WAGE GAPS AND MIGRANTION COSTS: AN ANALYSIS FROM SIMULATION DATA

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Abstract

Borjas (1987, 1991 and 1994) developed the self-selection theory, applying Roy's model (1951) to migration studies. He establishes that the characteristics of migrants in terms of skills and abilities are driven by wage distribution differences between the host country and home. In this regard, when the country of origin has higher relative returns for skills and more disperse income distribution, a negative selection of migrants is generated, and vice versa. A great deal of literature has studied Self-selection model to analyse how wage distribution influences migrants' decisions, leading to consistent and inconsistent results. Given the conflicting results in the literature, this paper examines how migration costs and wage differences influence self-selection patterns –i.e. skills in terms of schooling levels. Taking into account that self-selection can not be studied systematically by means of standard data sources because of the lack of data, we propose an analytical model based on the individual investment decision theory (Human Capital theory), applying simulated data by Monte-Carlo method. The theory of individual investment decisions allows us to analyze self-selection patterns across differences in wages and economic conditions at home and in host countries and to introduce uncertainty using a stochastic framework. An empirical application for long-distant migrations –from Ecuador to Spain– is implemented. Our findings show that migrants are positively selected on observable skills between Spain and Ecuador, considering both constant direct migration costs and constant direct migration costs-plus-variable opportunity migration costs. Secondary data from official sources confirm this tendency.

Key words: Labour migrations; Self-Selection; Computer simulation; Theory of individual investments decisions.

1. Introduction

Borjas (1987, 1991 and 1994) developed the self-selection (supply side) theory, applying Roy's model (1951) to migration studies. He establishes that the characteristics of migrants (selection) in terms of skills and abilities are driven by wage distribution differences between the host country and home. This affects migration in both number and the skill composition of migrants. Regarding skill compositions, developed countries have more equal income distributions on average than developing countries; therefore, Borjas (1991) states that migrants, who come from developing countries, are subject to unfavourable bias in selection processes; depending on migration, costs (time-equivalent migration costs) will be constant among individuals.

Nevertheless, the previous results are controversial and not conclusive according to empirical evidence (Brücker and Trübswetter, 2004) found with respect to Borjas' theory. Chiswick (1987, 1999, 2000) argues that a greater difference in income compared to the country of origin only attenuates positive selection of migrants; Jasso and Rosenzweig (2008) state that benefits from migrating are higher for more skilled workers, given the positive skill-price differential of migration costs in time between home and host country; Chiquiar and Hanson (2005) find intermediate and positive selection of migrants from Mexico to the United States; Akee (2007) affirms positive selection based on educational levels and unobservable skills from the Federated States of Micronesia (FSM) to the United States; etc.

Given the conflicting results in the literature about migration self-selection, this paper examines how migration costs and wage differences influence self-selection patterns –i.e. skills in terms of schooling levels, although only observable abilities related to education are considered. We propose an empirical framework based on the individual investment decision theory (Human Capital theory) and simulated data (Monte-Carlo method). This model introduces uncertainty using a stochastic framework and also includes differences in wage and economic conditions at home and in host countries, giving a view of the economic actors' decision-making processes or intentions. Furthermore, it provides a way to overcome the influence of push-pull factors in existing source and host-country data, as well as non-random sample-selection problems due to the self-selected samples of the population who migrates.

The study uses data from Spain and Ecuador. Spain has lower wage dispersion than Ecuador, and it has not got a migration policy of attracting migrants with higher studies. Furthermore, this country has become one of the main receiving countries in the European Union (EU). In 2008 some 11% of its population was immigrant, the migrant stock having increased more than 1.5 points since 2002 (OECD, 2009). Ecuadorians are the most numerous long-distant migration cohorts.

The paper is structured as follows. The next Section develops an extended version of the self-selection Borjas' model to analyse how the differences in earning distribution and the average wage levels affect the migrant's skill structure. In the third Section, the data and results are shown. Finally, the paper ends with a review of the main conclusions and a brief discussion of the most relevant issues.

2. Theoretical framework and the specification of the Net Present Value model

An empirical application of a simple model is developed in the tradition of the so-called Human Capital approach (Sjaastad, 1962; Harris and Todaro, 1970) where expected earnings are conditioned by the probability of finding a job. Migration is considered in our model as the result of an individual choice –i.e. an individual investment decision which leads to some expected incomes and costs.

The model only considers economic or pecuniary incomes and costs. Nevertheless, this limitation of the model is insignificant because of the aims of our research. This insight is applied to analyse the effects of migration costs and wage dispersions on self-selection tendencies, supposing, firstly, that out-of-pocket expenses are constant among migrants and, secondly, that opportunity costs vary according to the level of schooling.

The model assumes that migrants have risk neutrality, so migrants adopt the decision to migrate discounting expected incomes and costs at a constant interest rate ρ and there are no investments in acquisition of human capital after the migration.

The analyses focus on concrete profiles which depend on the sex i (i= 1, male; i= 2, female); the age j (j= 1, from 16 to 24 years of age; j= 2, from 25 to 44; j= 3, from 45 to 65), taking into consideration that the potential migrants' ages are between 16 and 65 years of age, because migrations are guided by labour – and adapting Borjas' classification (2000); and schooling levels k (k= 1, primary level with less than 9 years of schooling; k= 2, secondary level from 9 to 11 years of schooling; k= 3, tertiary level with over 12 years of schooling). This classification is a modification of that used by UNESCO (1997).

Potential migrants to a developed country face forecasted incomes and costs for a finite time horizon given by:

$$V = \sum_{t=1}^{n} \frac{[W_t \prod_{i=1}^{t}(1+g_i) + H_t \prod_{i=1}^{t}(1+l_i)] - [C_t + CR_t]\prod_{i=1}^{t}(1+f_i)}{\prod_{i=1}^{t}(1+\rho_i)(1+z_i)} - I_0 \quad (1)$$

V is the net present value from migration in *t*, i.e. it is the monetary surplus that the migrants can assign to consume, save-invest or send in remittances after satisfying their basic or primary necessities. The expected nominal wages in the country of destination for the migrant are given by $W_t = f(\delta_t)$. According to Harris and Todaro (1970), δ_t represents the employment rate in the host country (1-unemployment rate), being a random variable which represents a priori probability. In this regard, when the migrant is unemployed, the wage turns into a subsistence income (S_t) –e.g. subsidies, informal wages, etc.

In addition, H_t is the profitability derived from savings or capital investments in the country of destination *D*; and l_t represents the interest rate received from savings or capital investments. This profitability is estimated by means of the monetary surplus given by the differences between wages and habitual cost of living, and it is a function of the propensity to migrate ($H_t=f(R_t)$) where R_t represent a priori probability. The propensity to save or to invest is estimated as: 1- R_t.

C_t represents the usual living costs in the country of destination *D* as primary costs derived from basic consumption, which are also conditioned by the employment situation. CR_t is the cost of sending remittances because of the importance in migration decisions (Stark and Levari, 1982; Lauby and Stark 1988; Rapoport and Docquier, 2006). This figure is calculated by the migrants' monetary surplus, their propensity to send remittances (R_t) and transaction costs from sending remittances (q_t).

ρ_t explains the migrants' interest or discount rate [$\rho_t \in (0, 1)$], as the required rate of return because of the expected risk in the flows due to fluctuating economic conditions in their countries. Here, we consider that the lowest discount rate financially acceptable for migrants is capital opportunity cost in nominal terms. g_i, f_i and z_i add the effects of inflation in the country of destination *D* on wages, costs and general price increases, respectively. I_0 represents the costs related to migration in $t= 0$ in the broadly meaning defined by Chiswick (2000) where migration costs include: direct or out-of-pocket costs (travel costs, T_0, and regularization costs, R_0) as well as opportunity costs derived from travel to and reallocation in the new country (F_0). Thus, according to Chiswick (1987 and 2000) and Borjas (1987), we establish an opportunity cost for time equivalent units, such that: $\pi = p_k W_t$. The variable p_k

shows the proportion of the year dedicated to the satisfaction of migration costs which depend on schooling level ($p_k = \frac{T_0 + R_0}{W'_{t-m}}$). However, the cost of the time-equivalent units for migration is given by the wages in the host countries which increase according to educational levels. Therefore, investment is represented by: $I_0 = p_k W_t + T_0 + R_0 + F_0$. If different currencies between countries are considered the exchange rate is incorporated corrected by Power Purchase Parity.

The model allows controlling the effect of the educational level on the propensity to migrate. Nevertheless, the potential migrant makes his decision by comparing the potential earnings of migrating with those of remaining at home. The model posits that potential migrants will move if the expected utility of moving is higher (Funkhouser, 2009). Therefore, the expected net present value associated with the option of staying at home (V') has to be estimated:

$$V' = \sum_{t=1}^{n} \frac{[W'_t \prod_{i=1}^{t}(1+g'_i) + H'_t \prod_{i=1}^{t}(1+l'_i)] - [C'_t \prod_{i=1}^{t}(1+f'_i)]}{\prod_{i=1}^{t}(1+\rho'_i)(1+z'_i)} \tag{2}$$

V' is the net present value for the decision to stay at home, i. e. the value of not going through with the migration. The nominal wage in the country of origin, W'_t, is calculated from the same point of view as the timing of migration where $W'_t = f(\delta'_t)$.

3. Decision-making model for Migration from Ecuador to Spain

3.1. Data

Monte-Carlo simulation is a stochastic method to simulate output fluctuations. Input variables are random or stochastic ones whose behaviour depends on their statistical distributions (Fishman, 1996). In the study of migration decisions, the application of the Monte-Carlo simulation method is due to the lack of disaggregated data series and the inexact character of this data. We include uncertainty not only about the future behaviour of returns and costs derived from migration, but also about the returns if the option to migrate is not chosen, as well as about the economic situations in the countries of origin and of destination.

The analysis involves Ecuador (as the country of origin), situated in Latin America, and Spain (as the host country), located in southern Europe.

Ecuador is situated in Latin America and has more than 12 million inhabitants. Some 60% of Ecuadorians live in urban areas. Two million Ecuadorians have migrated in the last decade

(INEC, 2010); also, a feminization process has transformed the migration flows as 50% of Ecuadorian migrants were women between the years 2000 and 2005 (UN, 2005). Spain is located in the south of Europe and has become one of the most important migration-receiving countries in the EU, and has lower income dispersion than Ecuador (Gini's Index: less than 32 in Spain compared to 50 in Ecuador). In 2008, the migrant stock in Spain for Ecuadorians exceeded 400,000 people of whom 91% stated that they went to Spain to look for better jobs (INE, 2008).

Three migrant profiles are found in our design:

1. Y_1, rural women between 25 and 44 years of age with primary studies (less than 9 years of schooling);
2. Y_2, rural women of the same age and with secondary studies (9 – 11 years of schooling);
3. Y_3, rural women of the same age with tertiary studies (more than 12 years of schooling).

In the destination country, it is taken that entry wages are lower than those of native workers (Borjas, 2000) and wage gaps are reduced as time passes (Borjas, 2000) such that $W_t=\gamma_t W_{t-1}$. Depending on migrants' contractual situations, they can stay: employment, unemployment and sub-employment. Also, the period of time (t) used in the models is 10 years.

The selection of statistical distribution and ranges for each variable, presented in Table 1, are based on limited existing secondary data[1], and expert knowledge.

Table1. Input of variable statistical distributions and ranges

Variables	Statistical Distribution	Y_1	Y_2	Y_3
		Range	Range	Range
T_0	Triangular	[480, 840, 1200]	[480, 840, 1200]	[480, 840, 1200]
R_0	Uniform	[540, 1200]	[540, 1200]	[540, 1200]
$E_0^{(a)}$	Uniform	[0.80, 1.20]	[0.80, 1.20]	[0.80, 1.20]
$W_t^{(b)}$	Triangular	[4500, 6800, 9000]	[6000, 7500, 12000]	[7500, 8500, 16000]
γ_t	Uniform	[1, 1.007]	[1, 1.009]	[1, 1.01]
S_t	Uniform	[1200, 4000]	[1200, 5000]	[1200, 6000]
$S_{St}^{(c)}$	Uniform	[3000, 7000]	[3000, 8500]	[4000, 11000]
g_t	Uniform	[1, 5]	[1, 5]	[1, 5]
f_t	Uniform	[2, 7]	[2, 7]	[2, 7]
$C_t^{(d)}$	Triangular	[4500, 6000, 7000]	[6000, 7000, 7500]	[7000, 7500, 8000]
$C_{Ut}^{(e)}$	Uniform	[3500, 4000]	[4000, 5000]	[4000, 6000]
$C_{St}^{(f)}$	Uniform	[4000, 6500]	[4000, 7000]	[4000, 500]

[1] Secondary data come from Eurostat, OECD, ILO, The Spanish Statistical Institute (INE) and The Ecuadorian Statistical Institute (INEC).

R_t	Uniform	[0, 2000]	[0, 4000]	[0, 6000]
q_t	Uniform	[0.08, 0.20]	[0.08, 0.20]	[0.08, 0.20]
H_t	Uniform	[0, 2000]	[0, 4000]	[0, 6000]
l_i	Uniform	[0.02, 0.08]	[0.02, 0.08]	[0.02, 0.08]
ρ_t	Uniform	[1, 6]	[1, 6]	[1, 6]
z_i	Triangular	[1, 3, 5]	[1, 3, 5]	[1, 3, 5]
W'_t [(g)]	Triangular	[250, 1200, 3000]	[250, 1700, 5000]	[250, 2500, 8000]
S'_t	Uniform	[0, 730]	[0, 730]	[0, 730]
S'_{St} [(h)]	Uniform	[1000, 2000]	[1000, 3000]	[1000, 4000]
g'_t	Uniform	[0, 5]	[0, 5]	[0, 5]
f'_t	Uniform	[0, 13]	[0, 13]	[0, 13]
C'_t [(i)]	Triangular	[1000, 1200, 3000]	[1000, 1700, 3000]	[1000, 2500, 4000]
C'_{Ut} [(j)]	Uniform	[1000, 1200]	[1000, 1200]	[1000, 1200]
C'_{St} [(k)]	Uniform	[1000, 1500]	[1000, 2000]	[1000, 3500]
ρ'_t	Uniform	[5, 15]	[5, 15]	[5, 15]
z'_i	Triangular	[1, 6, 11]	[1, 6, 11]	[1, 6, 11]

[a] E_0 expresses the currency exchange between the dollar and euro.
[b] Host wage is conditioned by δ_t which represents the employment rate in the host country (70%, 88%, 92%, respectively for each profile), but we also introduce the probability of unemployment (15%, 6%, 4%) and being sub-employed (15%, 6%, 4%).
[c] S_{St} is earnings from illegal work or sub-employment.
[d] The habitual cost of living is calculated in function of the minimum costs for a basic shopping basket.
[e] Usual costs are linked to situations of unemployment.
[f] These usual costs are linked to sub-unemployment situations.
[g] Home wage is conditioned by δ'_t which represents the employment rate in the home country (45%, 50%, 70% respectively for each profile), but we also introduce the probability of being unemployed (10%, 10%, 6%) and sub-employed (45%, 40%, 34%).
[h] S'_{St} is earnings from illegal work or sub-employment.
[i] The habitual cost of living is calculated in function of a basic and vital shopping basket.
[j] Usual costs linked to unemployment situations.
[k] These usual costs are linked to sub-unemployment situations.

3.2. Results

Figures 1, 2 and 3 contain the probability of obtaining monetary surplus or losses by Y_1, Y_2 and Y_3 derived from migration (V) and not leaving the country of origin (V') when migration costs are constant.

Figure 1. NPV First Profile (Y_1) for constant migration costs

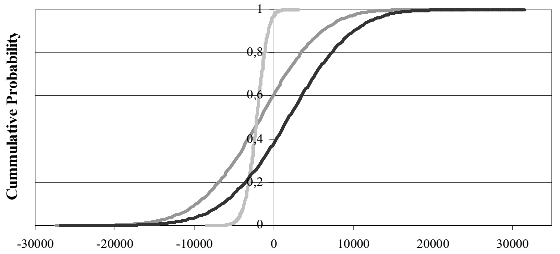


Figure 2. NPV Second Profile (Y_2) for constant migration costs

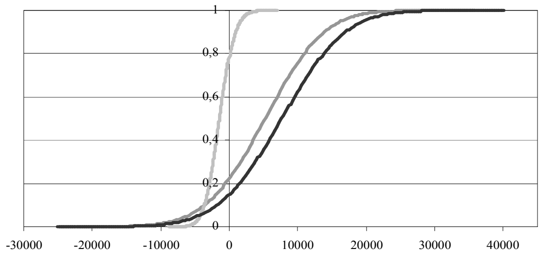
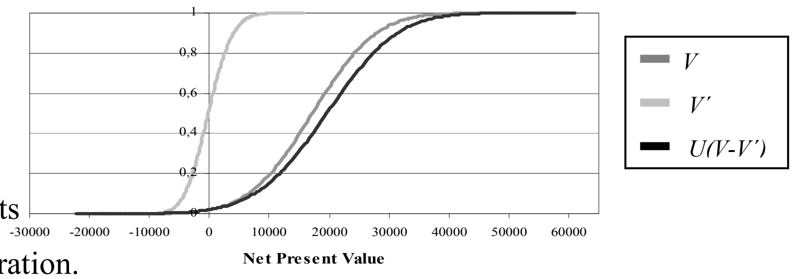


Figure 3. NPV Third Profile (Y_3) for constant migration costs



Source: authors' elaboration.

Figures 4, 5 and 6 show the same estimation as the previous one but for variable migration costs (opportunity costs) across schooling levels.

Figure 4. NPV First Profile (Y_1) for variable migration costs

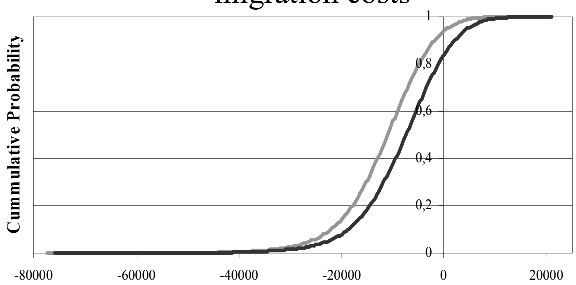


Figure 5. NPV Second Profile (Y_2) for variable migration costs

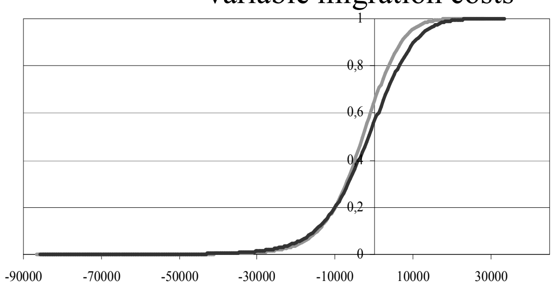
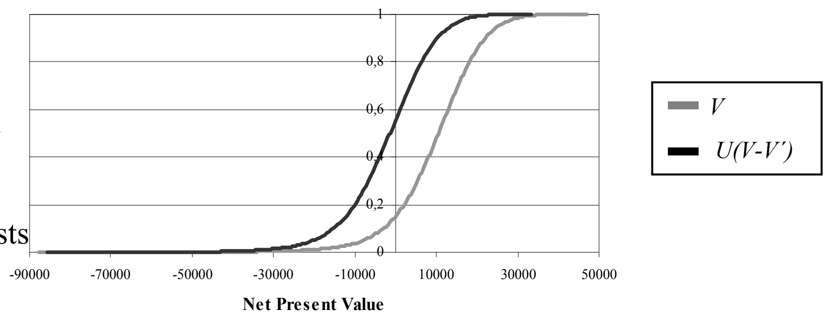


Figure 6. NPV Third Profile (Y_3) for constant migration costs



Source: authors' elaboration.

Ecuadorian rural women with a primary schooling level (Y_1) have 60% or 93% of probability of getting a negative V –i.e. not recovering migration costs–, depending on whether constant or constant- plus-variable migration costs are taken into account. The income dispersion for constant costs is situated between $-27,000 and $24,000; when variable costs are included, the upper limit for earning is similar but the lower limit decreases to $77,000. The average loss goes from $1,600 to $16,000. The option not to migrate (*V´*) has 96% likelihood of reaching a negative value –i.e. the potential migrant would not be able to pay the basic shopping basket–, resulting in a smaller range between $ -8,500 and $3,100, with $2,108 of average loss. The previous results take into account the poor economic conditions in Ecuador, where some 60% of the rural population lives in poverty conditions with a per capita income of about $1,000 per year, and 30% undergo extreme poverty conditions (INEC, 2010). Nevertheless, in different reports the poverty reaches 95% for rural women (FAO, 2008).

For the second profile (Y_2), the probability of obtaining a negative *V* is lower than in the previous example: 22% (constant costs) and 63% (constant-plus-variable costs), with the higher income limit at $35,000 and the lower one at $-24,000 or $ -86,000. Again, the uncertainty due to variable costs increases the dispersion range by raising the lower limit; the average is around $5,000 income or $3,000 loss. The option of not leaving home results in 78% likelihood of a negative *V´*. This percentage reflects the small wage gap between workers with primary and secondary studies in rural Ecuador. The simulation gives an average loss of $1,315.

As potential migrants Y_3 have 2% or 14% probability of obtaining a negative *V*, their recovery of migration costs, even variable costs, has 86% likelihood of occurring. The average income ends up being $17,000 or $9,700. The probability of obtaining losses from not leaving home (*V´*) approaches 51%.

Based on the previous probabilities, at first glance migrants would tend to be positively self-selected, considering both constant and constant-variable costs. Nevertheless, rural women with primary or secondary schooling levels are practically obliged to migrate due to the negative economic conditions in their country of origin, although they have more difficulties recovering migration costs. In this regard, internal migrations are easier for rural women with primary education. For the second group, rural women with secondary education, both internal and international migration would be a good option. 33% of rural people with secondary education migrate to urban areas. Furthermore, 58% of Ecuadorian migrants who work in Spain have secondary school levels, and only 27% have primary studies. In Ecuador, 60% of the population has the lowest schooling level and 30.7%, secondary education.

Rural women with tertiary education levels would tend to migrate as they have worse economic conditions than in urban areas or Spain, although only 4% of rural people have tertiary schooling level.

4. Discussions

The research has been based on a country of destination which has lower wage dispersions and the results suggest that migrants are positively selected on observable skills, considering constant direct migration costs and both constant direct migration costs plus variable opportunity migration costs among migrants' schooling levels. An increase in migration costs –direct or time-costs– involves a greater tendency toward favourable selection, so individuals with higher education levels would tend to have a higher propensity to migrate.

In the empirical application, Spain has a more equal income distribution than Ecuador. For long-distant migrations the model show a positive self-selection on observable skills; but also the precarious wages and conditions for rural people with primary an secondary education which would suppose the necessity to move. Descriptive statistic confirms that Ecuadorian migrants in Spain are middle and positive selected.

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