Female Migration, Human Capital and Fertility

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VERY PRELIMINARY AND VERY INCOMPLETE

Abstract

The objective of this paper is to provide a theoretical explanation to some puzzling facts. While among American residents women, Mexicans tend to have higher fertility rates - a total fertility rate (TFR) of about 2.7 as opposed to a TFR of US born women of 2.0 - the fertility rate of Mexicans resident in Mexico is closer to the fertility rate in the US (natives) - 2.1. Other three observations are also puzzling. First, Mexican born women who migrated to the US participate more to the labor force than Mexican stayers; second, the participation rate of immigrants relative to US or Mexican stayers decreases with education; third, the gap between the fertility rate of Mexican stayers and immigrants increases with education. In this paper I propose an explanation of these facts based on selection. One novelty of this explanation is that it explicitly takes into account the human capital composition within households. I model their decision to migrate together with decisions on fertility, investments in children's human capital and time allocation to market and household activities, where household activities are primarily intended to increase the human capital of children. Households are heterogeneous in terms of human capital pairs and human capital enters as input in the human capital accumulation function of their children. The fertility cost is also heterogenous within the household, as it is assumed that women face a fixed time cost per child additional to the time cost that both spouses face for rearing their children. Households who decide to migrate face a loss of human capital, as they cannot adapt their education completely to the foreign market, while they gain from migration in terms of higher returns to human capital for current and future generations. The model proposed predicts that fertility is an increasing function of men's human capital and decreasing of women's. It also predicts that, generally, more educated couples tend to migrate more than lower educated ones. However, because of the loss of human capital faced by both spouses upon migration, they are both relatively less productive in market activity, although equally productive in household activities. This, by reducing the opportunity cost, shifts the allocation of resources towards child rearing and fertility. This implies that immigrants women have higher fertility than natives in Mexico and the US, and, given the correlation between the education of spouses, why this gap increases by education. The incentive to migrate is stronger when women are more educated than men. That is, conditional on men's education, it is more likely that couples migrate the higher is the education of their spouse. This is because, among immigrants women specialize more on child rearing and, given that at high levels of education the main driver of migration is children's accumulation of human capital, the selection in terms of education for women is stronger. This prediction has clear empirical foundations, looking at the distribution of education among immigrants couples women tend to be more educated than men, especially at higher levels of education.

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1 Introduction

The objective of this paper is primarily to provide a theoretical explanation to an apparent very puzzling fact. It is a well known fact that among American residents women, immigrants tend to have higher fertility rates. In particular, Mexican women, as reported for example by the PEW institute in 2008 had a total fertility rate (TFR) of about 2.7 as opposed to a TFR of US born women of 2.1. Higher fertility rates among immigrants are often interpreted in terms of culture of values that immigrants bring with themselves once hey migrate to another country such that they make fertility decisions that are similar to the decisions they may have made in their own countries if they stayed. Culture of values are usually proxied by the behaviour of those who did not leave the country of origin. Yet, in the case of Mexican women, it is puzzling to observe that the fertility rate among those who do not leave their own country is actually very close to that of women born in the US, that is 2.1. To add to the puzzle there are other two observations, first is that Mexican born women who migrated to the US have a much higher rate of participation to the labor force than Mexican women in Mexico, and second that the gap between the fertility rate of Mexican born women in Mexico and in the US is increasing with education. That is, while low educated Mexican born women have about the same TFR in Mexico and in the US, higher educated women, especially those with a University degree, have about double the number of children if the reside in the US than if the stay in Mexico.

2 Facts

In this section I present evidence on fertility, labor participation - both on the extensive and intensive margins - and migration rates by educational groups of Mexican women. Migration rates are calculated by dividing the Mexican population resident in the US by the total population of Mexican born women. I also look at the difference between Mexican women and US born women. Moreover, I complete the section looking at "couples" human capital mix - proxied by the educational attainment of husband and wife in a household - and the earnings of men and women by educational groups. Immigrant women tend to have a higher total fertility rate than natives, this is generally true for most ethnic groups and for most host countries. It is also the case that in most cases women have lower participation rates or hours worked if immigrants compared to natives. An old but well accepted explanation for these patterns, is that immigrant women bring with them in the host country their own culture, intended as the ... However, this hypothesis cannot explain the puzzling evidence presented here. In particular, the fact that Mexican immigrants have a higher total fertility rate than both natives in the US as well as Mexican women that remain in Mexico. Moreover, while immigrants women have higher fertility rates than stayers, especially at lower and higher educational levels, their participation rates to the labor market are also higher, a fact that is puzzling as usually the relationship between TRF and participation rates is negative. In the four subsections below I present and discuss the evidence more in detail. All the evidence reported here is based on micro data from the 2010 Mexican Census and the 2010 American Community Survey Public Use Micro Data (ACS PUMS)

2.1 Migration Rates by Education

2.2 Fertility Rates by Education

Table 1 shows the Total fertility rates by educational group for Mexican immigrant women in the US, Mexican women who are resident in Mexico and non-Mexican born women in the US (natives).[1] The educational system in Mexico is divided into Elementary School, which goes from grade 1 to grade 6, Lower Secondary from grade 7 to grade 9 and High School up to about grade

Table 1: **Fertility Rates**

Education	Stayers in Mexico	Mexicans in the US	US Natives
No Schooling	2.7527	4.5101	3.2705
Elementary	2.5971	3.0711	2.8580
Lower Secondary	2.5185	3.2164	2.3761
High School	2.0789	3.0067	1.9218
College	1.5989	4.0900	1.8527
Total Population	2.2760	3.0687	2.0033

2.3 Participation Rates by Education

[1] The total fertility rates are calculated as the sum of age-specific birth rates in 5-year categories between 15 and 44, times 5. Birth rates are calculated as the weighted number of women in a particular educational group and age category, who had one living birth in the reference year over the total number of women in that group and category. The ACS provide information on the having had a live birth in the 12 months before the interview, the variable is named fertility". The Mexican census does not contain a variable with the same meaning, however, it does provide information on the number of children being born to a women and the year and month of the last living birth. A variable fertility was then constructed as a dichotomous variable taking value equal to one if a women had a living birth on or after June 2008. The interviews for the Mexican Census took place between June and September 2009, therefore the variable fertility for Mexico could be reporting a slightly inflated measure of the TFR, however, the measure obtained here is in line with the official statistics reported by the INEGI.

Figure 1: Total Fertility Rates - All

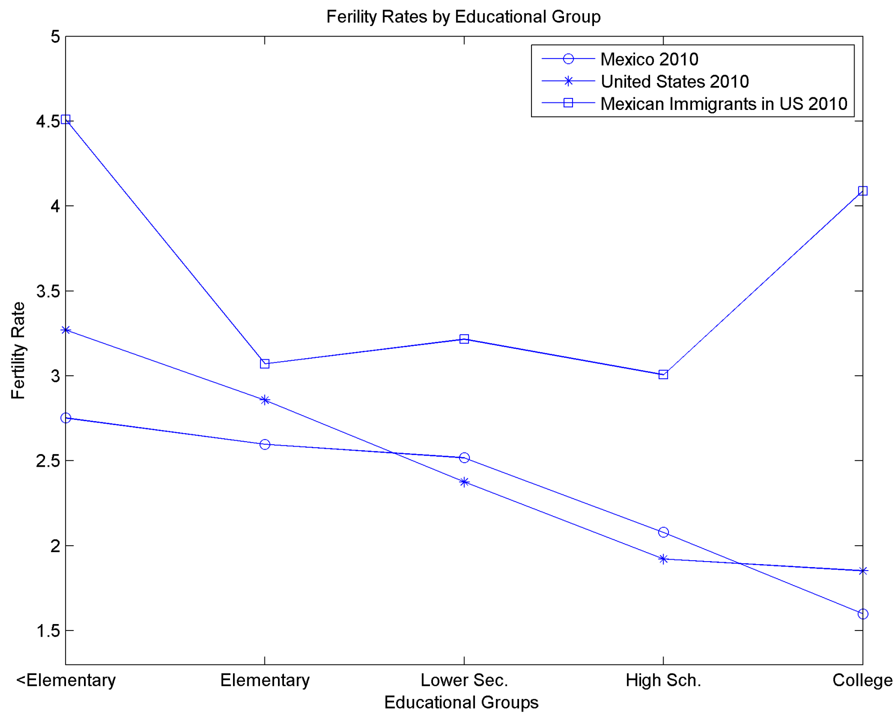


Figure 2: Total Fertility Rates - Immigrants/Stayers

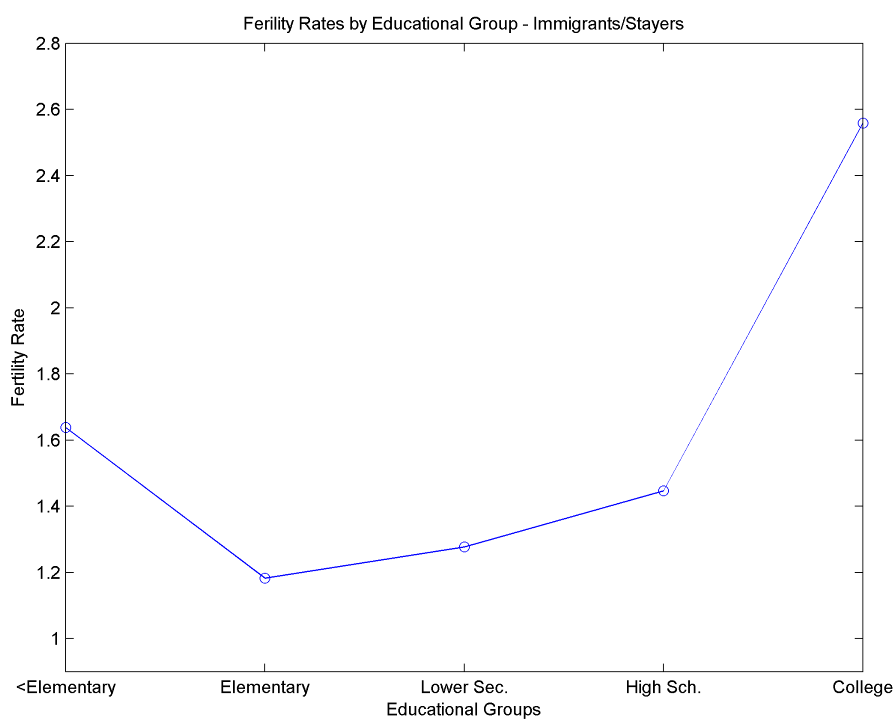
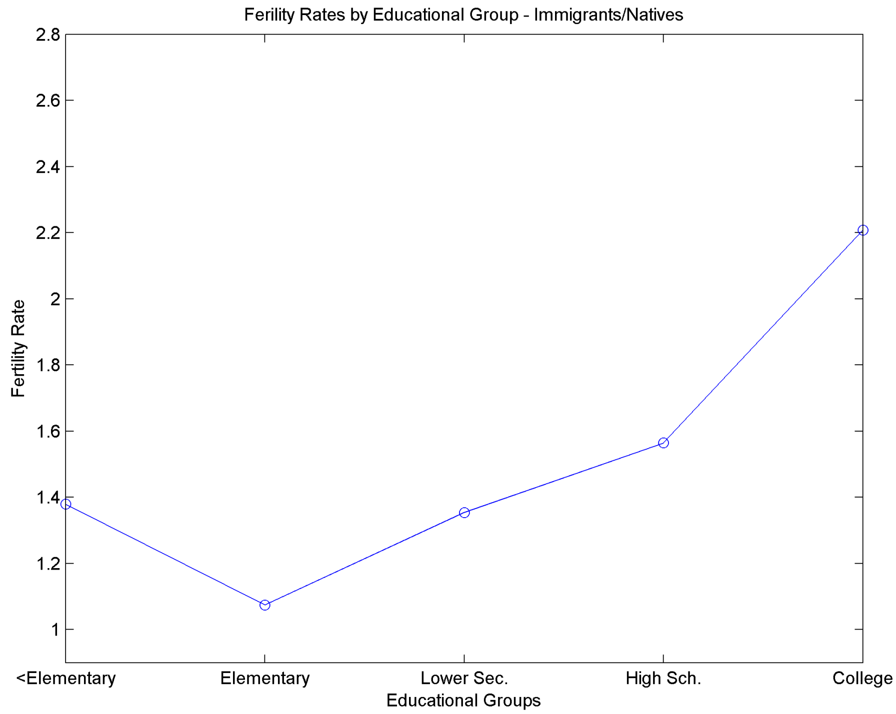
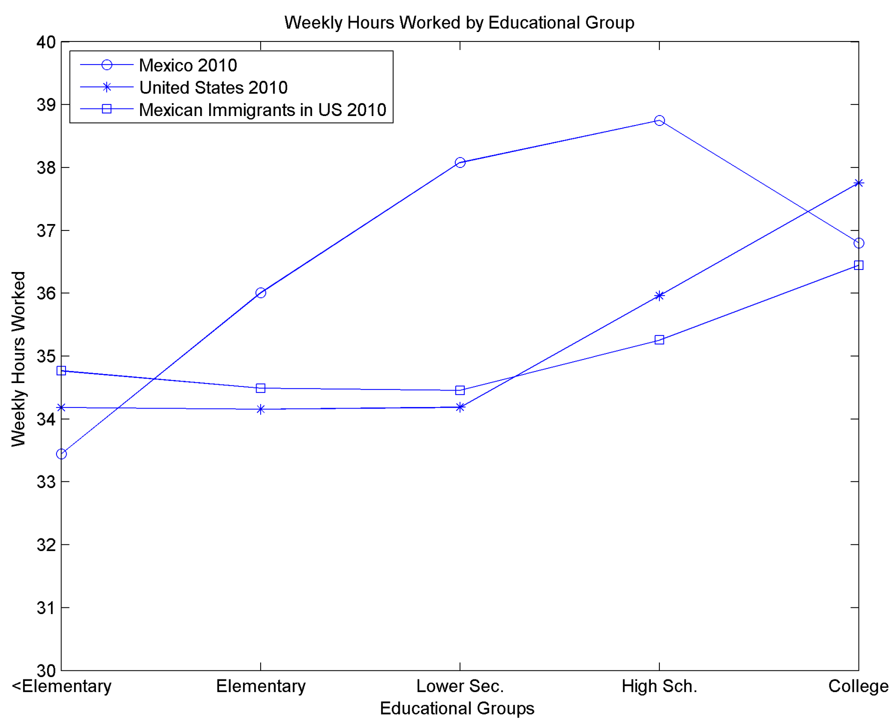
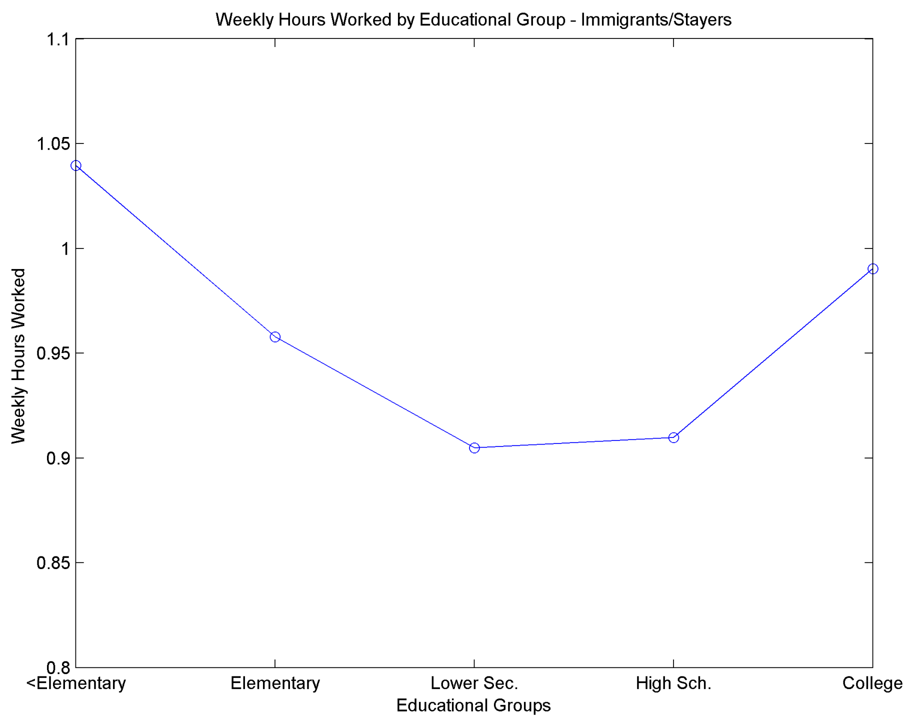
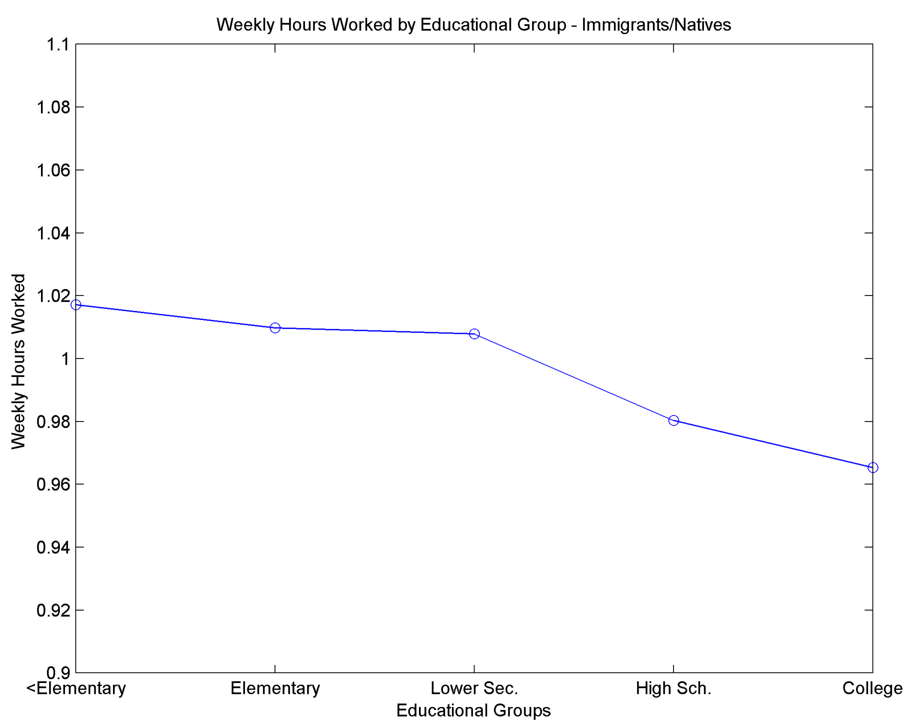


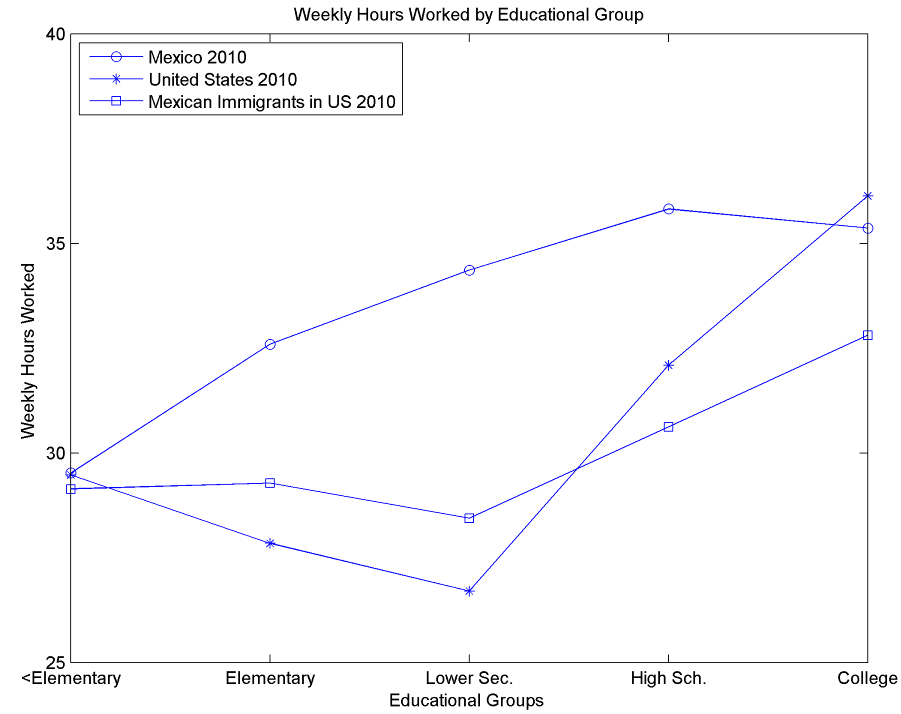
Figure 3: Total Fertility Rates - Immigrants/Natives

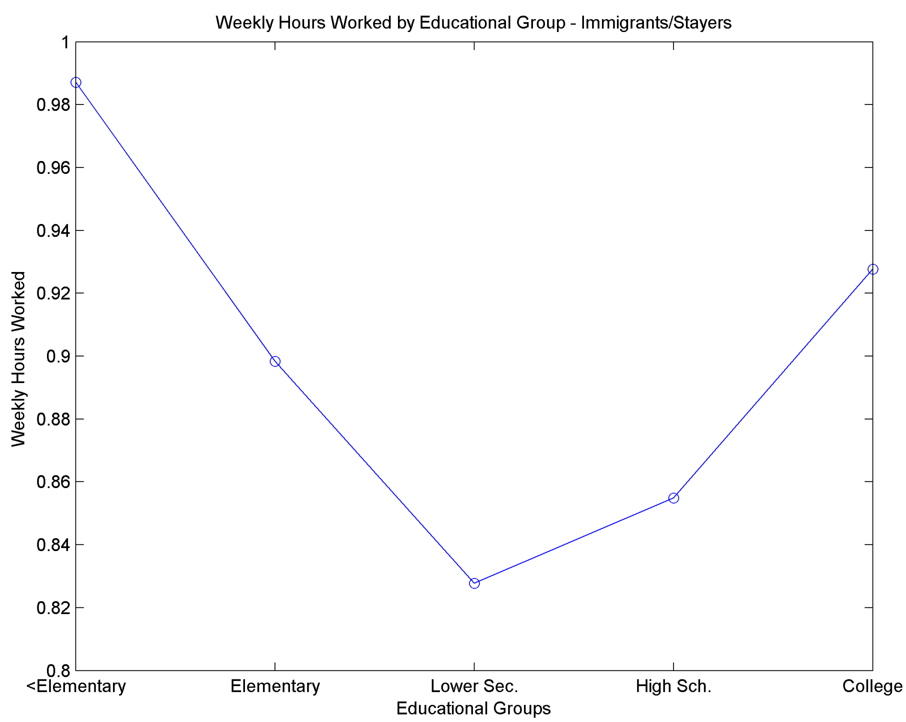





Weekly Hours Worked by Educational Group - Immigrants/Stayers
Weekly Hours Worked
Educational Groups
<Elementary
Elementary
Lower Sec.
High Sch.
College
1.1
1.05
1
0.95
0.9
0.85
0.8


Weekly Hours Worked by Educational Group - Immigrants/Natives
Weekly Hours Worked
Educational Groups
<Elementary
Elementary
Lower Sec.
High Sch.
College
1.1
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9


Weekly Hours Worked by Educational Group
Mexico 2010
United States 2010
Mexican Immigrants in US 2010
Weekly Hours Worked
40
35
30
25
<Elementary
Elementary
Lower Sec.
High Sch.
College
Educational Groups


Weekly Hours Worked by Educational Group - Immigrants/Stayers
Weekly Hours Worked
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0.84
0.82
0.8
<Elementary
Elementary
Lower Sec.
High Sch.
College
Educational Groups


Weekly Hours Worked by Educational Group - Immigrants/Natives
Weekly Hours Worked
1.1
1.05
1
0.95
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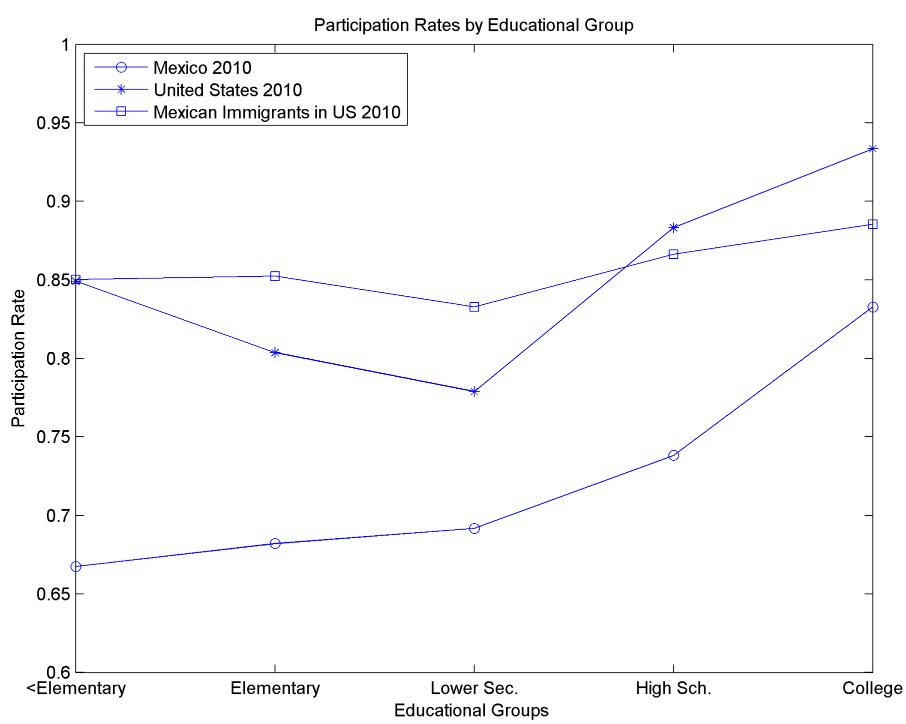
Elementary
Lower Sec.
High Sch.
College
Educational Groups


Participation Rates by Educational Group
Mexico 2010
United States 2010
Mexican Immigrants in US 2010
Participation Rate
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
<Elementary
Elementary
Lower Sec.
High Sch.
College
Educational Groups

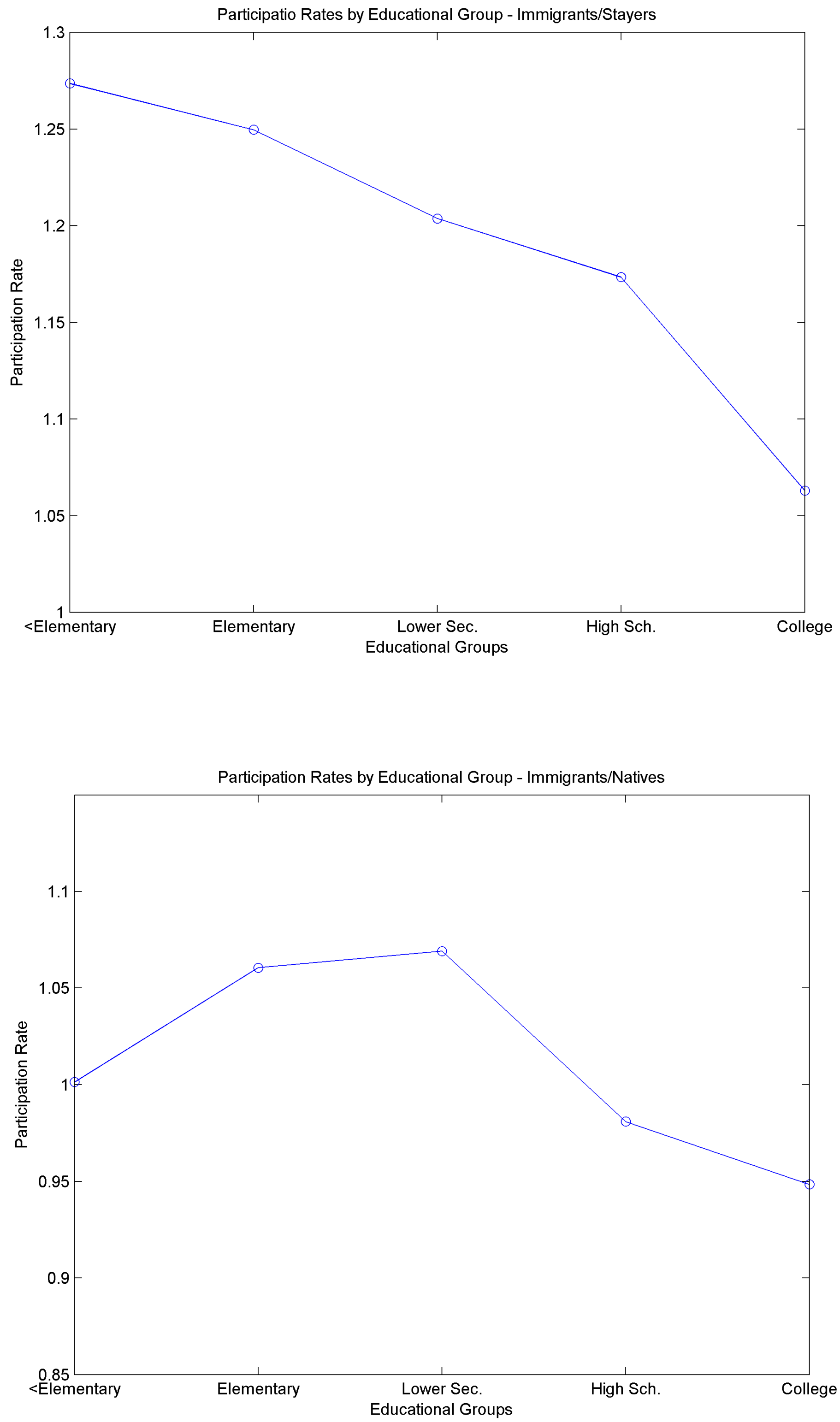


Figure 4: Awesome Image

3 The Model Economy

In this section I first introduce a simplified version of the model economy which has all the main features of the full model. By simplifying the structure of the model is possible to derive some analytical results that help identify the main mechanism of the model. The simplified model is an extension of the model in De la Croix and Doepke.

3.1 A simplified version of the Model Economy

Here I extend the model in De la Croix and Doepke (2003) to include nurturing decisions. Consequently I also differentiate between the role of men and women within the household. The model economy consists of two countries that are characterized by different production function for the consumption good, human capital production functions and the cost of education. In each country and in any given period two generations of agents are alive, adults and their children. The decision making unit in the model is the household. The house is composed of two parents, which I label man (M) and woman (W), and a number n of children. The parents make all decisions and derive utility from their own present and future consumption, as well as from having children and from their future human capital. In the full model I will assume that parents care about the future of their children, therefore they will take into account all possible decision their children can make given the space state the parents provide them with. There is no strategic behaviour between men and women and decisions are made jointly to maximize their joint utility. The state space of a household is given by the human capital bundle of men and women (h^M, h^W). I start describing the problem of a household that is resident in Mexico and decides not to migrate, their problem is to maximize the following utility function,

$$U(c_t, c_{t+1}, n_t, h_{t+1}) = \Big\{ \log(c_t) + \beta \log(c_{t+1}) + \gamma log(n_t h_{t+1}) \Big\}. \tag{1}$$

where c_t is consumption at time t, n_t is the number of children, h_{t+1} is the human capital of a child. The human capital of a child here should be interpreted as of an expected child, where the expectation is relative to be a female or a male child. For the simplified model this does not have any relevance, but for the complete model it is important since females and males with the same amount of human capital will face different distributions of human capital bundles.
subject to the following constraints,

$$c_t + w_{0,t}\delta_0 s_t n_t + x_t = w_{0,t}[(1 - \iota_M \lambda_M n_t)h_t^M + (1 - \phi n_t - \iota_W \lambda_W n_t)h_t^W] \tag{2}$$

$$c_{t+1} = R_{t+1} x_t. \tag{3}$$

Here s_t is the amount of formal education - schooling - that parents decide to acquire for their children. They buy the same amount for all their kids and each unit as an equal cost δ. Earnings are proportional to the human capital of the couple and to the amount of labor they supply to the market for wage. The Quantity $\iota_i\lambda_i$ is instead the cost in time units of participating in household production - child rearing. I also assume that women face an additional cost due to fertility ϕ that is again expressed in time units as it reduces the time available for other activities. When all other parameters are the same for men and women, a $phi > 0$ is the only parameter in the model that makes women and men different.

The human capital production function is assumed to be,

$$h_{t+1} = (\theta + s_t)^{\eta_0}((\theta_M + \lambda_M)h_t^M)^{\kappa_M}((\theta_W + \lambda_W)h_t^W)^{\kappa_W}. \tag{4}$$

Human capital is produced by means of formal education and by child rearing. The λs represent the amount of time each parent dedicate to the education of their children. This amount is effective proportionally to the human capital that each parent possesses.

If the same household decides instead to migrate, on the one hand it will pay a cost in terms of reduced capability to generate earnings proportional to the level of human capital, and a cost in terms of dis-utility (homesickness). On the other hand, they will earn a higher wage rate w_1 and will face a different human capital production function for their children. Their problem will be,

$$U(c_t, c_{t+1}, n_t, h_{t+1}) = \Big\{ \log(c_t) - \xi + \beta \log(c_{t+1}) + \gamma log(n_t h_{t+1}) \Big\}. \tag{5}$$

subject to the following constraints,

$$c_t + w_{1,t}\delta_1 s_t n_t + x_t = w_{1,t}[(1 - \lambda_M n_t)h_t^M(1 - \zeta) + (1 - \phi n_t - \lambda_W n_t)h_t^W(1 - \zeta)] \tag{6}$$

$$c_{t+1} = R_{t+1}x_t. \tag{7}$$

3.2 Some Predictions

I start by solving the problem for the Mexican stayers. From the first order conditions we derive the solutions for the nurturing efforts of men and women given by,

$$\lambda_M = \frac{\kappa_M(\phi h_t^W - \delta\theta)}{h_t^M(1 - \kappa_M - \kappa_W - \eta)} \tag{8}$$

and

$$\lambda_W = \frac{\kappa_W(\phi h_t^W - \delta\theta)}{h_t^W(1 - \kappa_M - \kappa_W - \eta)} \tag{9}$$

the schooling decision,

$$s_t = \frac{\eta\phi h_t^W - \delta\theta(1 - \kappa_{-}\kappa_W)}{\delta(1 - \kappa_M - \kappa_W - \eta)} \tag{10}$$

and finally the fertility decision,

$$n_t = \frac{\gamma(h_t^W + h_t^M)(1 - \kappa - \kappa_W - \eta)}{(1 + \beta + \gamma)(\phi h_t^W - \delta\theta)} \tag{11}$$

3.3 The Full Model

Here I extend the simplified model as in Caponi (2010). In what concerns the household problem the full model is very similar to the simplified one. The only, important, difference is that the full model recognises that stayers take into account the possibility that their children will have the possibility in the future to migrate or not. To account for this possibility I write the individual problem as a recursive one in which parents, with their decisions, determine the state space of their children and take into account, in an altruistic contest, the expected value of that state space given their optimizing actions. Moreover, I also specify formalize that the expected value of a child depends on her/his sex and the consequent expected match with her/his spouse. The expected match depends on the human capital of the child, the sex and the joint distribution of human capital and sex.[2]

3.4 Value of Being Born in the Destination Country

It is easier to start with the problem faced by the adult residing in the destination country because does not face the choice to migrate. The following is the recursive representation of a native in the destination country,

$$V_{1,1}(h^M, h^W) = \max_{\{\lambda_W, \lambda_M, n_t, s_t, x_t\}} \Big\{ \log(c_t) + \beta \log(c_{t+1}) + \gamma log(n_t) + \gamma E V_{1,1}(h_{t+1}) \Big\}. \tag{12}$$

The subscripts on the value function indicates the country of birth and the country of residents once the person has decided if to move or not. In this case $1, 1$ means born and resident in the destination country. The other possibilities are $0, 0$, for origin-origin, and $0, 1$ for origin-destination, while $1, 0$ is

[2] In other words I assume a probabilistic matching process in the marriage market that is exogenous to the spouses and that can be influenced by their parents only to the extent they contribute to determine their human capital. Also, I assume that the parents do not know the sex of their children until they are out of the household. This assumption helps abstracting from a different behavior of parents depending on the sex of the children.

excluded. The subscript t indicates the time and the quantities indexed by it refer to adult agents. In this case, h_t is the human capital possed by the adult agent of the family at time t, while h_{t+1} is the human capital possessed by the adult agent at time $t+1$. Moreover, because the problem describes a dynasty, the adult agent at time $t+1$ is also the child at time t for whom s_t, the level of schooling, is chosen. The discount factor γ represents the level of altruism towards future generations. Finally, parents care about the number of children, which enters into the value function similarly to a consumption good, and the average expected future value of their children which will depends on their human capital and the sex of the child. Notice here that to keep things simple I assume that all decisions are made at the beginning of one period, adulthood. At that point in time parents decide how many children they will have and how much they will be educated. They, however, do not know what sex their children will have, which is one of the component that will affect their future value. Moreover, conditional on the sex and the level of human capital, the value of future generations is also given by the match they will find. I.e., it will depend on their partner. I assume that each child once an adult will be matched with a partner, and the match also depends, in a probabilistic way, on the level of human capital. That is, at any period in time there is a fixed distribution of couples given by,

$$\log(h^M, h^W) \sim N(0, \Sigma_h).$$

Therefore,

$$\begin{aligned} EV_{1,1}(h_{t+1}) = 0.5 \textstyle\int_0^{+\infty} E_{\epsilon_{t+1}} V_{1,1}(h^M_{t+1}, h^W_{t+1}) f(h^W_{t+1}|h^M_{t+1}) dh^W_{t+1} + \\ 0.5 \textstyle\int_0^{+\infty} E_{\epsilon_{t+1}} V_{1,1}(h^M_{t+1}, h^W_{t+1}) f(h^W_{t+1}|h^M_{t+1}) dh^W_{t+1}. \end{aligned} \tag{13}$$

The budget constraint the household faces is given by,

$$c_t + w_{1,t}\delta s_t n_t + x_t = w_{1,t}[(1 - \iota_M \lambda_M n_t)h^M + (1 - \phi n_t - \iota_W \lambda_W n_t)h^W] \tag{14}$$

$$c_{t+1} = R_{t+1} x_t. \tag{15}$$

That is, the cost of consumption plus the cost of the desired amount of schooling must be (less or) equal to the earnings of the adult of family that are proportional to the human capital. Schooling costs are convex in schooling reflecting the assumption that teachers must be at least as much educated as the students. Because more education also implies more human capital, higher education is more costly than lower education. The human capital production function is assumed to be,

$$h_{t+1} = (\theta + s_t)^{\eta_d}[(\theta_M + \lambda_M)h_t^M]^{\kappa_M}[(\theta_W + \lambda_W)h_t^W]^{\kappa_W}e^{\epsilon_{t+1}}, \tag{16}$$

with

$$\epsilon_{t+1} \sim N(\mu_\epsilon, \sigma_\epsilon^2).$$

The parameter η_d corresponds to the returns to education which, like its costs, are allowed to be country specific. Education is more efficiently translated into human capital if the human capital of parents is higher and if they spend more time nurturing, reflecting the intergenerational transmission of ability. The uncertainty of the returns to the education investment is reflected by the shock ϵ, which is identically and independently distributed.

3.5 Value of Moving

The adult agent born in the origin country can choose to migrate or stay. Conditional on migrating, the value function that characterizes her decision is given by,

$$V_{0,1}(h^M, h^W) = \max_{\{\lambda_W, \lambda_M, n_t, s_t, x_t\}} \Big\{ \log(c_t) + \beta \log(c_{t+1}) + \theta log(n_t) - \xi + \theta EV_{1,1}(h_{t+1}) \Big\}. \tag{17}$$

where ξ is a stochastic disutility factor, distributed as

$$\xi \sim N(\mu_\xi, \sigma_\xi^2).$$

The budget constraint is,

The budget constraint the household faces is given by,

$$c_t + w_{1,t}\delta s_t n_t + x_t = w_{1,t}[\lambda_M h^M + (1 - \phi n_t)\lambda_W h^W]^{(1-\zeta)} \tag{18}$$

$$c_{t+1} = R_{t+1}x_t. \tag{19}$$

That is, the cost of consumption plus the cost of the desired amount of schooling must be (less or) equal to the earnings of the adult of family that are proportional to the human capital. Schooling costs are convex in schooling reflecting the assumption that teachers must be at least as much educated as the students. Because more education also implies more human capital, higher education is more costly than lower education. The convexity of the cost of education is also needed to have a well defined problem once the following mincerian human capital production function is assumed,

$$h_{t+1} = (1 + s_t)^{\eta_d}[(1 - \lambda_M)h_t^M]^{\kappa_M}[(1 - \lambda_W)h_t^W]^{\kappa_W}e^{\epsilon_{t+1}}, \tag{20}$$

3.6 Value of Staying

The problem of the agent who decides to stay is more complicated. In this case the expected values of the future generation takes into account the possibility of children choosing to migrate once they are adult. The recursive form of the problem is synthesized by the following,

$$V_{0,0}(h_t, H_t = 0) = \max_{\{s_t, H_{t+1}\}} \Big\{ \log(c_t - a) + \theta E \max\left\{V_{0,0}(h_{t+1}, H_{t+1}), EV_{0,1}(h_{t+1}, H_{t+1})\right\}\Big\}, \tag{21}$$

if the agent is a dropout, and

$$V_{0,0}(h_t, H_t = 1) = \max_{\{s_t, H_{t+1}, C_t\}} \Big\{ \log(c_t - a) + \theta E \max\left\{V_{0,0}(h_{t+1}, H_{t+1}), EV_{0,1}(h_{t+1}, H_{t+1})\right\}\Big\}, \tag{22}$$

if, instead, is a high school graduate. The budget constraints in this case are given by,

$$c_t + w_{0,\ell,t}\tau_0(e^{\delta_0 s_t} - 1) + H_{t+1}w_{0,\ell,t}\tau_0(e^{12\delta_0} - e^{\delta_0 s_t} + \chi_0) = w_{0,\ell,t}h_t. \tag{23}$$

if the person does not have a college education. If the agent has a college education the budget constraint is,

$$c_t + w_{0,q,t}\tau_0(e^{\delta_0 s_t} - 1) + H_{t+1}w_{0,q,t}\tau_0(e^{12\delta_0} - e^{\delta_0 s_t} + \chi_0) = [w_{0,q,t} - \rho w_{0,\ell,t}]h_t. \tag{24}$$

Finally, the accumulation of human capital for non-migrants is given by,

$$\log h_{t+1} = \eta_0 s_t + \kappa \log h_t + \epsilon_{t+1}.$$

The parameter reflecting the returns to education here is indexed by 0, to indicate that the human capital is accumulated using the technology available in the source country. The migration decision is characterized as follows,

$$V(h_t, H_t) = \max_{\{s_t, H_{t+1}, C_t, \psi_t\}} \{(1 - \psi_t)EV_{0,0}(h_t, H_t) + \psi_t(EV_{0,1}(h_t, H_t))\}. \tag{25}$$

where ψ is a dichotomous variable that takes value 1 for migration and zero otherwise.