (1996), for example, predicts that the 'least productive' migrants from Mexico stay in the United States and so it predicts positive selection of returnees relative to migrants, but it does not predict that returnees are positively selected relative to non-migrants. In that model, there should be positive selection of both or negative selection of both relative to non-migrants. Positive selection for one type (temporary or permanent migrants) and negative for the other would, instead, be possible in a model like Dustmann (1993), and more recently Dustmann et al. (2010). They explain this phenomenon by differentiating between the accumulation of skills and the price of skills in the destination country relative to the sending country. Highly educated Mexicans in the United States may accumulate skills (e.g. knowledge of English, connection with the US economy,

[2] Kaestner and Malamud (2010) find intermediate selection on observables and no selection on unobservables. The differences may arise from the fact that they include cognitive abilities among the observables (but not gender and family status), which they focus exclusively on males, while we include working women and that we aggregate all groups to obtain only one statistic of selection of observables and unobservables. Looking at their kernel density in Figure 2 for migrants and non-migrants seems likely that they would also obtain a negative average selection of migrants if they summarised the distribution with only its average.

etc.) highly valued in Mexico. Less educated Mexicans, on the other hand, are paid more in the United States than in the Mexico for their existing skills (e.g. manual tasks) but are not accumulating new skills. Hence, for the second group, it makes sense to stay in the United States, while for the first group, it is more attractive to return after those skills have been acquired.

The rest of the paper is organised as follows: in Section 2, we define the measures of average selection on observables and unobservables and calculate them for US migrants, domestic migrants and returnees using the MxFLS. Section 3 combines data from the US ACS 2002–05 and the MxFLS to construct the earnings premia of migrants in different skill groups. Section 4 presents the model that we use in our econometric analysis of the determinants of migration probability across skill groups and shows the regression results. First, we estimate some basic regressions of the migration probability on observed characteristics and the migration premium, and second, we test robustness to the inclusion of several controls for migration costs, initial wealth and idiosyncratic shocks. We also test the determinants of selection on unobservables and of return migration. Section 6 concludes the paper.

## 2. SELECTION ON OBSERVABLES AND UNOBSERVABLES

Our approach to analyse the selection of migrants follows and extends the methodology developed by Chiquiar and Hanson (2005); Fernández-Huertas Moraga (2011) and in particular Kaestner and Malamud (2010). We first characterise the distribution of non-migrants, migrants to the United States and returnees on their combination of observable characteristics. We group individuals in cells with homogeneous observable characteristics, so that the average wage as of 2002 in that cell can be considered their wage-earning ability. We call the wage-earning ability based on observables the ‘observable skill’ of that group of workers. For each skill cell, we can count non-migrants, migrants to the United States, migrants within Mexico and returnees. Hence, we can identify how each of these populations compare to the others in their distribution across skills. In particular, we call the difference in average skill of migrants relative to non-migrants the ‘selection’ (positive or negative) of migrants and similarly for other groups. More specifically, we can assess whether the likelihood of selecting oneself into a group (non-migrant, migrants or returnees) is systematically related to the skills of the individual. Besides characterising non-migrants, migrants to the United States and returnees based on their observable characteristics, we can also analyse their skill differences within cell (i.e. in their unobservable wage-earning skills). This is possible because we observe the wage in 2002 and we know whether the person migrated to the United States or has not migrated by 2005. By averaging the unobservable skill differences between non-migrants and migrants (or non-migrants and returnees), we can assess whether there is any evidence of overall positive or negative selection on unobservables.

We further analyse how the propensity to migrate across cells and the selection over unobservable skills are affected by incentives (the earnings differential between United States and Mexico) and by migration costs, which we can proxy with different sets of variables. Besides skills, we find that age, family structure and education affect the cost of moving, in general, while the distance to the US border and the presence of relatives in the United States affect the cost and opportunity of migrating specifically to the United States. Finally, initial wealth and debt affect the ability to pay fixed costs up front. We will analyse the impact of all these factors on the probability of migrating to the United States. Such analysis is a test of an extended Roy (1951) model with earnings differentials as well as varying migration costs across skill cells. In our specification, we assume a non-parametric dependence of earnings on skills, so that each cell may have a different earning potential in the United States and Mexico.

### *a. Data and Individual Wage Decomposition*

Our empirical analysis is based on data from the Mexican Family Life Survey (MxFLS), which is a longitudinal household survey, representative at the national level.[3] The survey sampled 8,400 families across 150 different communities in 2002. This baseline survey included several individual-level variables such as age, family status, gender, educational attainment, labour market participation, earnings, wealth, as well as other socioeconomic characteristics and retrospective questions. The original survey was followed by a second round administered between mid-2005 and 2006. The recontact rate was 90 per cent, and people who migrated to the United States between surveys have been recontacted at a rate of 91 per cent. Hence, this survey is an excellent source of information about Mexican immigrants in the United States. It is a nationally representative panel of individuals with a large number of individual characteristics, measured as of 2002, and it includes the migration status in 2005. Moreover, if people did not migrate or if they migrated and returned, we also know their labour market status and earnings as of 2005. The representativeness of the survey is evaluated *vis-à-vis* the 2000 Mexican census in Tables A1–A3 in the Appendix. While the MxFLS seems to slightly under-represent highly educated and older individuals, most of the summary statistics are quite close to those of the census. Also, the correlation of average log earnings by skill cell between the MxFLS and the census is extremely high: the

[3] These are the same data analysed in Kaestner and Malamud (2010).

ordinary least squares (OLS) coefficient of log earnings from MxFLS on the log earnings from the census is 1.04, the standard error is 0.06, and the $R$-square is 0.59 (see Figure A1 in the Appendix).

If individuals are in the United States in 2005, we cannot observe their individual earnings and their labour market status as of 2005.[4] However, we combine the MxFLS with the US American Community Survey (ACS; available from IPUMS, Ruggles et al., 2010) for the years 2002–05, and we can construct a representative sample of immigrants from Mexico who arrived during those years. We calculate individual yearly earnings and labour market status, by cell of observable characteristics. Assuming that potential migrants from Mexico only use the earnings of recent Mexican migrants in the United States with similar observable characteristics to form their expectations, we can calculate their expected migration premium.

In the constructed data, we group individuals according to an array of individual characteristics $X$ as measured in the 2002 survey. For the same individuals, we also observe whether, as of year 2005, they are still in the same location in Mexico ($S$ for 'stayer'), whether they are resident of the United States and hence a US migrant ($US$) or whether they are in Mexico but they spent some period of residence abroad and hence they are returnees ($R$). We restrict the individual characteristics included in $X$ to education, age, gender and family status. This particular set of characteristics matches that in Chiquiar and Hanson (2005) and, more importantly, is recorded in both the US ACS and the MxFLS. In particular, the subset of education characteristics ($Edu$) can take four values depending on the years of schooling (0–4, 5–8, 9–12, more than 12). The subset capturing age characteristics ($Age$) can take six values including workers above 21 years of age divided into five 9-year intervals and in a residual group of people above 65. The subset gender ($Gen$) can take one of the two values $M$ and $F$. The subset family type ($Fam$) can take one of the three values (Single, married with no children, married with children). These characteristics identify the observable features of an individual in our data set. We use the notation $x = (Edu, Age, Gen, Fam) \in X$ to denote the vector of characteristics of individuals. We allow for a fully saturated model in observable characteristics, so individuals can be put in one of 144 cells spanned by $x_i$ = (4 education by 6 age by 2 gender by 3 family groups). Each individual has also a 'migration status' $k$ attached to herself as she can be a non-migrant ($S$), a migrant to the United States ($US$) or a returnee ($R$); hence, $k$ varies within the set ($S$, $US$, $R$). Our data set also allows us to observe the wage of each individual, $w_i$, in 2002.

[4] The MxFLS is planning to post the data on labour market outcome and earnings of individuals who migrated to the United States to their website, but this has not been done at the time this paper was written.

We decompose the (logarithmic) wage as of 2002 of individual $i$ in cell (of observable characteristics) $x$ into two components as follows:

$$\ln(w_i) = \ln w_{MEX}(x_i) + \varepsilon_{MEX,x,i}. \quad (1)$$

The term $\ln w_{MEX}(x_i)$ is the mapping from individual observable characteristics $x_i$ into logarithmic wages in Mexico for that group as of 2002. Assuming that the observable characteristics $x_i$ are among the main determinants of wage-earning abilities of individuals, the function $\ln w_{MEX}(x_i)$ translates the characteristics into a wage-earning potential in Mexico. The term $\varepsilon_{MEX,x,i}$ captures the non-observable wage-earning characteristics that affect individual $i$ earning abilities in Mexico. For simplicity and tractability of the model introduced in Section 4.a, we assume that these idiosyncratic characteristics are distributed across individuals in each cell $x_i$ as a normal variable with zero mean and variance $\sigma_x^{MEX}$.[5] This variance may vary by cell. For each individual, $\varepsilon_{MEX,x,i}$ represents her specific earning ability relative to workers with identical observable age, schooling, gender and family status. Hence, people are heterogeneous in their abilities, and $\varepsilon_{MEX,x,i}$ is a measure of their idiosyncratic ability.[6] The MxFLS, however, allows us to measure $\varepsilon_{MEX,x,i}$ for each individual as the difference between the individual wage and the average wage in the cell. Hence, in this data set, we can measure the average value of unobservable earning potential (i.e. not explained by observable variables) for Mexicans who did not move, for migrants and for returnees. Similarly, we can measure the observable earning potential (i.e. that based on observable characteristics) of those who did not move, of movers and of those who moved and came back. We explain below how we can calculate the selection of migrants using these statistics.

### *b. Selection*

A first important question is: Are migrants (and returnees) selected, on average, among individuals with higher observable earning abilities (positive selection) or lower observable earning abilities (negative selection) than the average non-migrants (and non-returnees)? As long as we can observe the characteristics of migrants and the wage-earning potential of each skill group in the country of origin, we can answer this question. Our data allow us to answer a second question: Once we control for observable characteristics, are migrants selected among workers with higher or lower unobservable earning abilities relative to

[5] The idiosyncratic shocks need not be normally distributed as long as they are zero mean and independent. Asymptotically, the statistics would still have a normal distribution.

[6] The above model with 144 observable skill cells explains about 20 per cent of the variance of individual log earnings in our sample ($R$-squared of 0.198). Of these 20 per cent, about 10 per cent is explained by schooling, 10 per cent by age, gender and family status. The remaining 80 per cent is explained by non-observable characteristics.

non-migrants? We first characterise such selection on observable and unobservable characteristics for migrants and returnees on average, and then we will move to analyse how they depend on skills and whether the selection of migrants is consistent with a rational choice to maximise utility on the part of the migrant.

In this decomposition, we follow the literature. The observable characteristics are some of those features of a worker that can be observed and that have been proven by the labour literature to affect its productivity: typically, education and age, and sometimes gender and family status. While important in assessing the productivity of workers and widely available across censuses, they usually only explain a fraction in productivity (wage) differentials. Unobserved characteristics such as individual abilities, motivation and working ethics are also very important but harder to measure and observe. The need to construct skill cells that we can associate with wages (productivity) in Mexico and the United States and the need to aggregate for the whole country to have enough observations per cell bring us to this standard, but rather coarse, definition of observable skills. We will consider other characteristics of workers (state of residence, wealth and family shocks) as potential determinants of migration, but we include them as linear control variables in the regressions of Section 4.b rather than as determinants of the skill cells. In other words, we constrain those features to affect people of different skills in a common way in their migration behaviour, while letting skill-premium incentives to vary non-parametrically across groups.

*(i) Average selection on observable characteristics*

The average (logarithmic) observable earning ability of Mexican workers who do not migrate (*S*) with characteristics *x*, call this $\ln \widehat{w}_S(x)$, is summarised by the average earnings of all nonmigrant individuals in observable cell *x* as revealed in the 2002 survey. Hence:

$$\ln \widehat{w}_S(x) \;=\; (1/S_x)\sum_{i\in x} \ln w_{i,S},$$

where $S_x$ is total observed employment in cell *x* and $w_{i,S}$ are annual earnings of individual *i* who did not move location between 2002 and 2005. The variable $\ln \widehat{w}_S(x)$ summarises the wage-earning observable skills of non-movers in group *x*, and as this group is by far the largest, this value approximates the average observable (wage-earning) skills for all workers in group *x* in Mexico ($\ln \widehat{w}_{MEX}(x)$). The average observed skill of the non-migrant population in Mexico, therefore, corresponds to their average logarithmic wage based on observables and can be written as follows:

$$\ln w_S = \sum_{x\in X} \ln \widehat{w}_S(x) f_s(x). \qquad (2)$$

The term $f_S(x) = S_x / \sum_{z \in X} S_z$ is the observed relative frequency of nonmigrant workers $S$ in cell $x$. To identify how migrants compare to nonmigrants in their observable skills (wage-earning abilities), we construct the counterfactual wage distribution based on the observable characteristics of migrants and the corresponding observed wage of nonmigrants for each cell $x$. Such statistics show the average wage of migrants, as of 2002, if they had the same earning ability in each skill cell as nonmigrants, and the skill distribution of migrants. In particular, we define the average observable skills of migrants to the United States as:

$$\ln w_{US|S} = \sum_{x \in X} \ln \widehat{w}_S(x) f_{US}(x). \quad (3)$$

The term $f_{US}(x) = MUS_x / \sum_{z \in X} MUS_z$ is the relative frequency of workers who had migrated to the United States by 2005, *MUS*, in each of the skill cells (as defined in 2002). Such method accounts in a non-parametric way for the fact that migrants are selected from the original population nonrandomly and uses the relative frequencies of migrants to correct for this non-randomness. Hence, we can define the average 'selection' of Mexican migrants to the United States relative to non-migrants, based on observable characteristics ($O$), as:

$$O_{MUS,S} = \ln w_{US|S} - \ln w_S. \quad (4)$$

If expression (4) is positive, it means that migrants to the United States are selected, on average, above the mean of wage-earning characteristics of non-migrants. This is exactly the definition of positive selection. *Vice versa*, if it is negative, migrants are selected, on average, below the average observable wage-earning ability of non-migrants. As we use 144 cells to classify people, this statistic summarises the wage-earning advantage along all the considered dimensions. Moreover, quantitatively, as the expression is in log differences, it approximates the difference in wage-earning abilities as the percentage of the average non-migrant wage.

Let us emphasise the advantages in measuring the observable characteristics of migrants to the United States as they were in Mexico in 2002, relative to measuring them from Mexican migrants in the United States. This is probably the main advantage that these data buy us, relative to Chiquiar and Hanson (2005), who were constrained to census data. First, any bias coming from the fact that undocumented workers are under-counted and their presence varies by skill group is avoided. Second, any upgrade of observables (such as schooling) and any change in family status that took place after migration is not going to affect the comparison between migrants and non-migrants. Third, we can characterise the selection of a more recent wave of migrants (those who moved between 2002 and 2005) rather than the selection based on the stock of migrants in the United States. While both are interesting exercises, we focus on the selection of the flow of migrants to the United States between 2002 and 2005, and Chiquiar and Hanson (2005) analysed selection for the stock of immigrants to the United States as of year 2000.

*(ii) Average selection on unobservable characteristics*

Equally importantly, however, the use of MxFLS allows us to go beyond the selection on observable characteristics. As we observe the actual wages of Mexican workers who ended up moving to the United States by 2005, we can also measure the average selection on unobservable characteristics. To do that, consider the wage in 2002 of workers who, as of 2005, had migrated to the United States. In each skill group, we can calculate the unobservable skills of migrants, relative to non-migrants, as the difference between the average wage of migrants and the average wage of non-migrants in each skill group. Then by averaging across skill groups, using the relative density of migrants to the United States, we obtain a measure of the average selection on unobservable ($U$) skills of migrants relative to non-migrants:

$$U_{MUS|S} = \sum_{x \in X} \left[ \left( \ln \widehat{w}_{US,2002}(x) - \ln \widehat{w}_{S}(x) \right) f_{US}(x) \right] = \ln w_{US,PRE} - \ln w_{US|S}. \quad (5)$$

In equation (5), the term $\ln w_{US,2002}$ corresponds to the average wage in 2002 of Mexican workers who migrated to the United States by 2005. We will refer to the difference defined in (5) as ‘selection on unobservable characteristics’; however, an important caveat is that we do not know whether those unobservable factors are driven by temporary shocks or by permanent idiosyncratic characteristics. Specifically, if the wage of non-migrants is different to that of migrants because one of the two groups received some transitory negative or positive shock, then this statistic is not particularly useful to predict the wage-earning ability of migrants relative to stayers in the long-run. In Section 4.b.vi, we will explicitly consider the role of some idiosyncratic shocks (health, violence, bankruptcy) in determining the probability of migration and in part address this issue. The sum of $O_{MUS,S}$ and $U_{MUS|S}$, which equals the difference in average wage between Mexicans who migrated to the United States and Mexicans who stayed, combines the observable and unobservable skill differentials and measures the total selection of migrants to the United States, relative to non-migrants.

In this paper, differently from Kaestner and Malamud (2010), we summarise the whole distribution of selection on observable and unobservable characteristics with its average. We think this is an interesting statistic and allow a precise mathematical characterisation of what is positive, neutral or negative selection, depending on whether the average $O_{MUS,S}$ and $U_{MUS|S}$ are significantly positive, not significantly different from 0, or significantly negative.

### c. Returnees

It is easy to extend expressions (4) and (5) to measure the selection of returnees. These are identified as people who were in the United States for more than one month between 2002 and 2005. For these individuals, we also have information about their working status and earnings in 2005. We can analyse how they are selected relative to non-migrants. We can also measure the 'premium' that they get for having been abroad, that is, the differential gains in earnings between 2002 and 2005 relative to non-migrants with identical observable characteristics. As we observe their wages pre- and post-return and we observe the wages of stayers in 2002 and 2005, we can separate the genuine gains because of experience abroad from their selection. Finally, we can analyse whether the return behaviour is also consistent with an optimising model as in Borjas and Bratsberg (1996), by characterising how the migration premium varies with individual characteristics and whether selection is consistent with it.

### d. Evidence on Average Selection

Before calculating the average selection on observables (*OS*) and unobservables (*US*) for US migrants and returnees, Table 1A–C shows the percentage of people who migrated to the United States, domestically, or who migrated and returned between 2002 and 2005 as share of the group in 2002. Our analysis is concerned with migration to the United States and return migration; however, the group of domestic migrants is an interesting comparison group.

Table 1A gives a sense of what percentage of the total population, included in the MxFLS, migrated to the United States. Including the whole sample, we obtain that 2.8 per cent of them migrated to the United States while limiting the sample to adult men (over 21 years of age and below 65 years) 3.3 per cent of them migrated. Men in their twenties and thirties are the most mobile group with a migration rate to the United States of 4.3 per cent, while only 2.3 per cent of women in the same age range migrated to the United States. Two things are interesting to note. First, these values are consistent with those reported from other sources. Hanson et al. (2009) use consecutive Mexican censuses and report a migration rate of 10 to 12 per cent for men in their twenties and 5 to 10 per cent for men in their thirties. Passel and Cohn (2009) measure a yearly migration rate of 1.1 per cent of the adult Mexican population. An overall value of 1 per cent per year is compatible with our percentages. The second interesting fact is that, in the aggregate, the percentage of migrants to the United States and of domestic migrants is very similar for men, while women have a lower propensity to migrate to the United States. This could mean that migration to the United States involves less migration of whole families (at least in the short run).

TABLE 1

(A) Percentage of US Migrants, Internal Migrants and Returnees. (B) Percentage of US Migrants, Domestic Migrants and Returnees, by Schooling. (C) Percentage of US Migrants, Domestic Migrants and Returnees by Age as of Year 2002

| *A* | | | | | | |
|---|---|---|---|---|---|---|
| *Period 2002–05* | *Population* | *Adult Population (21–65)* | *Male Adult Population (21–65)* | *Male Pop (22.5–39.5)* | *Female Pop (22.5–39.5)* | |
| US migrants/total | 2.8 | 2.5 | 3.3 | 4.2 | 2.3 | |
| Domestic migrants/total | 2.6 | 3.2 | 3.3 | 4.3 | 4.3 | |
| Returnees/migrants to United States | 15 | 25 | 25 | 17.0 | 12 | |
| *B* | | | | | | |
| *Period 2002–05* | *0–4 Years* | *4–8 Years* | *8–12 Years* | *12 Plus* | | |
| US migrants/total | 2.3 | 4.3 | 4.1 | 1.6 | | |
| Domestic migrants/total | 2.2 | 3.1 | 5.0 | 6.2 | | |
| Returnees/migrants to United States | 30 | 16 | 15 | 26 | | |
| *C* | | | | | | |
| *Period 2002–05* | *Below 21* | *21–30* | *31–39* | *40–48* | *49–57* | *57–65* |
| US migrants/total | 3.3 | 4.0 | 2.4 | 2.4 | 1.5 | 1.1 |
| Domestic migrants/total | 2.2 | 5.3 | 3.3 | 2.6 | 1.8 | 1.2 |
| Returnees/migrants to United States | 5.6 | 11 | 21 | 32 | 63 | 64 |

Notes:
(i) US migrants are those individuals who have spent at least one month in the United States between 2002 and 2005. If they are in Mexico as of 2005 they are returnees. (ii) Domestic migrants are those individuals who as of 2005 are resident of a different Mexican state, relative to their state of residence in 2002.

Among US migrants, one in four adult men goes back to Mexico within three years. Temporary migration is a significant share of total migration, and the MxFLS is one of the few sources that allows us to quantify it as a percentage of migrants.[7]

Table 1B and C shows the percentage of US migrants, domestic migrants and returnees among migrants for four schooling groups and for six age groups. In terms of selection of immigrants across schooling groups, two facts emerge already from these summary statistics. First, migrants to the United States are disproportionately represented in the two intermediate education groups (5–8 and 9–12 years of schooling) and are particularly rare among highly educated (with more than 12 years of schooling). This feature is what Kaestner and Malamud (2010) call intermediate selection. Such a tendency is made even stronger after we account for the return migrations that tend to be larger for the two extreme schooling groups and smallest for the intermediate ones. Second, such a pattern is not shared by the domestic migrations. They show the more common pattern of an increase in percentages of migrants as the schooling level increases (Grogger and Hanson, 2008, document this pattern in international migrations across the world). The largest discrepancy between the share of domestic and US migrants among individuals is in the highest education group (more than 12 years). There is an extremely low migration rate of highly educated Mexicans to the United States which is rather odd as college educated are the more internationally mobile people (e.g. Docquier et al., 2010). In terms of age groups, shown in Table 1C, the highest percentage of migrants is among individuals below 30 years of age, and then the percentage declines steadily. This feature is shared by internal migrants as well as migrants to the United States.

Table 2 shows the average (wage-earning) skill selection for the population of adult migrants to the United States (between 21 and 66 years of age), domestic migrants and returnees relative to non-movers. The total average selection is decomposed between the part of the selection explained by observable characteristics (education, age, gender and family status) and the part explained by unobservable characteristics. To calculate the observable and unobservable selection, we apply the formulas in (4) and (5). To calculate the standard error, we use the standard deviation of earnings in each cell, and assuming normality and independence of the individual deviations, we apply the formula for the standard error of a weighted sum. Notice that the cells are constructed including workers only. For most of them (80 per cent), we have reported earnings, while for the remaining, we impute earnings based on their observable characteristics.[8] Interestingly, con-

[7] These return percentages are not far from those found for migrants to the UK during the first five years by Dustmann and Weiss (2007).

[8] We imputed the missing earnings based on the predicted values on a regression of log earnings on schooling, age, gender, marital status and state of residence.

TABLE 2
Average Selection, on Observable and Unobservable Characteristics

| *Selection* | *Migrants United States (%)* | *Migrants Within Mexico (%)* | *Returnees (%)* |
|---|---|---|---|
| Total adult population (age 21–65) | | | |
| Total selection | −23 (3.9) | +10 (3.3) | +6.2 (3.9) |
| Explained by observable | −5 (4.0) | +3 (3.3) | +10.1 (3.9) |
| Due to unobservable | −18 (3.8) | +7 (3.3) | −3.8 (3.9) |
| Male adult population | | | |
| Total | −40 (5.0) | +18 (4.3) | −21 (4.6) |
| Explained by observable | −12 (5.2) | +8 (4.0) | −6 (4.5) |
| Due to unobservable | −27 (4.7) | +10 (4.4) | −15 (4.7) |
| Female adult population | | | |
| Total | 10 (4.0) | +2 (4.0) | 116 (8) |
| Explained by observable | −5 (4.3) | +1 (3.7) | 37 (8) |
| Due to unobservable | +15 (3.7) | +1 (4.0) | 79 (8) |

Notes:
(i) The average selection variable is the difference in average wages between the two groups in log points. The part explained by observables is the difference in average wage explained by fully saturated education–age–marital status–gender models. The part not explained by observable is the residual difference in average wages between migrants and non-migrants after controlling for all the observables. (ii) The total number of Migrants to the United States (age 21–65) is 304. The total number of non-migrants is 11,583. The total number of internal migrants is 482.

firming the finding of Fernández-Huertas Moraga (2011) and contrary to what is found by Chiquiar and Hanson (2005), we find mildly negative selection of migrants to the United States, both on the observable and on the unobservable skills. Migrants to the United States earn on average 23 per cent less than non-migrants. Such difference is because of an insignificant negative selection (−5 per cent) on the observables and a significant −18 per cent negative selection on unobservables. Importantly, when we account for the standard error of this average selection, only including the selection on unobservables, we obtain a significant negative value, confirming the results in Fernández-Huertas Moraga (2011). Such selection is even larger when we consider only the male population (−40 per cent), while for the population of female migrants, it is mildly positive (+10 per cent). Kaestner and Malamud (2010) do not report this average selection statistic. Consistently with them, however, we do not have significant selection on observables. On unobservables, they suggest that they do not find a clear pattern of selection. However, in the regression on annual earnings (Table 4), they do find a significant negative selection on unobservables for the top quintile. Together with insignificant selection on other quintiles, this might indicate negative average selection on unobservables. Some readers may want to focus on male selection, given that often women follow their husbands in the migration decision. When we include women, we are only including those who worked before migrating in our selection analysis. Hence, for them, the decision to migrate may have been shared with their partner, and in any case, it is interesting to see whether they are subject to different selection pressures. The selection of domestic migrants (+10 per cent) as well as the selection of returnees (+6.2) is both positive and significant.

The way we should interpret average selection on observable and on unobservable characteristics is as follows. The first describes how much of the skill-earning differentials between non-migrants and migrants to the United States is explained by observable characteristics. While migrants and non-migrants indeed differ from each other in terms of observables, on average, they do not seem to differ across characteristics in a way systematically related to their wage-earning potential. We can call it a 'skill-neutral' selection. On the other hand, aggregating all the skill cells, there seems to be a systematic correlation between who left and her residual wage.

An alternative way of looking at the negative selection on unobservables is that those individuals have experienced a temporary wage shock in 2002 and hence are not permanently less productive but unlucky or only temporarily disabled. Because of their decrease in income, they are the more likely to leave. If the shock is purely temporary and has no bearing on the wage-earning ability of the individual in the future, then, rather than negative selection, the negative wage differential would simply capture a temporary dip. As we do not have past individual data, it is hard to rule out this possibility. We will use data on family shocks in the last five years to shed some light on the impact of negative unobservables on migration.

One suggestive regularity is that the selection on observables and unobservables has the same sign in seven of nine cases and they always have the same sign when they are both significant. This implies that the selection in both dimensions may be driven by returns to observables and unobservables in the United States relative to Mexico. In particular, according to the Roy (1951)–Borjas (1987) model, higher returns to observable and to unobservable productive skills in Mexico relative to the United States (as is the case) would generate negative selection along both dimensions. For a given difference in average wages and for constant migration costs, if workers who are higher in the skill distribution receive a higher premium in Mexico (i.e. there is a higher dispersion of earnings across skills), relative to the premium in the United States, they will be less likely to migrate. The problem is that migration costs may also vary with skill groups, and if those costs are inversely correlated with skills, they may reverse the selection. Our data set allows us to measure the differential returns (Mexico–US) for observable and unobservable characteristics; hence, we can test their individual impacts on migration frequencies and on selection at the same time, controlling for proxies of migration costs.

## 3. MIGRATION PREMIUM

The expected earnings that a Mexican individual $i$ would receive as worker in the United States after migration are:

$$\ln(w_i^{US}) = \ln w_{US}(x_i) + \varepsilon_{US,x,i}, \tag{6}$$

where $w_{US}(x_i)$ are the average earnings in the United States (i.e. after migration) of a Mexican migrant of observable skill $x_i$ and $\varepsilon_{US,x,i}$ is the individual-specific unobservable skill in the United States, whose average is 0 and variance is $\sigma_x^{US}$. The average migration premium for individuals of observable skill $x$ is $\ln w_{US}(x) - \ln w_{MEX}(x)$, which may differ across skills. Assuming that we observe a representative sample of Mexican migrants to the United States in each cell from the ACS data, we can calculate the expected migration premium $Prem(x)$ for each cell $x$ as:

$$Prem(x) = \ln \widehat{w}_{US}(x) - \ln \widehat{w}_{US,2002}(x), \tag{7}$$

where $\ln \widehat{w}_{US}(x) = 1/MUS_x \sum_{i \in x} \ln(w_i^{US})$. Hence, we assume that the average wage of a Mexican migrant of a certain skill group in a year is taken as the expected wage for a migrant candidate in the same skill group in Mexico. The average premium for migrants to the United States can be obtained, averaging across the population of migrants, as:

$$\Pr = \sum_{x \in X} \left[ \left( \ln \widehat{w}_{US}(x) - \ln \widehat{w}_{US,2002}(x) \right) f_{US}(x) \right]. \tag{8}$$

Similarly, we can calculate the average premium to returnees by differencing the earnings of those groups in 2005 and in 2002, for each skill cell. We can then aggregate into an average premium by weighting each cell by its employment frequency. In the case of returnees, the data on 2002 and 2005 earnings are both from the MxFLS.

Table 3 reports the 2002–05 real average earnings premium (in percentage points) for three different groups. For non-migrants, the premium corresponds to the wage growth experienced by each individual between 2002 and 2005 deflated using the Mexican consumer price index (CPI) deflator and averaged across non-migrants. For migrants in the United States, the premium is calculated as earnings in the United States as of 2005 deflated to 2002 minus the earning in Mexico in 2002 converted in 2002 US dollars using the purchasing power parity (PPP) exchange rate from the Penn World Table 6.2. For returnees, the premium is the difference in earnings in 2002 and 2005 as measured from MxFLS after having deflated the 2005 earnings using the Mexican CPI deflator. Here and in most of the remaining analysis, we use the male adult population as a reference since adult men usually have a more continuous work history, their participation rates are greater and more stable, and migration

TABLE 3
Average Earning Premium 2002–05 for Different Groups (%)

| | *Non-migrants* | *Migrants* | *Return Migrants* |
|---|---|---|---|
| Adult male population (>21 and <66 in 2002) | +6 | 448 | +44 |
| Young male population (≤40 in 2002) | +21 | 466 | +81 |
| Older male population (>40 in 2002) | −10 | 409 | +2.8 |

Notes:
(i) The average Premium variable is the percentage difference in average wages between the group who migrated (returned) and the group who did not. It is calculated by weighting the logarithmic wage differentials between 2002 and 2005 using the relative frequencies of each group and then converting it into percentage points using the exponential formula. (ii) All earnings are converted into 2002 US$ using PPP exchange rate for Mexican earnings.

decisions in a household are often made by them. Some interesting facts emerge from looking at these average premia. First, average wage growth in real terms for male workers was 6 per cent, which amounts to a reasonable 2 per cent increase per year in real terms. Relative to non-movers, returnees earned a wage premium 38 per cent higher and migrants to the United States experienced an increase in wage more than fourfold relative to their premigration one. On average, migrating permanently to the United States makes a very large difference in earnings (and it is certainly also very costly). Temporary migration, however, is also associated with a very high return (+44 per cent in three years), and hence, temporary migration can be considered as a highly profitable option. Interestingly, splitting the population between young and old workers (below and above 40) reveals that the largest gains from each option (migration to the United States and migration plus return from the United States) are realised for young workers. Among older workers (whose wage decreased in real terms for non-migrants), migration to the United States produces a premium somewhat smaller than for young workers. Possibly, part of their human capital is specific to Mexico, or given their proximity to retirement, they may lack the incentives to accumulate new human capital. Return migration from the United States still generates a premium (but much smaller) for older workers.

Table 4 characterises the US migration premium as a function of observable skills of migrants. If we are to explain the (mild) negative selection on observable characteristics of Mexican migrants to the United States with a theory of rational choice and response to incentives (as the one developed in Borjas, 1987 and Roy, 1951), we would expect the return to migration to be negatively correlated with observable skills. Hence, the premium to migrate should be larger for Mexican workers of low observable skill levels, and those workers would migrate in larger proportions. In fact, this is the message conveyed by the regressions of Table 4. A regression of (log) migration return across 144 skill cells on the log earning of the corresponding group in Mexico (Table 4,

TABLE 4
US Migration Premium and Skills

| | (1) | (2) | (3) | |
|---|---|---|---|---|
| Ln(Mexican wage) | −0.49** | | | |
| | (0.04) | | | |
| 4–7 Years of schooling | | −0.10 | −0.17** | −0.17** |
| | | (0.09) | (0.08) | (0.08) |
| 8–12 Years of schooling | | −0.37** | −0.51** | −0.51** |
| | | (0.10) | (0.08) | (0.08) |
| >12 Years of schooling | | 0.69** | −0.79** | −0.79** |
| | | (0.13) | (0.12) | (0.12) |
| Constant | 5.28** | 1.66** | 1.99** | 1.65** |
| | (0.38) | (0.08) | (0.08) | (0.08) |
| Age dummies | No | No | Yes | Yes |
| Family status dummies | No | No | No | Yes |
| Gender dummies | No | No | No | Yes |
| Number of cells | 144 | 144 | 144 | 144 |
| Observations | 6,201 | 6,201 | 6,201 | 6,201 |

Notes:
(i) The dependent variable is the logarithmic differential in earnings between the Mexican in the US in the 2002–05 period (from ACS) and the Mexican in Mexico in 2002, with corresponding observable characteristics. (ii) All regressions are estimated using least squares weighing each cell by the employment in Mexico in that cell. (iii) The standard errors are heteroscedasticity robust. (iv) **Significant at 5% confidence level.

column 1) returns a negative and significant coefficient of −0.49. For an increase in the wage-earning skills of 1 per cent, the return to migrating to the United States decreases by 0.49 per cent. Furthermore, columns 2 and 4 specifically highlight that the migration premium monotonically declines in the level of schooling, independent of whether we control for other characteristics. Considering the estimates of column 2, for instance, the estimated constant implies that the average migration premium for workers with less than four years of schooling (omitted group) is equal to 525 per cent of their Mexican wage; however, workers with more than high school (the last group shown) only gain, on average, 263 per cent of their initial wage from migration.[9] Hence, the log earnings differentials between skill groups are substantial and may generate incentives that differ significantly across skill groups and thus explain the low migration rates of the highly educated. In a similar way, Table 5 characterises the premium to return migration (from the United States) *vis-à-vis* the observable skills of a group. Recall (from Table 2) that the average selection of US returnees relative to non-migrants was neutral to positive (a mildly significant +6 per cent). Consistently with that figure Table 5 shows an intermediate-mildly positive level of selection of temporary migrants. The dependence of

[9] This value is obtained as: $2.63 = \exp(1.66 - 0.69)$.

TABLE 5
Return Migration Premium and Skills

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Ln(Mexican wage) | 0.51 | | | |
| | (0.47) | | | |
| 4–7 Years of schooling | | 1.44 | 1.90** | 1.74* |
| | | (0.90) | (0.90) | (0.97) |
| 8–12 Years of schooling | 0.24 | 0.46 | 0.45 | (0.94) |
| | (0.84) | (0.90) | | |
| >12 Years of schooling | −1.40 | −0.92 | −0.92 | |
| | (1.19) | (1.20) | (1.41) | |
| Age dummies | No | No | Yes | Yes |
| Family status dummies | No | No | No | Yes |
| Gender dummies | No | No | No | Yes |
| Number of cells | 144 | 144 | 144 | 144 |
| Observations | 6,201 | 6,201 | 6,201 | 6,201 |

Notes:
(i) The dependent variable is the logarithmic differential in earnings between the returnees measured in 2005 period and their earnings before migration and return, as of 2002. The unit of observation is a gender–age–education–family status cell. (ii) All regressions are estimated using least squares weighing each cell by the employment of returnees in that cell. The standard errors are heteroscedasticity robust.
(iii) **, *Significant at 5% and confidence levels.

the return premium on wage-earning skills (first column) is positive but not significant and, analysing the return-premium profile across education groups, we see a larger premium for workers with intermediate levels of schooling (5–12 years) relative to those with four years or less. Workers with a high level of schooling, however, have a significantly smaller return premium than less educated ones (in percentage terms). The standard errors of these estimates are usually rather large as the returnees in the sample are only a few (54 people out of a sample of 6,201). It is therefore hard to perform meaningful inference based on these estimates.

## 4. DETERMINANTS OF MIGRATION ACROSS SKILL GROUP

### *a. Theory*

Using the notation introduced in Section 2, it is easy to derive the migration condition for each Mexican individual in skill group $x$, assuming that the individual maximises her utility in her migration choice and that the cost of permanent migration to the United States is equal to $c(x)$. In particular, using expressions (8) and (6) and following the model of Borjas (1987), the probability of migrating to the United States for an individual in skill cell $x$ is:

$$P(x) = P[v_x > -(\ln \widehat{w}_{US}(x) - \ln \widehat{w}_{MEX}(x) - c(x))] = 1 - \Phi(z), \tag{9}$$

where $v_x = \varepsilon_{US,i} - \varepsilon_{MEX,i}$ is the differential in the return to unobservable characteristics between United States and Mexico. This variable is assumed to be distributed normally with mean 0 and standard deviation $\sigma_{vx}$. Also, in expression (9), $z = -(\ln \widehat{w}_{US}(x) - \ln \widehat{w}_{MEX}(x) - c(x))/\sigma_{vx}$, and $\Phi$ is the CDF of a standard normal distribution. This theory is based on the idea that heterogeneous workers choose whether to migrate or not by comparing the earnings in Mexico and in the United States, net of migration costs. Given their cell's wage differential and cost of migration, individual heterogeneity, captured by the distribution of unobservable skills, generates a distribution of the likelihood of migration. Through the law of large numbers, this probability becomes the share of individuals in the cell that migrates. This simple theory, then, implies that the share of migrants in a cell is (i) an increasing function of the migration premium for that cell, $\ln \widehat{w}_{US}(x) - \ln \widehat{w}_{MEX}(x)$ and (ii) a negative function of the cost of migrating for individuals of that cell, $c(x)$. At the same time, the theory predicts that the average unobservable skill of migrants in cell $x$ is given by the following expression:[10]

$$\ln \widehat{w}_{US,PRE}(x) - \ln \widehat{w}_{MEX}(x) = \frac{\sigma_x^{MEX}\sigma_x^{US}}{\sigma_{vx}}\left(\rho_x - \frac{\sigma_x^{MEX}}{\sigma_x^{US}}\right)\lambda_x, \tag{10}$$

where $\rho_x$ is the correlation between $\varepsilon_{US,x,i}$ and $\varepsilon_{MEX,x,i}$, and the returns to unobservable skills in United States and Mexico (respectively) in cell $x$ and $\lambda_x = \phi(z)/P(x)$ are inversely related to the probability of migrating. The expression above has an easy interpretation. Suppose that the unobservable skills are perfectly correlated between United States and Mexico, that is, $\rho_x = 1$. Then, the expression says that if the dispersion of returns to unobservable skills is larger in Mexico relative to the United States, the selection on unobservables will be negative. If the dispersion of returns to unobservables is larger in the United States, the selection will be positive. This is the well-known Borjas (1987) result that implies that migrants from a country with larger dispersion of returns to unobservable skills are negatively selected on unobservables. Our interpretation allows the variances of unobservable skills to be different across skill cells.

The implications of formulas (9) and (10) are very straightforward and can be tested to see whether differences in returns by cell and in their dispersion can explain the selection on observables and unobservables. The key difference of our analysis is that we will consider variation of returns and of the variance across skill groups. Linearising (9) and assuming that the observed migration

[10] For a derivation of this expression, see the expression of the average of a truncated normal distribution as shown in Borjas (1987).

frequency from each skill cell approximates the probability of migration with an error, we obtain the linear regression:

$$L_{US}(x)/L_{2002}(x) = \beta_0 + \beta_1[\ln \widehat{w}_{US}(x) - \ln \widehat{w}_{MEX}(x)] + \beta_2 c(x) + u_x \text{ for } x \in X, \quad (11)$$

where $L_{US}(x)$ is the number of Mexican individuals who migrated to the United States between 2002 and 2005 and $L_{2002}(x)$ is the total Mexican population in cell $x$ as of 2002. $\ln \widehat{w}_{US}(x) - \ln \widehat{w}_{MEX}(x)$ is the migration premium for skill cell $x$, and $c(x)$ is the cost of migration for skill cell $x$. The variable $u_x$ is a zero mean measurement error. The theory predicts that $\beta_1 > 0$ and that $\beta_2 < 0$. Migration costs, however, are hard to observe as they include a monetary part, a psychological part and other components related to the availability of immigration visa and permits or to the opportunity of migrating illegally. Hence, in the empirical analysis, we will include several controls that proxy for some clear determinants of those costs. Regression (11) allows us to study the determinants of selection of migrants along the dimension of observable skills.

Log linearising expression (10) we can analyse the dependence of unobservable selection on the relative variance of unobserved skill returns in the United States and Mexico, $\sigma_x^{MEX}/\sigma_x^{US}$. To do this correctly, however, we need to control for the determinants of migration flows (as $P(x)$ enters expression (10) through $\lambda$) and so we will run the following regression:

$$\ln \widehat{w}_{US,PRE}(x) - \ln \widehat{w}_{MEX}(x) = \delta_0 + \delta_1 \frac{\sigma_x^{MEX}}{\sigma_x^{US}} + \delta_2[\ln \widehat{w}_{US}(x) - \ln \widehat{w}_{MEX}(x)] + \delta_3 c(x) + u_x. \quad (12)$$

The prediction of the theory is that unobservable selection in group $x$, measured as $\ln \widehat{w}_{US,PRE}(x) - \ln \widehat{w}_{MEX}(x)$, depends negatively on $\sigma_x^{MEX}/\sigma_x^{US}$, so $\delta_1 < 0$. For given costs of migrating, larger dispersion of the returns to unobserved skills in Mexico relative to the United States would produce a less positive selection of workers.

Extending the intuition of the Roy–Borjas model to the choice of return migration, as we observe also the return premia and the frequency of returnees by skill cell, we can also use the empirical specification (11) using returnees (and the return premium) instead of US migrants and test whether return migration depends positively on the return premium (which has, as we have seen above, a different behaviour in relation to observable skills than the migration premium has) once we control for some proxies of temporary migration costs. Because of the low number of returnees, however, the precision of the results for this group will be limited.

*b. Evidence on Migrants to the United States*

Our basic empirical specification consists of equation (11). The idea of the model is that the probability to migrate to the United States for an individual in a skill group depends on the migration premium for that skill group and on the costs. The premium is given by the difference in earnings in 2005 for new Mexican migrants in the United States and the earnings in Mexico in 2002 for those with the same observable characteristics. The cost is proxied by a series of individual characteristics, plus geographic location, presence of networks as well as initial wealth (to fund the initial fixed costs). As we observe the frequency of migration in a cell (i.e. the share of those who migrated), we assume that this frequency is a noisy measure of that probability. In some skill cells, we do not observe any migrant, and we consider this information as relevant, namely a zero probability of migrating. That is, we include zeroes as dependent variables in the regression implying a null probability of migration to the United States in that skill group. We also consider the (unobserved) heterogeneity of workers within a skill cell as a random noise, so that errors are uncorrelated within a skill group. Their variance, however, may vary across skill groups so we allow for heteroscedasticity.

*(i) Basic*

Tables 6–10 show the estimates of the coefficients from regressions all similar to the basic specification, including progressively more cost controls. In Table 6, the dependent variable is the frequency of migrants to the United States in each of 72 skill cells. Our main specifications consider only male migrants as they constitute the group with a more consistent work history and usually the main decision makers in matters of migration. Column (1) includes only the migration premium as an explanatory variable in the regression (i.e. the real earnings differential between Mexicans in the United States as revealed by the 2002–05 ACS and Mexicans in Mexico as revealed by the MxFLS in 2002 for the same skill cell).[11] Column (2) includes age dummies, family status dummies and education dummies. The first set of controls accounts for the fact that the cost of migrating increases for older people as they have more local ties and longer working experience. The second accounts for the fact that migration, usually first undertaken by the male head of the household, becomes more costly when they are married and have children. The third set is fixed effects for education levels. More educated people usually have better access to international networks, can afford better travel and communication technology and hence may have lower cost of migrating.

[11] Kaestner and Malamud (2010) also include the migration premium in some of their regressions. They find a positive effect of it on migration. However, most of their specifications do not include this premium and focus on other controls. We consider the skill-specific migration premium as the main determinant of a cell migration frequency, according to the theory.

TABLE 6
Determinants of Migration Frequencies: Wage Premium and Demographics

| *Dependent Variable: Frequency of Migration to the United States in the Skill Cell* | | | | |
|---|---|---|---|---|
| *Specifications* | *(1) Basic* | *(2) With Age, Family and Education Dummies* | *(3) Male and Female Pooled* | *(4) Linear Premium in Thousands of 2002 US $* |
| Migration premium | 0.018*** | 0.014** | 0.005** | 0.0007* |
| | (0.001) | (0.001) | (0.001) | (0.0001) |
| Age 29–37 | | −0.016** | −0.016** | −0.019** |
| | | (0.001) | (0.001) | (0.001) |
| Age 38–47 | | −0.014** | −0.014** | −0.018** |
| | | (0.002) | (0.002) | (0.002) |
| Age 48–56 | | −0.027** | −0.027** | −0.030** |
| | | (0.002) | (0.002) | (0.002) |
| Age 57–65 | | −0.032** | −0.032** | −0.039** |
| | | (0.003) | (0.003) | (0.003) |
| Married | | −0.038* | −0.029* | −0.039* |
| | | (0.001) | (0.002) | (0.001) |
| Married with children | | −0.048** | −0.039** | −0.048** |
| | | (0.003) | (0.004) | (0.003) |
| 4–8 Years of schooling | | 0.010** | 0.007** | 0.006** |
| | | (0.001) | (0.001) | (0.001) |
| 9–12 Years of schooling | | 0.006** | 0.002* | −0.0008 |
| | | (0.001) | (0.001) | (0.001) |
| More than 12 years of schooling | | −0.010** | −0.014** | −0.023** |
| | | (0.001) | (0.001) | (0.001) |
| Number of cells | 72 | 72 | 144 | 72 |
| Number of observations | 4,246 | 4,246 | 6,201 | 4,246 |

Notes:
(i) Units of observation are each of 72 skill cells. (ii) The method of estimation is ordinary least squares. (iii) The standard errors in parenthesis are heteroscedasticity robust. (iv) The migration premium is the cell-specific differential between the logarithmic earning of new Mexican migrants (2002–05) in the United States and the logarithmic earning in Mexico, both converted in 2002 US$. (v) In specification (4) the differential is between earning levels rather than logarithms. (vi) The omitted age category is 21–29. The omitted schooling category is 0–4 years. The omitted family category is single. (vii) ***,**,* Significant at the 1%, 5% and 10% levels.

Column (3) displays the regression results for the pooled sample of men and women. The irregular working history of women and their lower participation in the labour market could imply that the observable variables do not describe the actual skills of women very well. Finally, in column (4), we use a different measure for the migration premium. It enters earnings as a linear difference (rather than as logarithmic difference). Recently, Grogger and Hanson (2008) have argued that international migration behaviour and, in particular, the sorting of highly educated migrants across receiving countries are better explained by taking wage differentials in levels between the destination and origin country. The method of estimation in Table 6 is least squares weighting each observation by the employment size of the cell. This accounts for the different measurement error in the dependent variable. The results are quite consistent across specifications, and the relevant coefficients are very significant. We will comment on three important features of the results leaving it to the reader to check the details of each estimate in Table 6. First, the coefficient on the migration premium is always significant, and (in the 'log earnings' specifications 1 to 3) it is around the value of 0.01. This is a large coefficient. In fact, the average migration rate in the sample is 0.025 (2.5 per cent as can be seen in Table 1A), and its standard deviation is 0.022. On the other hand, the standard deviation of log earnings differentials between cells is around 1. This implies that a migration premium one standard deviation above the average is associated with a migration probability almost half a standard deviation above the average. Doubling the migration premium is associated with a 1 per cent increase in the migration probability of individuals in a cell, other things equal. The specification with the linear premium implies a similar effect: increasing the migration earning premium by $8,000 (which equals its standard deviation across cells) implies an increase in migration probability of 0.0136 ($= 0.0017 \times 8$), which is, as before, around half of one standard deviation. Differently from what was found by Grogger and Hanson (2008), we find that both the logarithmic and the linear specification of earnings produce results compatible with the utility maximisation framing proposed in Section 1.1: individuals in different skill groups respond to earnings differentials. Second, the effect of age and family status on the probability of migrating is also as expected and very significant.[12] An increases in age is associated with a monotonically declining migration probability. Workers older than 57 are associated with a migration probability that is 3.1 percentage points lower than that of workers in their twenties. This is a very large effect, keeping in mind that the standard deviation of the migration probability across cells is 2.2 per cent. Similarly, married individuals and individuals with children are associated with a much lower migration probability (by 3 and 4 per cent, respectively) than singles. The third interesting result emerging from Table 6 is that, while intermediate schooling levels (between 4 and 12 years) are associated with higher migration rates relative to individuals with very low schooling (0–4 years), highly educated individuals are associated with much lower rates than the least educated workers, even after controlling for the migration premium. While the migration premium is very important to explain selection of migrants on observables and goes part way to explain the mildly negative selection of Mexican migrants to the United States, even after controlling for the migration premium, we still measure a significant under-representation of Mexican migrants among the highly educated. This is counter to what we know of other migrants from

[12] Kastner and Malamud (2010) find a similar effect of age but do not inquire into the effect of family structure.

developing to developed countries (see Docquier and Marfouk, 2006). In those cases, high education is associated with a significantly higher migration probability, other things equal. There are some possible explanations for this. The first is that, while less educated workers have the option of crossing the border illegally and still have access to jobs, more educated workers do not have this option as the jobs they would want to access are not open to undocumented immigrants. Hence, the possibility of undocumented migration may substantially decrease the cost of migration for workers at low levels of schooling. The second possibility is that, as Mexican migration has traditionally involved people with low education, relatives of less educated workers, who are likely to be less educated, may have access to legal immigration via family unification. Alternatively, networks of Mexican migrants, who are well known to reduce costs of migration, may be mostly made of and targeted to unskilled workers (we will inquire into this channel in Section 4.b.ii).

*(ii) The role of network and migration costs*

In Table 7, we explicitly include three variables that proxy for the geographic distribution and for the connections of potential migrants among the potential determinants of migration costs. In these regressions, we consider the following three variables: first, the share of workers in the cell who lived in a border state as of 2002 (lower migration costs); second, the share of people in the cell who also lived in Mexico City in 2002 (to characterise whether urban population has a different tendency to migrate); and third, the share of individuals in the cell with a relative in the United States (also should decrease the costs of moving). Our framework, organised by skill cell, is equivalent to an individual regression in which we control for these at the individual level allowing these variables to vary only by skill group and clustering their effect by skill group. These variables provide controls for the cost of migrating as far as this cost depends on distance to the United States and presence of a pre-established network of relatives in the United States. Specification (1) includes only these variables plus the migration premium as explanatory variables. Specification (2) includes also all the demographic dummies of Table 6. Specification (3) pools data for men and women, and finally specification (4) includes the migration premium in linear form.

The results are interesting and reveal a very important role of geography/networks. First, the wage premium is always very significant, and when we control for all the demographics and geography dummies, it still has a coefficient in the proximity of 0.015. At the same time, the share of people in border states has also a very positive impact. In cells where the share of individuals living in border states is 10 per cent larger, the probability of migrating is 0.07–0.08 larger. To the contrary, once we control for demographics (accounting for the younger age of urban people), the share of individuals in Mexico

TABLE 7
Determinants of Migration Frequencies: Geography and Network

| *Dependent Variable: Frequency of Migration to the United States in the Skill Cell* | | | | |
|---|---|---|---|---|
| *Specifications* | *(1) Basic* | *(2) With Age, Family and Education Dummies* | *(3) Pooled Male and Female* | *(4) Linear Premium in Thousands of 2002 US$* |
| Migration premium | 0.035*** | 0.014*** | 0.003** | 0.0007* |
| | (0.002) | (0.001) | (0.001) | (0.0001) |
| Living in border states | 0.08** | 0.07** | 0.07** | 0.07* |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Living in Mexico City | 0.33** | −0.06** | −0.014** | −0.09* |
| | (0.03) | (0.02) | (0.01) | (0.02) |
| Having a relative in United States | 0.002 | 0.05** | 0.01 | 0.05** |
| | (0.010) | (0.007) | (0.05) | (0.007) |
| Age, education and family status dummies | No | Yes | Yes | Yes |
| Number of cells | 72 | 72 | 144 | 72 |
| Observations | 4,246 | 4,246 | 6,201 | 4,246 |

Notes:
(i) Units of observation are male Mexican workers in 2002 in each of 72 skill cells (4 education by 6 age by 3 family type groups). (ii) The method of estimation is ordinary least squares where each cell is weighted by its population. (iii) The standard errors in parenthesis are heteroscedasticity robust. (iv) The migration premium is the cell-specific differential between the logarithmic earning of new Mexican migrants (2002–05) in the United States and the logarithmic earning in Mexico, both converted in 2002 US$. (v) 'Living in Border States' is the share of people in the cell who live in a border state. Living in Mexico City is the share of people in the cell loving in Mexico city. 'Having a relative in the United States' is the share of people in the cell with a relative in the United States. (vi) The In specification (4) the differential is between earning levels rather than logarithms. (vii) ***,**,* Significant at the 1%, 5% and 10% levels.

City is negatively correlated with US migration. Migrants to the United States are more likely to come from bordering, rural areas than from Mexico City. Finally, the share of individuals with relatives in the United States in the cell also generates a higher probability of migration (but only in the case of male migration and controlling for other factors). Possibly, having a member of the family in the United States is an important driver of migration for working reasons. Hence, male migrants are more sensitive to it. One interesting feature of the results of Tables 6 and 7 (and it will also be common to the other tables) is that, while the coefficient on the migration premium remains very significant after including cost controls, it does not increase in magnitude. This means that the cost controls that we are including are not necessarily negatively correlated with the migration premium; hence, the simple idea that the migration cost may reverse the selection that the premium would generate does not seem to hold true in our analysis.

TABLE 8
Determinants of Migration Frequencies: Initial Income and Wealth

*Dependent Variable: Frequency of Migration to the United States in the Skill Cell*

| *Specifications* | *(1) With Initial Income* | *(2) Initial Poverty Dummy* | *(3) Initial Income and Wealth* | *(4) Income, Wealth and House* |
|---|---|---|---|---|
| Migration premium | 0.017** | 0.016** | 0.007** | 0.006** |
| | (0.001) | (0.001) | (0.001) | (0.002) |
| Pre-migration income | 0.005** | | −0.007* | −0.006 |
| | (0.002) | | (0.003) | (0.003) |
| Poverty dummy | | −0.048** | | |
| | | (0.005) | | |
| Pre-migration log of assets | | | 0.002** | 0.002** |
| | | | (0.0001) | (0.0001) |
| Pre-migration log of debt | | | −0.003* | −0.002* |
| | | | (0.0001) | (0.0001) |
| Pre-migration log of house value | | | | −0.02** |
| | | | | (0.001) |
| Age, education and family status dummies | Yes | Yes | Yes | Yes |
| Border and family network dummies | Yes | Yes | Yes | Yes |
| Cells | 72 | 72 | 72 | 72 |
| Observations (actual and imputed) | 4,246 | 4,246 | 4,246 | 4,246 |

Notes:
(i) Units of observation are male Mexican workers in 2002 in each of 72 skill cells. (ii) The method of estimation is ordinary least squares weighing each cell by its population. (iii) The standard errors in parenthesis are heteroscedasticity robust. (iv) **,* Significant at the 5% and 10% levels.

*(iii) The role of initial income and wealth*

The detailed nature of our data allows us to explore some other issues in the analysis of the determinants of migration. The first is whether the initial income/wealth of an individual has an effect on her propensity to migrate, after controlling for the migration earnings premium and other migration costs. The regressions of Table 8 analyse this issue. Aggregate studies of the determinants of international migration (e.g. Mayda, 2010), often find that the income in the country of origin has two opposite effects on the propensity to migrate. On the one hand, for given average earnings in the receiving country, an increase in the income in the country of origin reduces the premium to migration and hence the incentive to migrate. On the other hand, if there is a fixed initial cost to migrate, low income coupled with credit constraints may prevent migration; hence, especially for the poorest, lower initial earnings may be associated with lower migration probabilities. However, the initial liquidity constraints can also be relaxed if the potential migrants own some assets, such as financial wealth, or can be worsened if the potential migrant is burdened by debt. In our framework, we can identify the impact of initial income as well as initial wealth, in the form of assets, of potential migrants by including the initial average income (in Mexico as of 2002) of potential migrants in the regression, and the average financial wealth and the average debt in the same cell. Initial income can be important to overcome credit constraints and cover the migration costs; however, initial financial wealth should be even more important for relaxing this constraint. In the case of a significant fixed cost of migration, people with higher wealth and lower debt would be in a better position to take advantage of the migration opportunities.

Specification (1) of Table 8 includes the pre-migration average income as a determinant of the probability of migration and finds a positive and significant effect of this variable. This confirms that once we control for the migration premium, an increase in the initial income has a positive effect on the migration probability. Even if we transform initial income in a simple dummy (poverty dummy), that equals one if such income is below 3$ per day (bottom 25 per cent of the MxFLS sample), we obtain that such a dummy has a significant negative effect on migration probability. More interestingly, as we do in specification (3) and (4), if we include a measure of initial financial wealth (the logarithm of total financial assets), a measure of debt (the logarithm of total debts) and a measure of housing value (logarithm of value of current house), we find the expected signs on these variables, and the influence of initial income is reduced and it even changes signs. In particular, a 10 per cent increase in premigration wealth corresponds, other things equal, to a 0.02 per cent increase in the probability of migrating, while 10 per cent higher debt has an opposite effect of decreasing the migration probability by 0.03 per cent. Once we control for wealth and for the migration premium, the impact of initial income is not significant. Finally, controlling for financial wealth and debt, owning a house of higher value is associated with a lower migration probability. This is reasonable, as owning a house may imply a higher degree of commitment to the local community or a higher status in the community and hence a higher cost of migrating.

*(iv) Initial entrepreneurship and shocks*

It is sometimes thought that migrants are entrepreneurial individuals and also less risk-averse than non-movers. These individual characteristics are features that may affect selection but are not easy to observe. Our data allow us to measure the average number of the self-employed in each cell and use this as a measure of entrepreneurial spirit and check whether it affects the likelihood of migrating. Moreover, we can also see whether recent shocks to the household, which may also affect the income earning ability of the household, affect the

TABLE 9
Determinants of Migration Frequencies: Initial Characteristics and Shocks

| *Dependent Variable: Frequency of Migration to the United States in the Skill Cell* | | | | |
|---|---|---|---|---|
| *Specifications* | *(1)* | *(2)* | *(3)* | *(4)* |
| Migration premium | 0.014** | 0.016** | 0.017** | 0.009** |
| | (0.001) | (0.001) | (0.001) | (0.002) |
| Pre-migration income | 0.005** | 0.006** | 0.006** | −0.006 |
| | (0.004) | (0.002) | (0.002) | (0.004) |
| Share of individuals who experienced a family shock in the last year | 0.041** | | 0.038* | 0.038* |
| | (0.006) | | (0.007) | (0.008) |
| Share of entrepreneurs | | −0.0002 | −0.0002 | −0.0006 |
| | | (0.0003) | (0.0003) | (0.0006) |
| Age, education and family status dummies | Yes | Yes | Yes | Yes |
| Border and family network controls | Yes | Yes | Yes | Yes |
| Initial wealth controls | No | No | No | Yes |
| Number of cells | 72 | 72 | 14,472 | 72 |
| Observations (actual and imputed) | 4,246 | 4,246 | 4,246 | 4,246 |

Notes:
(i) Units of observation are male Mexican workers in 2002 in each of 72 skill cells. (ii) The method of estimation is ordinary least squares weighing each cell by its population. (iii) The standard errors in parenthesis are heteroscedasticity robust. (iv) **,* Significant at the 5% and 10% levels.

probability of migrating. Table 9 shows the effects of these two types of variables. We include the measure of entrepreneurship in the cell and the share of households who have received a significant negative shock in the family (death, hospitalisation, unemployment, total loss of crop, natural disaster) during the last five years. The specifications (1)–(3) include all the demographic dummies, the border/network variables, while specification (4) includes also initial wealth. Interestingly, the variable capturing the level of entrepreneurship in the cell does not have a significant effect on the probability of migrating, while the share of individuals affected by a negative shock had a large positive impact on migration. The occurrence of a negative shock increases the probability of moving to the United States, either because it increases the incentives to move or because it provides the resolve needed to pay the individual costs of migration. Such a significant correlation is interesting as it may, in part, explain the negative selection on unobservables measured among migrants. If people are more likely to move when they have received a negative shock, associated at least temporarily with lower wages, even controlling for observables, then we would observe that movers have lower residual wages than non-movers. However, rather than selection of migrants on permanent features of migrant's productivity, this explanation would imply that migration occurs in periods of transient negative shocks. Hence, the measured negative selection may not have implications for the long-run wage-earning abilities of immigrants. The migration premium, included in each regression, is always significant, and its effect ranges between 0.01 and 0.017, consistent with the standard deviation of the premium.

*(v) Endogeneity of US wages*

By including the earnings of Mexican migrants in the United States between 2002 and 2005 as part of the migration premium on the left-hand side of our regressions, we measure the migration premium much more precisely than it has been done before, but we risk introducing a potential source of reverse causation in our estimates. If cells with a large inflow of Mexicans have experienced large downward pressures on the earnings of Mexicans in the United States, this may induce a negative correlation between the share of migrants in a skill group and the migration premium. This would bias the estimate of the direct effect of a premium on the migration probability upward. Moreover, as pointed out recently by Ottaviano and Peri (forthcoming), this issue can be particularly severe if migration of Mexicans specifically affects the wage of migrants themselves, rather than wages of native workers with similar skills. The wage structure in the United States, by skill, relative to the structure in Mexico is likely to be affected only to a small degree by recent Mexican migrants. As we have seen in Section 7, Mexican migrants move to the United States driven by expected wage premia in the order of 400 to 500 per cent of their current wage. The effects of migration on wages of Mexicans in the United States are estimated to be at most in the order or 12–15 per cent. Still, for theoretical correctness, we need to deal with this issue. First, we construct the potential migration premium using wages of recent Mexican migrants in 2000, that is, before the actual inflow during 2002–05. This eliminates any direct effect of recent migration on the wage of the skill group. Second, to isolate the wage in the United States from the effect of recent immigrants even further, we construct the migration premium using wages of US citizens in the same skill groups in 2000, rather than wages of Mexican migrants. Then, we use either measure as an instrument for the cell-specific wage of Mexican migrants in the United States as of 2005. Table 10 reports the results of the specifications that use earnings of recent Mexican migrants in 2000 minus earnings in Mexico in 2002 as an instrument. We still focus on male workers only as they represent a more homogeneous and precisely measured sample. The correlation of earnings of recent Mexican migrants by skills between 2000 and 2002–05 is very high so that the first stage of the 2SLS is very strong (the $F$-statistics are as large as 1,000 and never smaller than 100). On the other hand, the coefficient of interest (of the migration premium on the migration probability) remains very significant and very close to the OLS estimate. Column (1) of Table 10 reports the 2SLS estimates for the basic specification on male workers with no controls and the first-stage statistics. Column (2) includes individual

TABLE 10
Determinants of Migration Frequencies: Two-stage Least-squares (2SLS) Estimates, with Premigration US Wages as Instrumental Variables (IV)

| *Dependent Variable: Frequency of Migration to the United States in the Skill Cell* | | | | |
|---|---|---|---|---|
| *Specifications* | *(1) Basic* | *(2) Basic with Controls* | *(4) With Regional Network Controls* | *(5) With Initial Wealth Controls* |
| Migration premium in 2005 | 0.019** | 0.013** | 0.012** | 0.003** |
| | (0.002) | (0.002) | (0.002) | (0.001) |
| First stage statistics | | | | |
| Coefficient on migration premium calculated with census 2000 | 0.76** | 0.67** | 0.67** | 3.30** |
| | (0.01) | (0.024) | (0.02) | (0.32) |
| *F*-stat | >1,000 | 737 | 997 | 114 |
| Number of cells | 72 | 72 | 72 | 72 |
| Observations (actual and imputed) | 4,246 | 4,246 | 4,246 | 4,246 |

Notes:
(i) Units of observation are male Mexican workers in 2002 in each of 72 skill cells. (ii) The method of estimation is 2SLS using the wages of new Mexican migrants in the skill cell in the 2000 census to instrument the wages of new Mexican migrants in 2005. (iii) The standard errors in parenthesis are heteroscedasticity robust. (iv) The migration premium is the cell-specific differential between the logarithmic wage of new Mexican migrants (2002–05) in the United States and the logarithmic wage in Mexico, both converted in 2002 US$. (v) ** Significant at the 5% level.

demographic controls. The effect of the migration premium is estimated to be 0.013 with the 2SLS specification (Table 9, Column 2) versus 0.014 in the OLS specification (Table 6, Column 4). The other two specifications add further controls. In column (3), we include the regional and network control and in column (4) the initial wealth. The effect of the migration premium is always positive and significant and not very different from the one estimated in the corresponding OLS regression. The estimates using earnings of US-born workers in 2000, to proxy the wage of Mexicans by skill in 2002–05, give very similar results and are available upon request.[13]

Overall, the analysis of migration frequencies as a function of skill-specific migration returns and controlling for migration costs is very consistent with the model of migration in response to economic incentives. The US–Mexico earnings differentials are very important determinants of migration flows, and the fact that they are negatively associated with skills (both in levels and in logs) implies that they contribute to a negative selection of migrants from Mexico. On the other hand, being older and having a family is associated with higher costs of moving to the United States. Similarly, living in a border state or hav-

[13] For instance in the basic specification with cost controls the coefficient of the migration premium on is 0.012 with standard error of 0.003.

ing a relative in the United States is associated with lower costs and increases the probability of migrating. Also, higher financial wealth increases the propensity to migrate but so does a recent negative shock to the household.

*(vi) Selection on unobserved characteristics*

One of the unique features of this data set is that we can also measure the extent of selection on unobservable characteristics within a skill group. The average wage differential between migrants and non-migrants within a skill group is interpreted as the selection of migrants on unobservable characteristics. As stated above, the caveat is that the residual wage can be driven by permanent or transitory characteristics. In the first case, negative selection has an implication in terms of long-run wage-earning potential. In the second case, people with temporary bad shocks move to the United States, and there are no long-run implications. Equation (12) expresses the relationship between the selection on unobserved characteristics in group $x$ and the relative standard deviation of within cell earnings in Mexico and in the United States. The intuition is that, for a given average difference in the earnings of a group (the migration premium), a larger dispersion of earnings in Mexico would reduce the incentive of highly skilled to move (as their wage is likely to be higher in Mexico), while it will increase the incentives of less skilled to move (as their wage is likely to be smaller in Mexico). Hence, higher values of the ratio $\sigma_x^{MEX}/\sigma_x^{US}$ should be associated with lower quality of migrants (i.e. with more negative selection on the unobservables). At the same time, if the unobserved wage-earning ability is mostly driven by recent shocks (possibly with only temporary effects), then the negative observed selection could be explained by these shocks. As shown in Table 2, the average selection on unobservables of Mexican migrants is significantly negative (−18 per cent). This means that, among workers with identical observable characteristics, those that ended up migrating between 2002 and 2005 were on average paid 18 per cent less in 2002 than those that ended up not migrating. Our goal is to inquire whether this difference is mostly driven by shocks or by permanent unobservable features. Measuring the ratio of standard deviations of earnings, $\sigma_x^{MEX}/\sigma_x^{US}$, between Mexican workers in Mexico as of 2002 and Mexican migrants to the United States in 2002–05 were the average value across the 144 cells is 1.5. This implies that the dispersion of earnings for given observables was significantly larger in Mexico than for Mexicans in the United States.

Table 11 shows the estimates of the effects of relative earning dispersion on selection on unobservables. From columns (3) and (4), we see that, once we control for the migration premium and cost proxies, there is a significant negative correlation between selection on unobservables and the relative standard deviation in the cells. Moreover, column (4) shows that the presence of shocks to the household during the last five years is very significantly associated with

TABLE 11
Determinant of Selection on the Unobservable Skills

*Dependent Variable: Average Difference in ln Wage Between Migrants and Non-migrants in the Same Cell*

| *Specifications* | *(1) Male, Basic* | *(2) Male, Basic with Migration Premium* | *(3) Male, with Migration Premium and Cost Controls* | *(4) Male, with Migration Premium and Cost and Initial Shock Controls* |
|---|---|---|---|---|
| Relative standard deviation of earnings Mexico/United States | −0.26 (0.43) | −0.36 (0.52) | −0.78** (0.37) | −0.81* (0.30) |
| Migration premium | | 0.11 (0.40) | 0.44 (0.48) | 0.79 (0.44) |
| Share of household that received a shock | | | | −4.19** (1.55) |
| Other controls | No | No | Education, age and family status dummies | Education, age and family status dummies |
| Number of cells | 72 | 72 | 72 | 72 |
| Observations (actual and imputed) | 4,246 | 4,246 | 4,246 | 4,246 |

Notes:
(i) The dependent variable is the average selection of male migrants on unobservable relative to other male workers in the same skill cell. Namely it is the difference in the wage of migrants and the wage of nonmigrants for workers in the same skill cell. (ii) The method of estimation is weighted least squares, with each cell weighted by the number of migrant workers in it. (iii) The standard errors are heteroscedasticity robust. (iv) **,* Significant at the 5% and 10% levels.

a worse selection. Hence, part of the negative residual wage may be due to a temporary shock. Still, even controlling for these shocks, the relative standard deviation of earnings in the cells has a significant and negative impact on selection. The limited number of observations in the regressions in Table 11 is due to the fact that the dependent variable, selection on unobservables, can only be observed for cells that actually have migrants. The estimates in column (4) imply that making the within-cell dispersion of Mexican earnings roughly equal to the US within-cell dispersion would improve the unobservable wage-earning skills of migrants by 40.5 per cent, which would be more than enough to make the selection of Mexican migrants positive (from negative).

### *c. Evidence on Returns*

To complete the picture on migration flows between Mexico and the United States, we now consider whether temporary migrants, that is, those migrants who have spent some time in the United States and have returned to Mexico

TABLE 12
Determinants of Return Frequencies

| *Dependent Variable: Frequency of Temporary Migration to the United States in the Skill Cell* | | | |
|---|---|---|---|
| *Specifications* | *(1) Basic* | *(2) Demographic Controls* | *(4) Linear Premium in Thousands of 2002US$* |
| Return premium | 0.0004*<br>(0.0001) | 0.0003*<br>(0.00005) | 0.00005*<br>(0.00002) |
| Other controls | No | Education, age and family status dummies | Education, age and family status dummies |
| Observations | 54 | 54 | 54 |

Notes:
(i) Units of observation are Mexican workers who return to Mexico as of 2005 in each of 54 skill cells. (ii) The method of estimation is Ordinary least squares. (iii) The standard errors in parenthesis are heteroscedasticity robust. (iv) The return premium is the cell-specific differential between the logarithmic wage of return migrants (2005) and the logarithmic wage of other Mexican workers in the same cell, both converted in 2002 US$. (v) In specification (4) the differential is between wage levels rather than logarithms. (vi) * Significant at the 10% level.

by 2005, have also responded to the economic incentives of migration and return. As shown in Table 2, returnees are mildly positively selected relative to non-migrants. Table 5 shows also that the premium to return migration is mildly positively associated with (the log of) Mexican wages. In particular, the return premium is significantly larger for workers with intermediate levels of schooling than for workers with either very low or very high schooling levels. Table 12 shows the estimates of the correlation between the return premium (in logs) and the probability of temporary migration. The average value of return migration frequency in the skill cells is 0.007. This implies that of the 6,201 individuals that we considered in the sample, only 54 migrated and returned. This is a very small sample to make any sort of inference from. Still we find evidence that doubling the return premium implies an increase of 0.04 per cent in the frequency of temporary migrants in a cell. While the effect is not very large, it is still consistent with the idea of mildly positive selection of returnees driven by a return premium positively related to skills. Also, not reported in the table, we find that the probability of temporary migration is significantly larger for workers with more than 12 years of schooling than for any other group, even after controlling for the return premium. Temporary migration is more common among highly educated, possibly as they have access to short-term visas and a US experience significantly enhances the human capital of professionals in Mexico.

While the results on returnees are based on a small sample, they are suggestive of a pattern in which highly educated, positively selected workers migrate and return as spending some time in the United States provides enhanced earning abilities in Mexico. To the contrary, less educated workers migrate permanently to the United States more often as their premium to do so is larger and, possibly, because of family ties, networks or the availability of undocumented migration options relative to the highly educated.

## 5. DISCUSSION

The findings of this paper are helpful to better understand the determinants of migration and return from Mexico and hence may have some direct implications for the likely evolution of the phenomenon in the next years and for the possible policies that the governments of Mexico and of the United States may consider. While many of these results were known and the analysis of migrant selection using MxFLS was undertaken first by Kaestner and Malamud (2010), we have some interesting extensions, new findings and a simple framework to interpret them. First of all, we find that the wage differential is a very important driver of migration pressures and of its selection. This is analysed in much more detail in this paper and with a much more precise measure of the migration premium than previous papers. Even when including various proxies for migration costs, initial wealth and idiosyncratic shocks, the migration premium is still an important driver of migration frequencies. This result is a key phenomenon when thinking of an economic theory for migration.

Such wage differentials are likely to remain for at least the next decade and hence one can continue to expect strong migration pressures, possibly still negatively selected. If the income distribution in Mexico becomes less unequal while college premia keep rising in the United States, the selection of immigrants to the United States may, however, become positive. Two other important factors, emphasised in this study, are rapidly evolving and may have an opposite impact on future migration. First, the cohort of 20 to 30-year-olds is the most likely to migrate, and this cohort is shrinking in Mexico. Second, controlling for wage differentials, increases in family income (moving out of poverty) and in family accumulated wealth increases the probability of migration. This trend may generate higher migration pressure as Mexico becomes richer and as families accumulate savings. In turn, higher income in Mexico, especially for the more educated, is also an important determinant of return migration. Putting together these forces, if Mexico continues to grow at the rate of the last decade and on par with the United States, so that the income gap remains stable, and Mexican wealth increases as it ages we can expect similar, or somewhat reduced, migration pressures and a higher likelihood of return migration.

One aspect that should be the object of further analysis and potentially the target of policy measures is the very low rate of migration to the United

States of the college educated (revealed by the coefficient on the dummy for more than 12 years of schooling in Table 6). The inclusion of all the other explanatory variables does not notably affect this negative effect. Possibly, because the concern of undocumented immigrants is monopolising the attention of the public, increasing security and controls and making the cost of stay in the United States higher for all Mexicans, highly educated Mexicans do not migrate much to the United States. This may be a positive outcome for Mexico, but, in the light of the return behaviour of highly educated workers, and because of the large premium that they receive in Mexico, it might be beneficial for Mexico to promote temporary migration (for study or early career development) of the highly educated to the United States. Similarly, highly educated migrants may stimulate improved education infrastructure in Mexico (as in Beine et al., 2008) so better international opportunities for the highly educated may translate into better educated labour force overall.

A second interesting finding is that the negative selection of migrants is mostly on unobserved wage-earning characteristics and not on observed ones. Namely, the migrants to the United States are not very different from the non-migrants in terms of schooling and age; however, they seem to have lower unobserved productivity. This result is akin to Fernández-Huertas Moraga (2011) and a bit different from Kaestner and Malamud (2010), who find no selection on unobservables. It may be the case that, because many border crossings occur without documentation, there is selection on certain unobserved characteristics (e.g. risk-taking, underestimating dangers and low respect for authority) that could have a negative correlation with productivity.[14] The regression evidence suggests that negative shocks make people more likely to migrate, possibly reinforcing their resolve to take the risks of undocumented crossing. Hence, creating options for legal migration for the less educated may improve their selection and may increase their perspectives of migration and return. A temporary worker programme, targeted to the sectors of construction, agriculture, personal services, etc., sectors that demand manual skills may serve this purpose well. Such a programme would generate better screening on unobservable characteristics, and as a temporary programme, it would induce more return migration of higher skilled workers back to Mexico.

One reason for the low migration premium of highly educated Mexicans in the United States and hence for their low migration rates may be the lower quality of schooling in Mexico. College-educated Mexicans might not have as many opportunities in the United States because the quality of their human capital is lower. This is supported by some studies on cross-country school

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[14] As Kaestner and Malamud (2010) control for cognitive abilities, possibly a proxy for some of the individual productive skills, this may reduce the role of unobserved heterogeneity in their paper.

quality, such as Schoellman (2010), and would involve very different policies. In particular, looking at the premium to schooling in the United States, Schoellman (2010) finds that Mexican immigrants are among those receiving the lowest wage differences for each extra year of schooling.

## 6. CONCLUSIONS

This paper reproduces part of Kaestner and Malamud (2010) by using the MxFLS to measure selection of Mexican migrants to the United States. We modify and extend their analysis by focusing on the determinants of migration frequency across skill groups in greater detail, by testing the impact of the migration premium on migration frequencies accounting for many determinants of migration costs. We also analyse the selection of return migrants back to Mexico. Using a simple utility maximisation model of migration, we derive some implications on the probability of migration for Mexicans of different observable characteristics and on the selection of Mexican migrants on unobservable characteristics. Similarly to Fernández-Huertas Moraga (2011), but somewhat differently from Kaestner and Malamud (2010) and Chiquiar and Hanson (2005), we find evidence of negative selection of migrants. However, the negative selection is mainly on unobservables (as in Fernández-Huertas Moraga, 2011) explaining the difference with Chiquiar and Hanson (2005), who only analysed selection on observables. Likely, the differences are in part because of individual abilities (that Kaestner and Malamud, 2010, control for) and in part due to temporary negative shocks. A simple model of utility maximisation (á la Roy, 1951) augmented to incorporate skill-specific migration costs, as well as geography, network and initial wealth effects, explains the probability of migration rather well. It is interesting that, even after controlling for the earnings premia from migration, there is a particularly low propensity of highly educated Mexicans to migrate to the United States. For returnees, those who temporarily move to the United States and are back by 2005, we find opposite features of the premium and selection. While we only have a quite small sample of returnees, we calculate that the return premium is (mildly) positively associated with skills, the selection of returnees is mildly positive, and the propensity to return is (mildly) dependent in a positive way on the return premium. The option of undocumented migration, only attractive for less educated, may explain the high cost of migration for highly educated and in part the negative selection. Possibly, temporary work programmes, for both more and less educated, with the option (or the requirement) of returning after four years could be an improvement over the current situation as it could select better workers, reduce their migration costs and benefit their income once they return.

## APPENDIX: COMPARISON BETWEEN 2002 MxFLS and 2000 Mexican Census

TABLE A1
Schooling Distribution of Workers

| *Schooling* | *0–4* | *5–8* | *9–12* | *More Than 12* |
|---|---|---|---|---|
| Share in census employment | 0.18 | 0.27 | 0.39 | 0.16 |
| Share in MxLFS employment | 0.18 | 0.29 | 0.41 | 0.12 |

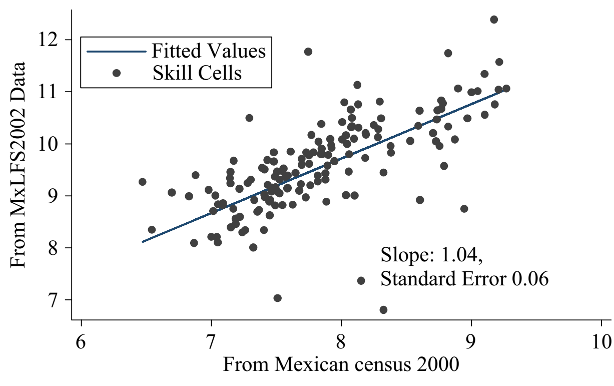
TABLE A2
Age Distribution of Workers

| *Age* | *<22.5* | *22.5–30.5* | *30.5–39.5* | *39.5–48.5* | *48.5–57.5* | *66.5* | *>66.5* |
|---|---|---|---|---|---|---|---|
| Share in census employment | 0.19 | 0.26 | 0.23 | 0.16 | 0.09 | 0.04 | 0.02 |
| Share in MxLFS employment | 0.14 | 0.22 | 0.25 | 0.20 | 0.11 | 0.05 | 0.02 |

TABLE A3
Gender Distribution of Workers

| *Gender* | *Male* | *Female* |
|---|---|---|
| Share in census employment | 0.67 | 0.33 |
| Share in MxLFS employment | 0.67 | 0.33 |

FIGURE A1
Logarithmic Total Earnings, by Education–Age–Gender–Family Cell: Comparison Between Mexican Census 2000 and MxLFS 2002




Note:
(i) The scatterplot shows the correlation between the log earnings averaged in 168 skill cell (education by age by gender by family status) as measured by the MxFLS 2002 and the Mexican census 2000.

FIGURE A2
US Migration Frequencies by Cells Versus Level of Schooling

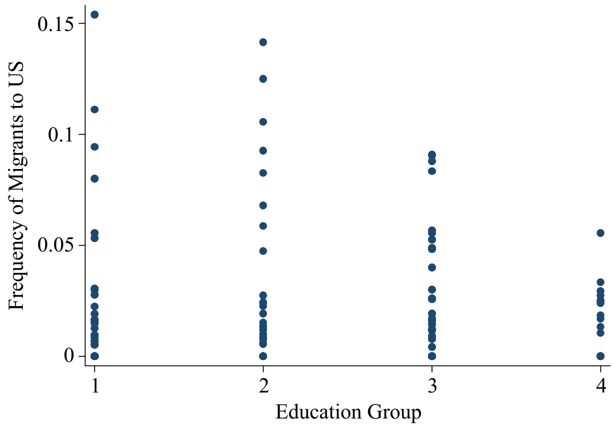
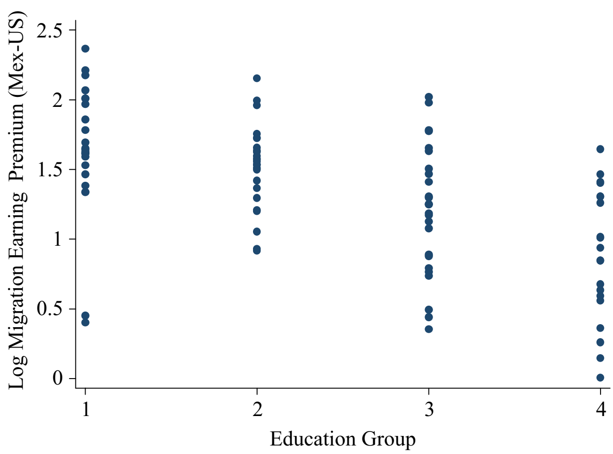



FIGURE A3
Logarithmic Earning Differentials by Cell Versus Level of Schooling




Note:
(i) The cells into which workers are grouped are education (4) by age (7) by family status (3) by gender (2) cells for a total of 168 cells.

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