# THE SELF-SELECTION IN THE MIGRATION PROCESS: WHAT CAN WE LEARN?

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## 1. Introduction

International migration has gained increasing attention in the economic literature, as the volume of migrants crossing the national borders has shown a stable up-ward trend. The literature presents a particular interest in the analysis of the determinants of migration, representing the factors influencing the individual decision to move: economic considerations, such as earning advantages, appear to be relevant features driving the choice, because individuals seek to enjoy favourable job opportunities moving to places where the wages are higher. The human capital theory in migration contributes in its statement that migration represents an investment which enhances the productivity of human characteristics and that two agents may meet in the alternative destinations different gains as well as different costs, as a consequence to their distinct individual features. The fact that one individual migrates, whereas another does not, implies that between the two occurs an important distinction: for example one may be more motivated than the other, may have higher abilities and higher skills, which create a relative wider spread between earnings and costs, and therefore ensure a higher propensity to migrate. "Rationality dictates that persons choosing a given alternative do so because they have some tangible basis for perceiving a more favourable return than those who choose otherwise" (Nakosteen and Zimmer, 1980; p. 840).

The distinct returns to individual characteristics may give birth to a process of self-selection in migration: in fact, individuals endowed with some specific features may find more profitable to move than others and therefore, self-select themselves in the activity. It follows that migrants may not represent a random sample of the home country population, but they are selected in a systematic way from the relevant distributions. Self-selection could arise with respect with different individual characteristics: some are observable elements, such as wealth and education, while some others are unobservable features, such as ambition and ability.

The implications of this phenomenon are quite serious whenever the selection involves the most skilled and the most motivated individuals: in fact, according to Bhagwati and Hamada

(1974), the outflow of skilled workers is regarded as more critical compared to the emigration of less skilled individuals, because there are social costs related to the departure of individuals who are employed in socially important occupations as well as fiscal losses associated with the public subsidies to education. The brain drain, in fact, induces a detrimental cost to the labour sending countries, whenever the social marginal product of labour exceeds the marginal product, and this seems the case with doctors for example; moreover, if education is financed by the State, which will recover in the future the returns on this investment through a progressive taxation, the emigration of highly educated individuals will deprive those remaining in the home country of this returns, worsening consequently their welfare. Finally, the departure of skilled individuals produces negative externalities, as predicted by the endogenous growth framework, which highlights the importance of human capital as a source of growth.

Despite the sensitivity of this topic, however, there is not a clear picture upon the relevance of the process of selectivity and in particular upon the direction of the selection. The empirical investigation is hindered by a lack of comprehensive international data: in fact, not only the figures on international migration are limited, but also they do not offer detailed information on the observable characteristics of migrants. Moreover, the process of self-selection can occur along unobservable characteristics, which, by their nature, cannot be captured.

The objective of this survey is to review the theoretical and the empirical literature in order to cast some light on the direction of the migration selection and to identify the factors which induce a skilled rather than an un-skilled migration: therefore, some conclusion upon the existence as well as the determinants of a selective process in migration will be offered.

## 2. Self-Selection in the Migration Process

### 2.1 Models with Asymmetric Information

The first attempt to model the direction of the selection bias within a context of international migration is offered by Kwok and Leland (1982): according to this model, the assumption of imperfect labour market is crucial in the prediction of the outcome. In fact, the authors introduce information asymmetry in the origin labour market and perfect information in the destination country, which represents the place of training of the immigrant labour force. The uneven set of information between the two countries can alone generate what the authors define a “brain drain problem”, implying that the high skilled workers leave the country of origin: this result follows despite the wage gap between home and destination is limited, the migrants’ location preferences are biased in favour of home country and the worker’s productivity is the same in both countries.

The framework is very simple: individuals seek to maximize their utilities and move to places where wages are higher. Given that the model aims to explain the high number of students from less developed countries who study in the Western world and do not return in the home countries, the authors place the information asymmetry in the home nation[1]: in fact, the country of emigration is the place where migrants obtained their education and therefore, foreign employers have a more accurate understanding of the true productivity, due to the familiarity with the academic system and the historical experience in facing domestic as well as foreign workers. Therefore, the workers' productivity is assumed perfectly observable abroad, whereas it is unknown by the employers in the home country, prior to hiring; moreover, under perfect labour markets, the wage that would prevail reflects the workers' productivity, whereas under asymmetric information the wage reflects the average productivity.

Introducing home preferences, which is formalized by the assumption that migrants compare the wage in the home country with *k* times the foreign salary, with *k*<1, the migration condition of a worker of productivity *p* is:

$$w_H < kw_F(p)$$

where $w_H$ is the wage offered in the home country and $w_F(p)$ is the wage paid abroad. An individual with productivity *p* compares earnings at home with the discounted wage abroad and migrates only if the former is strictly smaller than the latter. If there is no asymmetric information and the wage differentials between home and destination are not too large, the existence of home preference can be consistent with zero migration. However, the introduction of asymmetric information allows an equilibrium with emigration such that the "productivity of any worker remaining abroad exceeds the productivity of any worker returning home" (Kwok and Leland, 1982, p. 94): in other words, the model predicts a positive self-selection. To proof the statement, the authors introduce two arbitrary individuals with productivity $p_h$ and $p_f$, such that the first remains at home whereas the other migrates: provided that the foreign market pays according to the marginal productivity, for the first individual it must hold: $w_H > kw_F(p_h)$, while for the second $w_H < kw_F(p_f)$. It follows that $w_F(p_h) < w_F(p_f)$ and therefore $p_h < p_f$.

An extension of the previous model is provided by Katz and Stark (1984) who introduced different hypotheses in terms of both the "location" of the information imperfection as well as the magnitude of the wage differentials between home and destination. In fact first they allow the information asymmetry to be placed not only in the home but also in the destination nations alternatively, and second they investigate the effects of both a small and a large wage gap

between the two places. In this way they show that the treatment of migration proposed by Kwok and Leland is only one of the four plausible scenarios; moreover they find that the use of alternative hypotheses imply opposite outcomes in terms of the direction of the selection.

In agreement with Kwok and Leland, when imperfect information upon the true productivity of the workers exists, the employers pay according to the workers' average productivity and the marginal productivity otherwise. The conclusions of their work can be summarized as follows: first, under perfect information both in the destination and in the host labour market, either no migration or complete labour drain can potentially occur, depending on the assumption regarding the magnitude of the wage differentials in the two states: it should be clear that if destination offers substantial higher wages, even after introducing a discount factor to account for home preference, all individuals favour working abroad. The reverse case of no migration occurs if the gap in earnings is not big enough.

Second, the choice of the location of the asymmetry, whether in the origin or in the host country, is crucial in determining who migrates. Katz and Stark do not agree with the suggestion that foreign employers rather than national have perfect foresight upon the true productivity of labour, and allow the more likely assumption that imperfect information is located in the foreign labour market, whereas home country enjoys perfect information. The outcome, which has been formalized in a more rigorous way in a subsequent contribution (Katz and Stark, 1987) states that if this scenario occurs and if the difference in earnings in the two countries is large enough, the bottom skill workers migrate, which contradicts the prediction of positive selection of Kwok and Leland[2]. On the contrary, if the earning differential between home and destination is small, no migration will occur.

To proof the statement, two individuals with different productivities are introduced and their migration behaviours are compared. If $\overline{p}$ is the top skill level migrating and $p^*$ is a level of productivity such that $p^* < \overline{p}$, it follows that $w_H(p^*) < w_H(\overline{p})$. The top skill individual enjoys a higher wage than the lower skill individual in the home country. The hypothesis that $\overline{p}$ migrates implies that $w_H(\overline{p}) < kw_F$, where $w_F$ is wage payable in the destination country to a migrant of unknown productivity, which reflects the average product of all members of the group. It follows that $w_H(p^*) < w_H(\overline{p}) < kw_F$ and therefore individual $p^*$ will also find profitable migrating. Therefore, only the less skilled workers, with productivity less than or equal to $\overline{p}$, migrates.

## 2.2 The Human Capital model

Sjaasstad (1962) introduced the human capital approach in a migration framework. He modelled the migration decision as an investment which aims to increase the productivity of human resources. The innovative feature of the approach is related to the central role gained by personal characteristics in the evaluation of future earnings and costs following the decision to migrate. Depending on the skill levels, for example, agents face different remunerations in the alternative locations and different costs of migration and therefore compare the expected returns in all possible destinations, including the home location. Variables like experience, age, sex, education, occupation or training affect earnings and indeed give the estimates of the returns to migration. The human capital variables have a crucial role in the migration process because they affect the likelihood of both internal and international movement, through their impact on earnings and costs. The human capital model, therefore, offers insights upon the determinants of the selectivity: given that the expected income, net of migration costs, influences migration, the type of selectivity depends on how the skill levels are rewarded in the alternative locations and on how they affect the costs of migration.

### *2.2.1 Constant time-equivalent costs of migration*

Following the innovative contributions of the human capital model, Borjas (1987) presents an analysis of the selectivity of migration. Borjas entered the economic debate on the selectivity of international migration criticizing the empirical findings of the "first generation" studies of this literature (Chiswick, 1978; Carliner, 1980). These analyses support the idea that migrant are more able and more motivated than non-migrants, as it follows from the empirical finding that immigrants manifest a steeper age-earnings profile than native population, and that, after a reasonable short time, the age-earnings of migrants overtake those of natives. Borjas, however, reports that these conclusions are an artefact of the application of a single cross section of data: in fact, pooling information of different generations of immigrants, the aging effect cannot be disentangled from the cohort effects of different waves of immigrants. The declining of labour market quality between successive immigrants cohort may have contributed to the apparent fast increase in the migrants wage, estimated from a single cross section of data. On the contrary, the author theoretically predicts the negative selection of the immigrants on the basis of a model of comparative advantage.

The author adapted the seminal model of Roy (1951), originally developed in a context of occupational decision, to a migration choice. The original version of the Roy model offers an example of self-selection based on comparative advantage; in fact, different occupations provide distinct returns depending on the abilities of the workers. While modelling the occupation

choice as an utility maximization, Roy emphasizes that the distribution of income in the alternative sectors determine the allocation of skills in the occupations. The application of Roy's general framework can be found in a variety of other labour market settings[3]: among others Borjas (1987) models international migration.

Migration incentives in the model depend on earning opportunities across countries net of migration costs. Borjas decomposes the individual potential earnings at home (H) and abroad (F) into a part due to observed characteristics ($\mu$) and a second part due to unobservable elements ($\varepsilon$), which should be interpreted as the abilities of individuals. The earning function, therefore, can be expressed as:

$$ln\, w_i = \mu_i + \varepsilon_i \qquad i=Home, Foreign \qquad [1]$$

where $\varepsilon_i \sim N(0, \sigma_i^2)$

The author introduces only one type of cost, which is assumed constant across all individuals in the home country, because it reflects a constant fraction of home foregone incomes. The author defines this cost "the time-equivalent measure of cost", as it captures the time spent in the process of emigration. The assumption implies the absence of any efficiency effect of ability in migration: in this model, in fact, there is no role for skills and education in reducing costs. The decision to migrate is expressed by the Index function I:

$$I = ln(\frac{w_F}{w_H + C}) \approx (\mu_F - \mu_H - C_f) + (\varepsilon_F - \varepsilon_H) \qquad [2]$$

where $C_f$ represents foregone earnings. Emigration occurs if I is greater than zero.

The conditions which determine the type of selection prevailing, positive or negative, are determined from the above equation: it can be shown that, whenever the distribution of income for skill levels is more dispersed in the destination than in the origin country, individuals will be positively selected. Under this circumstance, "source country taxes high-ability workers and insures less able workers against poor labour market outcomes" (Borjas, 1994 p. 1689). On the contrary, if the country of origin displays a higher differential in skill rewards compared to destination, migrants will be drawn from the lower tail of the income distribution.

The author in fact demonstrates, with a little of computation, that the direction of the self-selection depends only on $\frac{\sigma_F}{\sigma_H}$, where $\sigma_i$ is the standard deviation of the error term in equation [1]: in particular if the ratio is less than one, the income gap between the average emigrant and the average person in the home country, as well as the earning gap between the average immigrant and the average native of the destination country will be negative, implying negative selection[4]. Therefore, Borjas is able to show that the type of self-selection depends on the

second moment of the earning distributions and neither the differences in mean income between home and destination nor the magnitude of the costs influences the outcome of the model.

Borjas' final conclusion that migrants are negatively selected, which is contradicting the "first generation" findings, follows from the observation that a large number of labour exporting countries have higher inequality than the major destination nations[5]. In fact, high returns to schooling and high dispersion in earnings in source nations, allow the high skill individuals to be relatively better rewarded in source countries, whereas these conditions provide low skill individuals with stronger incentives to migrate.

### *2.2.2 The efficiency effect of ability in migration*

The model and the predictions offered by Borjas opened the ground for subsequent and alternative formulations which aimed to draw some lights upon the selectivity of migration. Chiswick (2000) for example, disputed the hypotheses of the model proposed by Borjas and presents a different framework which predicts opposite conclusions: namely, the tendency toward positive self-selection of migrants.

The two models diverge upon the treatment of migration costs: first, while Borjas considers only one type of cost, which is a constant proportion of foregone earnings, Chiswick introduces also direct, out-of-pocket costs, which do not depend on home income, such as transportation costs or general expenses to process the migration requirements. Second, Chiswick allows ability to reduce the costs of migration: in fact, he assumes that high skill individuals are more efficient in using resources as they require less units of time to compute the same investment; alternatively he assumes that the skills improve the efficiency in utilizing out-of-pocket expenditures. On the contrary, in the model of Borjas there is no role for ability to improve the efficiency in migration. The introduction of these hypotheses turns the conclusion of Borjas into the opposite direction.

In agreement with the human capital framework, a rational agent chooses to migrate "if the rate of return to the investment in migration is greater than or equal to the interest costs of funds for the investment in human capital" (Chiswick, 2000, p.3). The rate of return can be expressed as the difference in earnings between destination and home countries over migration costs:

$$r = \frac{w_F - w_H}{C_f + C_d} \qquad [3]$$

where $w_F$ and $w_H$ denotes the earnings in the destination and in the origin respectively. The costs can be decomposed into foregone earnings, $C_f$ and direct out-of-pocket costs, $C_d$. The model assumes that the wage differential for low (U) and high (S) ability workers is constant between home and destination.

$w_{iS} = (1+k)w_{iU}$ *i=Home, Foreign*; k>0 [4]

The comparison between the rate of return to the investment for the high ability persons ($r_S$) and for the low ability persons ($r_U$) determines the direction of the migration selection.

In contrast with Borjas, the model predicts a positive self-selection, and this is obtained introducing direct out of pocket costs. In fact, assuming the existence of fixed costs, which do not vary with ability ($C_{dS} = C_{dU}$) and allowing the foregone earnings of high ability workers to be a positive portion of foregone earnings of low ability workers ($C_{fS} = (1+k)C_{fU}$), it follows that $r_S > r_U$ [6]. Moreover, the higher the earning gap between low and high ability workers (1+ *k*), the greater the differentials between $r_S$ and $r_U$. High direct costs reduce the overall incentive to migrate but they increase the propensity for favourable selectivity of migration: in fact high ability workers can compensate for the high fixed costs with greater earnings compared to low skill workers and therefore, the move will be more profitable for the most skilled persons. On the contrary, on the basis of this model, if there were no fixed costs induced by emigration, there would not be any type of selection.

Second, the model predicts even higher tendency for positive selection, if it is allowed that ability reduces the emigration expenses. In fact, ability can enhance efficiency in investment in migration, reducing either the units of time lost for managing the process and therefore the foregone earnings, or the out-of-pocket costs; this makes the investment more profitable for high skill individuals. This situation can be expressed, for example, as the more able facing lower fixed costs of migration such that $C_{dS} = (1+\lambda)C_{dU}$ and $\lambda < 0$.

The rate of return for the most skilled workers turns: $r_S = \dfrac{w_{FU} - w_{HU}}{C_{fU} + \dfrac{1+\lambda}{1+k}C_{dU}}$; the greater the efficiency ($|\lambda| > 0$), the larger is $r_S$ relative to $r_U$.

The treatment of migration costs distinguishes the model proposed by Chiswick from the contribution of Borjas: the difference, however, appears to be crucial in the prediction of the direction of the selection. In fact, allowing ability to impact on costs and introducing the possibility of positive fixed out of pocket costs, migration returns for high ability workers will be greater than the returns for low ability workers, inducing a positive selection. On the contrary, if there are not out of pocket costs, if ability does not play any role in reducing the costs of migration, and if "the ratio of wages across regions is greater for the low ability, they would have a greater propensity to migrate" (Chiswick, 2000, p. 6). In fact, in agreement with Borjas, assuming that $C_d = 0$, that the relative wage differentials varies across nations and that

the only migration costs are a constant proportion of forgone earnings ($C_{fS} = tw_{HS}$ and $C_{fU} = tw_{HU}$, $t>0$), it turns that $r_S = \frac{w_{FS} - w_{HS}}{tw_{HS}}$ and $r_U = \frac{w_{FU} - w_{HU}}{tw_{HU}}$. With some arrangements it results that $r_U > r_S$ if $\frac{w_{FU}}{w_{HU}} > \frac{w_{FS}}{w_{HS}}$. This condition implies that the dispersion of wages for different skills is greater in the origin than in the destination country.

### *2.2.3 Additional Contributions*

The strand of theoretical literature, which follows, mainly supports the positive selection view. Additional hypotheses are introduced to the framework offered by Roy and applied by Borjas, which corroborate the prediction that migrants may be chosen from the upper tail of the home country's income distribution.

Brucker and Trubswetter (2004) provides an extended version of Roy's model, which, in line with the assumption of Chiswick, introduces a negative correlation between abilities and moving costs; in fact, it is reasonable to believe that the human capital characteristics that enhance the returns in the labour market do also ensure lower moving expenditure. Therefore, both the benefits and the costs of migration are not equally distributed across the population. The cost function is assumed to be normally distributed with mean $\tau$ and disturbance $\eta$.

$$C = \tau + \eta \qquad [5]$$

where $\eta \sim N(0, \sigma_\eta^2)$

Applying the different hypothesis upon individual costs, the migration index becomes:

$$I' \approx (\mu_f - \mu_h - \tau) + (\varepsilon_f - \varepsilon_h - \eta) \qquad [6]$$

The conditions predicting the direction of the selection should now encounter the existence of a new term $\eta$, which represents the unobservable affecting the migration costs. The author demonstrates that the direction of the self-selection is influenced by the correlation coefficient between labour market abilities and moving costs: in particular, the assumption that abilities decrease the migration costs ensures a higher probability of positive selection. Stated in another way, the fact that moving costs are influenced by individual ability strengthens the chance that emigrants are positively selected. Finally the author highlights the implication on the selectivity bias of some changes in economic factors: for example, Brucker concludes that higher income inequality in the origin compared to the destination region does not necessary introduce a negative self-selection, as the effect of an increase in inequality on the selectivity is ambiguous.

An alternative extension of the Roy's model focuses on migrant selection in terms of observable characteristic, such as education, rather than ability. For this purpose, Chiquiar and

Hanson (2005) introduce the effect of schooling on earnings, modifying the wage equation in [1] as:

$$ln(w_i) = \mu_i + \delta_i s \qquad i=Home, Foreign \qquad [7]$$

where *s* is the observable level of schooling and $\delta$ is the return to schooling for migrants in the two countries. He also assumes that $\delta_H > \delta_F$, to account for possible scarce supply of skills in the labour exporting country and that $\mu_H < \mu_F$ to emphasize that the mean wage is lower in the home country than in destination. Moreover, the assumption of constant migration costs is rejected, as better educated individuals likely face lower expenditure, as they are better able to manage the migration process or they incur in less stringent credit constraints[7]. Therefore, the time-equivalent migration cost, which represents the foregone earnings in the model of Borjas, is a negative function of the level of schooling:

$$ln(C_f) = \mu_c - \delta_c s \qquad [8]$$

and the migration index function becomes:

$$I'' \approx ln(w_F) - ln(w_H) - C_f = \mu_F - \mu_H + (\delta_F - \delta_H)s - e^{\mu_c - \delta_c s} \qquad [9]$$

It can be shown that the direction of the selection now jointly depends on the size of the migration costs and on the distribution of schooling in the labour sending country.

If the migration costs are small, a negative selection occurs: in fact, the existence of migration costs which decrease with the level of education does not provide a sufficient constraint to low-skill individuals and at the same time, high return to schooling in the home country prevents high skill workers from moving. On the contrary, if migration costs are large and if the schooling distribution is not too skewed in either of the tails, migrants, compared to non-migrants, will be individuals with intermediate schooling. In fact, the effect of high return to schooling in the home country on the one hand and the effect of high costs of migration for low level of schooling on the other, create a disincentive to move for both higher and lower educated individuals. However, if the schooling distribution in the home country is highly skilled to the right, with the average education level higher than a minimum threshold $s_L$, migrants will have lower mean education. Whereas, if the mass of the population is characterized by a low level of education and the average value of schooling is below a certain threshold $s_U$, with $s_L < s_U$, migrants will positive selected. The author states that the implications of the model do not differ if the analysis accounts for possible selectivity in terms of unobservable characteristics, such as ability.

To summarize, some lessons can be drawn throughout the theoretical models: first, sending country characteristics *vis-à-vis* host country conditions –earning gaps, different level of

inequality, asymmetric information- create uneven incentives for different levels of abilities or education, and therefore create the ground for a selectivity process. Second, costs do represent the key determinants of the direction of the selectivity, which is highly sensitive to both the size of the migration expenditure and to the hypotheses regarding the links between costs and ability. In particular, it can be stated that high fixed costs induce a positive self-selection, which is reinforced by the possibility that high skilled workers are more efficient than low skilled workers in reducing costs. On the contrary, high dispersion of earnings in the home country, provided the absence of fixed out of pocket costs, and imperfect information in the foreign labour market predict a negative self-selection among emigrants.

## 3. The empirics on Self-Selection

The process of self selection, as already mentioned, can occur along a number of different individual dimensions: among others, for example, migrants can be selected in terms of their ability or in terms of their educational level. It should be clear that while the education of individuals can be captured, through the number of years of schoolings or the qualification levels, the ability, motivation and ambition of individuals represent unobservable features, which cannot be measured. This point becomes critical whenever the self- selection in terms of un-observable characteristics has to be empirically analysed. It is usually assumed that skills and education coexist in the same individual and therefore skills are proxied by qualification. However, in the remaining part of the paper, a clear distinction will be made between the selectivity in terms of observable and un-observable elements.

### 3.1 The characteristics of migrants over time

The simplest way to analyse the selection of migrants in terms of observables characteristics, is to survey the level of education of movers. Carrington and Detragiache (1998) for example, compute selection rates from 61 developing countries to OECD countries in 1990 by educational attainment and they report that the majority of migrants own secondary and tertiary education, whereas the participation of individuals with primary education is quite limited. A similar analysis is conducted by Docquier and Marfouk (2005) for 190 countries, both developing and industrial, in 1990 and 2000, to OECD nations: differently, the assessment of the selection rate highlights the existence of a relevant share of primary educated movers, in both years: for example in 2000, 36 per cent of the total stock of migrants has only primary education, compared to 35 per cent with tertiary education. On the contrary, the selection rates, which compare the number of emigrants in different educational categories with the number of

remaining residents in the source country for the same educational group, emphasise the existence of a brain drain problem for labour exporting countries; in fact, these nations seem to lose a big fraction of their highly educated individuals: in 2000, for example, the average emigration rate among individuals with tertiary education is 5.4 per cent, whereas it is 1.8 per cent and 1.1 per cent for secondary and primary education respectively.

An equivalent method of investigation compares migrants' average qualification levels with the average educational performance of non-migrants in the source country. Hatton and Williamson (2004), for example, report the average years of education of movers and of stayers of the same home country: the figures show that migrants have a sensible higher qualification attainment than the average person remaining at home. The interesting result, however, is that the educational gap between the two groups varies significantly across countries and it is influenced by factors such as the geographical proximity of the home country with the destination nation. In fact the reported data shows that the gap between movers and stayers is much smaller for Mexicans, who migrate to US, and for east Europeans, Balkans and Turks, who move mainly to EU than for other nationalities, who do not have important destinations at close proximity. They show that Mexican movers have only 1.2 year of schooling more than co-nationals, and migrants from East Europe, Balkan states and Turkey have 4.8 more years, whereas among Africans the gap in years of schooling between the two groups is 10.8 and among Asians is 8.6.

Low migration costs, due to the proximity with host countries, might be responsible for the weaker positive selection of the first group of countries: in agreement with the theoretical predictions (Chiswick, 2000; Chiquiar and Hanson, 2005), low costs of migration induce a less favourable positive selectivity, whereas high expenditures determine a more positive selection. The African case, for example, can confirm that long distance to destinations, together with lower source country inequality and a stronger effect of poverty constraint induces a sharp positive self-selection.

An empirical analysis conducted by Mora and Taylor (2005) confirms the findings that Mexican migrants are not endowed with particularly high education: positive selection, in fact occurs only if schooling plays an important role in alleviating the costs and the risks of migration or if it has a greater positive impact on income at the migrant destination than at origin. In the case of Mexican migration, however, migration costs are low and therefore the scope for ability to reduce the costs and risk is limited. Moreover, the low demand for skilled Mexican labour in US, which depresses the return to skills of Mexican migrants, implies that schooling becomes more valued in Mexico than in US. Therefore, the finding of Mora and Taylor corroborates the Borjas' prediction of negative selection: the combination of a higher

skill premium in origin countries compared to destination, together with low fixed out of pocket costs, determines the direction of the selection.

The educational information can be analysed in a third direction, assessing the educational attribute of the secular flows of migration. Hatton and Williamson (2004) document the existing trend in migration after the 19th century and underline two distinct shifts from very positive toward negative selection which took place both after 1820 and after 1950. The authors, in fact, present how the labour market quality of migrants has decreased across time and how this shift impacted on the earning gap between old and new immigrants.

It should be noted that, according to Borjas (1992) the quality change of migrants can be attributed to two factors: a shift due to changes in the source country composition and a shift due to the specific changes in the educational level of migrants from the single country of origin. In the case of US immigration, for example, "the changing national origin mix explains over 90 percent of the decline in educational attainment and relative wages across successive waves between 1960 and 1980" (Borjas, 1994, p. 1685); in fact, throughout the time, the country composition included more low-wage, low-skilled and low-schooled regions and this variation from richer to poorer labour exporting countries is responsible for lowering the educational level of migrants.

The reported trend toward negative selection along the time, however, is not in contrast with the country level support to positive selection (Carrington and Detragiache, 1998; Docquier and Marfouk, 2005). In fact, the two events can play simultaneously: while on the one hand, the country mix composition is shifting toward the less developed source regions, inducing a negative country level selection, on the other hand, within the single source country, the most educated individuals find more profitable to migrate, generating a positive self-selection at individual level.

The theoretical predictions, therefore, are partially in agreement with the empirical evidence: in fact, those models, which introduced the effects of earnings and costs in a bilateral flow analysis, namely between one origin and one destination country, concluded in favour of positive self-selection within the same country of origin, and this finding is supported by the empirics. What the theoretical models did not capture, however, is the tendency toward a negative selection, as a consequence of a country mix change.

Moreover, it should be emphasized that immigration policies in destination countries play a critical role in influencing the direction of the selection: for example, while prior to 1965 immigration in US was restricted according to a national-origins quota system, the 1965 Amendment to the Immigration and National Act, made the allocation of entry visas less dependent upon immigrant skill and more on family reunification and this policy shift has likely

induced a less-skilled migration flow. Therefore, while the theoretical models emphasize the importance in the selection process of sending countries *vis-à-vis* host nation characteristics, the role of destination country specifics, such as migration policy, has been completely neglected in the formalizations, which, as a consequence, failed to predict the selectivity component due to the country mix.

There is a second factor, however, which has never been considered in the theoretical models, but which is likely to play an important role in the process of self-selection: the constraint introduced by poverty; in fact, poverty hampers low skill migration and therefore emphasizes a positive selectivity. This factor influences both the country mix selectivity and the selectivity within the single source nation: Hatton and Williamson (2004) for example, state that as the poverty constraint on immigration was released, because of transport revolution which lowered the travel costs, and because of industrial revolution, which increased the working class earnings, the positive selection decreased and the negative selection increased. On the contrary, analysing the skill premium for different types of British workers in 19$^{th}$ century, the authors emphasise that workers from low skilled occupations had the greatest incentives to migrate, but the poverty constraint limited their chance of emigration.

### 3.2 The assimilation of migrants in the host labour market

So far, the observable quality of migrants have been analysed with reference to the home country population. However, the direction of the selection can also be judged relative to the destination country population, providing information upon the assimilation of migrants. The empirical evidence suggests that movers compared to native born have lower than mean quality, and this disadvantage seems to worsen along the time. Borjas (1995) for example, reports that in 1970 the average years of schooling of newly arrived migrants was slightly lower than the mean educational attainment of US natives, whereas the gap diverged in more recent years: in fact, in 1990 the gap was three time as much as the figure in 1970, increasing from 0.4 year of disadvantage to 1.3 year. Although the level of education increased among migrants between the two periods, it did not grow at the same rate as it did for American citizens. It should be noted that the fact of being positively selected in the origin country does not ensure migrants to have higher educational level than the average individual in the host country.

The performance of migrants in the host labour market has been subject of a large number of empirical studies, which investigate whether foreign born assimilate with the native population. Successful performance of movers has been interpreted as a proof of a self-selection process. According to this strand of empirical literature, the assimilation capacity of migrants can be tested comparing the migrants' earnings after move with the average earning of the native

population. The initial wage gap between movers and natives does not imply any conclusion upon the direction of the selectivity: in fact, individuals newly arrived, lack knowledge of destination countries customs and language, lack information about job opportunities or lack firm-specific training and experience: therefore, they are likely to be disadvantaged compared to the host country workers. The crucial feature however, is weather earning crossovers between the two groups exist: if migrants have the same level of labour market ability and work motivation than native born, the earnings of the foreign born would potentially equal, but would not go above that of the native born, *ceteris paribus*. On the contrary if, other observable characteristics being equal, migrants show more innate ability than the native population, the wage of foreigners may overtake that of natives after a certain period.

Chiswick (1978) first estimates earning functions, which analyse the distinction between migrants' and natives' performance. The author studies the assimilation process of movers into the US market due to un-observable characteristics, and this analysis represents an indirect way to assess the relevance and the direction of the self-selection. It should be clear that the human capital of foreigners largely enhances their performance in the host country, thought it is not the exclusive determinant: in fact, ability, motivation, ambition and other non-measurable features have a critical role in boosting the degree of assimilation.

The empirical analysis adopts a human capital wage function, which controls for socioeconomic characteristics, such as years of schooling, region of residence or marital status; for labour market experience; for migration status and for years since migration. A cross section of individuals, which includes US immigrants and US native born, is estimated and the key finding is that at the time of arrival, immigrants earn less than the native born, whereas they show a faster wage growth than their counterpart: it results that the earning functions cross after approximately 13 years since migration. The suggested explanation for this outcome is that migrants possess greater ability and stronger motivation than natives, which more than compensate for the initial lack of knowledge and skills relevant for the US labour market: in order words, the result gives support to the hypothesis of positive self-selection.

This conclusion, however, has been challenged some years later by Borjas (1985), who criticized the methodology adopted. In fact, he states that the effect of possible quality changes within successive migrant cohorts has been erroneously interpreted as the effect of assimilation in a cross-section regression analysis. Borjas highlights that in the cross section framework, proposed by Chiswick and by other authors, there is an implicit assumption of fixed cohort quality: in order words, it is assumed that labour market characteristics of migrants arrived in the past can forecast the future earnings of recent migrants, and therefore, the possibility that recent movers might be inherently different from old immigrants is not taken into consideration.

However, if the quality of migrants' waves has experienced some secular trend, inducing some intrinsic differences in productivity across cohorts, the estimated coefficient of the "assimilation" variable[8] in a cross section would be biased, invalidating any conclusion upon the degree of assimilation of migrants. The direction of the distortion, moreover, depends on weather quality has decreased or increased over time.

As mentioned above, the hypothesis of a shift in migrants' quality has been documented in the empirical literature: in particular, it is widely recognized that the change in national origin mix has decreased the skill levels of US immigrants, providing support to the Borjas' critique. Therefore, the empirical analysis of Chiswick produced an overestimation of the true relationship between wage and years since migration as well as of the wage growth of a particular cohort. Borjas (1987), to account for these quality differentials within migrant cohorts, introduced in the regression a term capturing the calendar year of arrival in US: in this way, the dynamic of the particular cohort can be tracked across several cross sections of data. Three measures of quality are thus estimated: the first is the wage of the most recent cohort of immigrants relative to the wage of natives, which provides an idea of the earning disadvantage that the newly arrived migrants face before any assimilation process occurs; the second is the wage growth across 10 years of a specific cohort relative to native, which captures the degree of assimilation of migrants; the third is the wage differentials between the alternative cohorts, which indicates the extent of cohort quality change.

The key finding is that the assimilation rates of migrants differ substantially by country of origin: in fact, movers from some countries show a high degree of assimilation while immigrants from other country do not assimilate at all. To this feature corresponds alternative trends of cohort qualities by country of origin: in fact, in some cases the quality of successive cohorts increases, suggesting positive selection, while in other it decreases, and this may indicate that the quality of immigrants is influenced by source country specific characteristics: in particular, if the predictions of the Roy model were correct, it would be expected that at a higher (lower) level of source country inequality corresponds a negative (positive) self-selection of migrants.

To test this hypothesis the author analyses the relationship between entry wage differentials between migrants and natives from the origin countries, which represent a measure of immigrant quality, and the income inequality of the labour exporting nations, controlling for other country level characteristics. The country level income distribution is proxied by the ratio of the income of the top 10 percent of the households and the bottom 20 percent. The outcome of the analysis, however, is unable to supply an explicit conclusion: in fact, the income inequality exerts only a frail negative impact on migrants' quality and the coefficient is not

robust to alternative specifications: in three out of four specifications, in fact, the coefficient of the inequality variable is not statistically different from zero. Nevertheless, Borjas interprets the result as a support of the theory: he quotes that "immigrants from countries with more income inequality are of lower quality. This result is consistent with the theoretical implications of the Roy model." (Borjas, 1987; p. 546)

It should be noted that the author is aware of two possible shortcomings in the analysis; first, there is a specification problem: in fact, the true country specific feature which influences the self-selection in the Roy model is the relative dispersion of opportunities in the source market, which does not completely correspond to inequality. Therefore, the attempt to approximate this element with the income inequality can weaken the link between the theory and the empirical work (Borjas, 1987). Second, there is a selection problem: in fact, the analysis does not take into consideration the incidence of return migration, which, as far as it potentially develops as a non random process in the immigrant population, it can itself be a source of selection bias in the estimated relationship (Borjas, 1985).

Jasso and Rosenzweig (1990) and Chiswick (2000) raise another set of objections to the framework. The first authors emphasize that the origin country sample, which includes 41 nations only, can constitute a highly selective sample and therefore it may itself bring in the analysis an additional process of self-selection. Second, according to Chiswick, the test implemented by Borjas, does not truly assess the effect of income inequality on positive or negative selectivity, but it only verifies "whether inequality in income in the origin is associated with a greater or lesser degree of selectivity" (Chiswick, 2000, p.11); In fact, a negative relationship between country of origin inequality and entry wage gap does not preclude migrants to be positive selected: it may only suggest that higher income inequality in the source nation reduces the incentives to migrate for high quality individuals. Both a positive and a negative selection can be compatible with the estimated result.

### 3.3 Taking selectivity seriously

The previous debate seems to suggest that a clear tendency toward one single type of selectivity does not exist, but idiosyncratic features at a country level may play a determinant role in the selectivity process. However, it should be noted that the existence of selectivity imposes econometric problems when OLS are utilized: in fact, if the sample used for estimation is not random, conventional linear regression techniques return biased estimates of the population parameters. The consequences implied by the process of sample selection, however were not taken into consideration in the previous analysis.

### *3.3.1 Parametric Techniques*

The first time the term selectivity bias entered the economic literature was in 1974 when Heckman analysed the wage determination process within a context of female labour participation; in 1979 the author presented an analytical clarification of the concept of selection bias, resulting whenever non-random selected samples are used. The typical situation which gives rise to a selectivity bias is when the outcome variable is not observed for the entire sample, but only for part of it; this problem has been traditionally interpreted by the literature as a truncation problem although the key feature of the selectivity is not only the lack of observations but also the fact that the observations included in the sample are potentially non-random. The self-selection problem has been analysed in different context, after the seminal study of female earnings and labour supply (Heckman, 1974): some examples are union versus non-union employment, housing ownership versus renting, schooling decisions, training program participation, occupation choice or internal and international migration.

These are all switching regression models, with endogenous switching: the central feature is the fact that individuals make alternative choices belonging to one group or another and in this way they self-select themselves. The observed realization of the decision is therefore truncated as the outcome is observed only for one part of the sample. For example, the product of the female labour supply, the earning, is observed only if women choose to be in the labour force and it is not observed otherwise. If standard econometric techniques, such as Ordinary Least Squares, are used to estimate female earnings, inconsistent estimates of the parameters may be generated, because of the failure to take into consideration the existence of a switching decision behind, which selects the sample observations. The observed wages of women, in fact, do not provide a reliable estimate of what non-participating women would have earned had they worked, as the earning functions of the selected sample may not represent the population wage functions.

The study of Nakosteen and Zimmer (1980) represents the first example of endogenous switching model applied to inter-state migration in United States. The problem of truncated sample arises because the authors model an individual migration decision as a function of wages differentials between home and destination: the information on earnings at origin however, is not observed for migrants, whereas the information at destination is not observed for non migrants. Therefore the authors predict the non-available information, through the estimation of wage equations for movers and for non-movers. However, given that individuals sort themselves into movers and stayers, the earning estimations need to control for the selectivity process. The application of the two-step procedure, developed by Heckman (1979) enables the estimation of consistent wage functions and moreover it allows to draw some conclusions upon

the existence of a sample selection generated by the migration process. Therefore, this is the prime attempt to estimate empirically and consistently the existence of a self-selection, using origin country specific data.

The empirical equations of the model are: the selection rule, which is expressed in terms of the latent dependent variable $M_i^*$ and represent the migration function:

$$M_i^* = Z_i\gamma + u_i \qquad \text{i=1….,N} \qquad [10]$$

where *Z* is a set of personal characteristics, influencing the decision to migrate. If $M_i^* > 0$, the individual migrates.

The earning if individual moves is:

$$w_{mi} = X_{mi}\beta_m + \varepsilon_{mi} \qquad [11]$$

and the earning if individual stays is:

$$w_{si} = X_{si}\beta_s + \varepsilon_{si} \qquad [12]$$

where X is a set of personal characteristics. For identification issues, the matrix Z should contain factors which influence the migration decision, but do not impact on earnings. According to the sample rule, the migration income $w_{mi}$ is observed only if $M_i^*$<0; on the contrary if $M_i^*$<0, $w_{si}$ realizes. The model assumes that the error terms in the earning and migration equations follow a normal bivariate distribution, with zero means and correlation $\rho$.

Therefore, the truncated conditional mean earning of migrants is:

$$\text{E}(w_{mi}|w_{mi} \text{ is observed}) = \text{E}(w_{mi}|M_i^* > 0) \qquad [13]$$

$$= \text{E}(w_{mi}|u_i > -Z_i\gamma) \qquad [14]$$

$$= X_i\beta_m + \text{E}(\varepsilon_{mi}|u_i > -Z_i\gamma) \qquad [15]$$

$$= X_i\beta_m + \delta\lambda_{mi} \qquad [16]$$

where $\lambda_{mi} = \dfrac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}$

and $\delta = \rho\sigma_\varepsilon$

The authors estimate corrected earning functions for both migrants and non-migrants, which include the selectivity terms. Provided that the selection rule for non-migrants implies that $M_i^*$ in [10] is smaller than zero, the selectivity term for non-migrants turns:

$$\lambda_{si} = \frac{\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}$$

and the conditional mean earning of non-migrants becomes:

E ( $w_{si} | w_{si}$ is observed)= $X_i \beta_{si} + \varphi \lambda_{si}$ [17]

Given the form of the conditional mean, it follows that the marginal effect of the independent variables *X* on $w_i$ has two components: there is a direct effect of the variable *X* on $w_i$, which is captured by $\beta$ and there is an additional effect, which exists because some of the *X*s may influence the probability that $M_i$ is positive and therefore will enter $\lambda$ in [16]. The decision to migrate, in fact, depends on the net benefit of moving, which in turn depends on potential earnings at destination compared to origin. Therefore, individual characteristics that influence the migration choice do also affect the income received in either places. To correctly model a wage function within a context of migration, controlling for observable characteristics *X* is insufficient, as an additional feature is influencing the earnings, namely, the process governing whether an individual migrates. Therefore, the earning function needs to be adjusted for the selection term. Computationally speaking, the first stage of the double steps procedure estimates a probit migration function[9] and the fitted values are used to compute the selectivity term $\lambda$ in [16]. To generate support to the selectivity hypothesis, the selection correction terms have to enter the income equations significantly.

The outcome of the analysis of Nakosteen and Zimmer is that the estimated coefficient of the selection is non-significant in the migrant earning function, whereas it is significant in the non-migrant equation, providing support to the self-selection hypothesis at least with regards to the non-migrants. The authors interpret the result suggesting that "non-migrants in the population choose their status because they fail to perceive more favourable returns elsewhere" (Nakosteen and Zimmer, 1980; p. 847).

Evidence of significant self-selection in the empirical literature, however, is quite mixed: Robinson and Tomes (1982), in the context of inter-provincial migration in Canada, find support to self-selection in both the movers and stayers groups, whereas Hunt and Kau (1985) find that the selectivity is not statistically significant in a model of inter country migration in United States. In more recent analysis, Lee and Roseman (1999) study a probit model for the probability of being employed for white and black males in United States, and report that the selection term for white man is not statistically significant, while the coefficient for black male is positive and statistically significant, suggesting that black migrants are positively selected. Agesa (2001) finds a positive selection term for migrants, moving from rural to urban areas in Kenya and a non-statistical term for non-migrants workers in rural areas. Brucker and Trubswetter (2004) analysing East-West migration in Germany, report significant and negative selection term for stayers and no robust result for movers. On the contrary, Axelsson and

Westerlund (1998) find insignificant coefficient for both stayers and movers in Sweden; Chiquiar and Hanson (2005) find that selectivity has no impact on earnings for Mexican resident and Mexican immigrants to United States; finally Adams (2005), find no sign of selectivity in a context of internal and international migration in Guatemala.

The previous setup contains single choice selection criteria, implying that only two alternative options are offered to individuals. A generalization of this framework has been offered, allowing polychotomous choice models, where multiple options are presented to the individuals. For example many alternative locations can be offered to a worker, in place of a simple dichotomous choice between move and stay. The model of Falaris (1987) allows 17 categories, which represent the individual choices of location in Venezuela and one potential outcome in each category:

$$w_{si} = X_{si}\beta_s + \varepsilon_{si} \qquad \text{s=1…, D} \quad \text{i=1…., N} \qquad [18]$$

where $w_{si}$ defines the earnings if destination s is chosen and X is a set of personal characteristics. The number of wage functions is equal to the number of possible destinations. Given the polychotomous latent index function $M_{si}$*:

$$M^*_{si} = Z_{si}\gamma + u_{si} \qquad [19]$$

which depends on a set of personal characteristics (*Z*), $M_i$=*s* if the sth category is chosen:

$M_i$=*s* iff $M^*_{si} > \text{Max } M^*_{ji}$ j=1…N, j≠s

Defining $\vartheta_{si} = \text{Max}\,(M^*_{ji})- u_s$

$M_i$ =*s* iff $\vartheta_{si} < Z_{si}\gamma$

Therefore, the probability that the destination s is chosen can be expressed as:

$$\text{Prob}(M_i = s) = \text{Prob}(\vartheta_{si} < Z_{si}\gamma) = \frac{\exp(Z_{si}\gamma)}{\sum_j \exp(Z_{si}\gamma)} = \pi_{si} \qquad [20]$$

It follows that the conditional mean of wages becomes:

$$w_{si} = X_{si}\beta_s + \sigma_s\rho_s\left(\frac{-\phi(J(\pi_{si}))}{\pi_{si}}\right) \qquad [21]$$

where $J(\pi_{si}) = \Phi^{-1}(\pi_{si})$, denotes the inverse of the standard normal distribution and $\phi$ is the standard normal probability density function. According to the model of sample selection with polychotomous choices, the first step estimation consists in a conditional logit model, which allows the calculation of choice probabilities ($\pi_{si}$). These probabilities form the sample selection correction term (the second term on the right hand side of equation [21]), which is added in the earning functions in the second step OLS estimation. Falaris (1987) finds

significant selectivity effects in six out of seventeen earning equations and the sign suggests that migrants are positively selected.

A second type of generalization introduces multiple criteria for selectivity: the selectivity can derive from several sources and the switch follows from more than one decision function. Moreover, two cases can be distinguished: the joint decision model and the sequential decision model. The difference is that, given two selection equations for example, while in the joint decision model, the second selection function is defined over the full sample of observations, in the sequential decision model, the second selection function is defined only on a subset of observations, which depends on the outcome of the first selection. Tunali (1986) develops a double selection model, where the first selection rule allows the option to migrate or to stay, while the second rule introduces the chance of remigration. The sequential selection functions are:

$$M_i^* = Z_{1,i}\gamma + u_i \qquad [22]$$

which defines whether an individual migrate or not, and:

$$S_i^* = Z_{2,1}\xi + \upsilon_i \qquad [23]$$

which determines whether an individual re-migrate or not. $Z_1$ and $Z_2$ are a set of individual characteristics. The earning equations are:

$$w_i = X_i\beta + \varepsilon_i \qquad [24]$$

Given two dichotomous decision functions, $D_1$= 0 or 1 and $D_2$ = 0 or 1, and given the observability condition such that $D_2$ is observed only if $D_1$=1, the switching rule becomes:

$$w = \begin{cases} w_s & \text{If } D_1=0 \\ w_o & \text{If } D_1=1 \text{ and } D_2=0 \\ w_f & \text{If } D_1=1 \text{ and } D_2=1 \end{cases}$$

where $w_s$ is the income if the "stay" option is chosen, $w_0$ is the "one-time move" income and $w_f$ is the "frequent move" income. The earning functions for one time move and frequent move need to control for two selectivity terms and the parameters of these terms are obtained estimating a bivariate probit, which contains both the selection rules [22] and [23]. On the contrary, the wage function for stayers contains only one selection term, which follows from a univariate probit estimation. The outcome of the analysis of Tunali offers little support in favour of the selectivity hypothesis: in fact, estimating different specifications of the wage functions, the selectivity terms enter insignificantly in the many of the equations.

A similar methodology is followed in Barham and Boucher (1998), where the two sequential selection equations are a no-migration function and a labour participation function.

The authors estimate an earning function only for non-migrants, entering the labour force, because no observations are available if the individual chooses to migrate: the two selection coefficients, however, do not enter significantly.

### *3.3.2 Semi-parametric and Non-parametric techniques*

The Heckman standard approach relies on strong parametric assumption of the error terms: in fact, it imposes the joint normality of the error term in the earning equation and in the selection equation. However, one potential limitation of this technique is its sensitivity to the violation of the assumed parametric distribution: if the normality assumption fails, the estimates turn inconsistent. The costs imposed by the parametric estimation, therefore placed some effort in relaxing these strong distributional assumptions: semi-parametric and non-parametric methods have been proposed. Non-parametric models require minimal assumption regarding the process generating the data, whereas semi-parametric models "combines a parametric form for some component of the data generating process (usually the behavioural relation between the dependent variable and the explanatory variables) with weak non-parametric restrictions on the remainder of the model (usually the distribution of the unobservable errors)" (Powell, 1994, p. 2444).

In selection models, relaxing the joint normality assumption of the error terms in the wage and migration functions, the conditional mean earning for migrants in [13] becomes:

$$\mathrm{E}\,(w_{mi} \mid w_{mi} \text{ is observed}) = X_i\beta_m + \mathrm{E}\,(\varepsilon_{mi} \mid u_i > -Z_i\gamma) \qquad [25]$$

$$= X_i\beta_m + g(Z_i\gamma) \qquad [26]$$

where g(.) is an unknown function, representing the correction function, which needs to be estimated semi-parametrically or non-parametrically. Moreover, the parameters $\gamma$, which enter the correction function are unknown and need to be estimated using a semi-parametric binary model.

In the context of US inter-state migration, Dahl (2002) develops a semi-parametric selection model: in particular he estimates a polychotomous choice model to control for selectivity bias in individual earning equations. The author extends the Roy's occupational choice model, allowing individuals to select the place to live and work among different states: the objective of the analysis is to test for selectivity bias in the returns to schooling and to compute unbiased returns.

The sample selection correction in his framework takes the form of an unknown function of a small number of selection probabilities[10]: the selection probabilities are estimated semi-parametrically in the first step, and the correction functions are added in the second step estimation. The first result is that education increases the average migration probability: therefore, highly educated individuals are more mobile than lower educated workers. Secondly,

the returns to schooling in the corrected equation are almost uniformly lower than the returns in the uncorrected function: this suggests that the self-selection of high educated workers, who choose the destinations that offer a better match for their skills and talents, induces an upward bias in the education coefficients which are estimated with ordinary techniques. Third, the selection correction functions enter the earning equations significantly for almost all the states. The author concludes that "college migration choices might be more responsive to unobserved earnings because highly educated individuals are more likely to move for a fixed moving cost or because variation in the unobserved earnings across states is greater for individuals with a college degree" (Dahl, pp. 2400-04).

Zaiceva (2005) applies the methodology in Newey and Vella (2003) to control for sample selectivity in East-West German migration: the approach consists in a non-parametric version of the usual sample selection model. The first step estimates non-parametrically the conditional probability of emigrating, while in the second step the correction function is approximated with polynomial series. The result suggests no support to self-selection among either the stayers or the movers. The author applies a similar methodology to analyse the effect of geographical mobility on the income of commuters, and differently, sign of self selection is found: in fact, commuters seem to be positively selected. Finally, the standard Heckman parametric model is used prior testing the respect of the normality assumption: the model provides quite similar results, corroborating the finding that movers are not self-selected.

## 4. Conclusions

The phenomenon of the brain drain has raised a series of concerns, as far as social and economic detrimental costs might become the major result of the process of international migration, from the view point of labour exporting countries. Nevertheless, despite the sensitivity of this topic, there is not a clear conclusion upon the existence of a process of selection among the migrants and in particular upon the direction of the selection. Is truly migration a selective process, inducing the brightest to move? The empirical investigation is hindered by a lack of comprehensive international data: in fact, not only the figures on international migration are limited, but also they do not offer detailed information on the observable characteristics of migrants. Moreover, the process of self-selection can occur along unobservable characteristics that, by their nature, cannot be captured. Reviewing both the theoretical and the empirical studies, the objective of this paper is to draw some light upon the factors which are likely to induce a skilled rather than an un-skilled migration as well as upon

the existence of a process of self-selection in migration and its direction, both in terms of observable and un-observable characteristics.

The contribution of the theoretical literature is the finding that sending country characteristics *vis-à-vis* host country conditions –earning gaps, different level of inequality, asymmetric information- create uneven incentives for different levels of abilities or education, and therefore create the ground for a selectivity process. Second, migration costs do play a major role in determining the direction of the selectivity: in fact, it has been found that the direction of the selection crucially depends on the size of the fixed migration costs, and it is also influenced by the possibility that ability dampens part of this expenditure. To summarize, negative selectivity likely arises on the one hand if destination countries face imperfect information in the process of screening the foreign labour force and on the other hand if the investment in migration does not imply high fixed costs, provided that the origin country has higher inequality than destination. On the contrary, if the information asymmetry is placed in the origin country, or if the fixed costs of migration are sizeable or if ability and schooling contribute to either dampen the costs or to increase earnings, then positive selection likely occurs. Finally it should be noted that host country migration policies as well as demand side considerations, such as the type of migrants' skill requested in the foreign labour market, influence the direction of the selection.

The empirical evidence corroborates the importance of costs as determinants of the selectivity, to the extent that the brain drain is found to have a geographical connotation. In fact, the educational gap between migrants and non-migrants proved to vary significantly across countries with different proximity with the destination nation: the lower the distance, which implies smaller fixed costs, the lower the degree of positive selection.

The assessment of the educational endowment of the existing stock of migrants suggests that the direction of the selectivity does vary considerably across countries: in fact, while for some labour exporting nations the emigrant flow is mainly characterized by highly educated individuals, it also true that for another big set of countries, the emigration flow is predominantly made by low skilled individuals: not only migrate the brightest and most educated, but also people with primary education or less. However, for some countries the loss of tertiary educated individuals can be quite considerably, if compared with the total number of remaining residents for the same educational group.

The final consideration analyses the direction of the selectivity in terms of unobservable characteristics, such as motivation, ability or ambition: the empirical finding is again quite mixed, in the sense that the results seem to vary from country to country. However, the overall outcome is that movers are either positively selected or not selected at all: in fact, there are not

cases of negative selectivity in terms of unobservable features. It should be noted, however, that some of the empirical studies reviewed might be subject to inconsistency problems, because of the impropriety of the econometric technique applied.

## References

Adams R.H. (2005) "Remittances, Poverty and Investment in Guatemala" in Ozden C. and M. Schiff *International Migration, Remittances and the Brain Drain*, World Bank and Palgrave Mcmillan

Agesa R.U. (2001) "Migration and the Urban to Rural Earnings Difference: a Sample Selection Approach" *Economic Development and Cultural Change*, vol. 49, pp. 847-875

Ahn H. and J.L Powell (1993) "Semiparametric Estimation of Censored Selection Models with a Nonparametric Selection Mechanism" *Journal of Econometrics*, vol. 58, pp. 3-29

Axelsson R. and O. Westerlund (1998) "*A Panel Study o Migration and Household Real Income" Journal of Population Economics*, vol. 11, pp. 113-126

Barham B. and S. Boucher (1998) "Migration, Remittances and Inequality: Estimating the Net Effects of Migration on Income Distribution" *Journal of Development Economics*, 55(2), pp.307-331

Bhagwati J. and K. Hamada (1974) 2The Brain Drain, International Integration of Markets for Professionals and Unemployment. A Theoretical Analysis" *Journal of Development Economics*, vol. 1, pp. 19-42

Borjas (1985) "Assimilation, changes in Cohort Quality and the Earnings of Immigrants" *Journal of Labour Economics*, vol. 3(4), pp. 463-489

Borjas, G.J. (1987) "Self-Selection and the Earnings of Immigrants" *American Economic Review,* vol. 77(4) pp. 531-553

Borjas, G.J (1992) "National Origin and the Skills of Immigrants in the Postwar period" in Borjas G.J. and R.B. Freeman, *Immigration and the Work Force: Economics Consequences for the United States and Source Areas*. Chicago: University of Chicago Press

Borjas, G.J (1994) "The Economics of Immigration" *Journal of Economic Literature*, vol. 32(4) pp. 1667-1717

Borjas (1995) "The Economic Benefits from Immigration" *Journal of Economic Perspective*, vol.9(2), pp. 3-22.

Brucker H. and P. Trubswetter (2004) "Do the Best Go West? An Analysis of the Self-Selection of Employed East-West Migrants in Germany" *IZA Discussion Paper n. 986*. IZA Bonn

Carliner G. (1980) "Wages, Earnings and Hours of First, Second and Third Generation American Males" *Economic Inquire*, vol.18(1) pp. 87-102

Carrington W.J. and E. Detragiache (1998) "How Big is the Brain Drain?" *IMF Working Paper n.98/102*, International Monetary Fund, Washington

Chiquiar, D. and G. Hanson (2005) "International Migration, Self-Selection and the Distribution of Wages: Evidence from Mexico and United States" *Journal of Political Economy*, vol. 113(2), pp.239-281

Chiswick, B. R. (1978) "The effect of Americanization on the Earnings off Foreign-born Men" *Journal of Political Economy,* vol. 86(5) pp. 897-921

Chiswick, B. R (2000) "Are Immigrants Positively Self-Selected? An Economic Analysis" *IZA Discussion Paper n. 131.* IZA Bonn

Dahl G.B. (2002) "Mobility and Return to Education: Testing a Roy Model with Multiple Markets" *Econometrica*, vol. 70(6) pp. 2367-2420

Docquier F. and Marfouk A. (2005) "International Migration by Educational Attainment (1990-2000)- Release 1.1. Data Set

Falaris E.M. (1987) "A Nested Logit Migration Model with Selectivity" *International Economic Review*, vol. 28(2) pp.429-443

Grubel H. and A. Scott (1966) "The International Flow of Human Capital" *American Economic Review,* vol. 56, pp. 268-274

Hatton T.J. and J.G. Williamson (2004) "International Migration in the Long Run: Positive Selection, Negative Selection and Policy" *IZA Discussion Paper n.1304*, IZA Bonn

Heckman J. (1974) "Shadow Prices, Market Wages and Labour Supply" *Econometrica,* vol. 42(4), pp. 679-694

Heckman J. (1979) "Sample Selection Bias as a specification Error" *Econometrica*, vol. 47(1), pp. 153-162

Hunt J.C. and J.B. Kau (1985) "Migration and Wage Growth: A Human Capital Approach" *Southern Economic Journal*, vol.51, pp. 697-710

Jasso G. and M.R. Rosenzweig (1990) "Self-Selection and the Earnings of Immigrants: Comment" *American Economic Review*, vol. 80(1), pp.298-304

Katz E. and O. Stark (1984) "Migration and Asymmetric Information: Comment" *American Economic Review,* vol. 74(3), pp 533-534

Katz E. and O. Stark (1987) "International Migration Under Asymmetric Information" *Economic Journal*, vol. 97(387), pp.718-726

Kwok V. and H. Leland (1982) "An Economic Model of the Brain Drain" *American Economic Review*, vol. 72(1), pp 91-100.

Lee L. (1982) "Some Approaches to the Correction of the Selectivity Bias" *Review of Economic Studies*, vol.49 (3), pp. 355-372

Lee L. (1983) Generalized Econometric Models with Selectivity" *Econometrica*, vol. 51(2), pp. 507-512

Lee S. and C.C. Roseman (1999)"Migration Determinants and Employment Consequences of White and Black Families" *Economic Geography*, vol. 75(2), pp. 109-133

Maddala G.S. (1983) *Limited Dependent and Qualitative Variables in Econometrics*. Cambridge, UK, Cambridge University Press

Mora J. and J. E.Taylor (2005) "Determinants of Migration, Destination and Sector Choice: Disentangling Individual, Household and Community Effects" in Ozden C. and M. Schiff *International Migration, Remittances and the Brain Drain*, World Bank and Palgrave Mcmillan

Nakosteen, R.A. and M.Zimmer (1980) "Migration and Income: the Question of Self Selection" *Southern Economic Journal,* vol. 46 pp. 840-851

Newey W.K. and F. Vella (2003) "Nonparameric Estimation of Sample Selection Models" *Review of Economic Studies*, vol. 70, pp. 33-58

Powell J.L. (1994) "Estimation of Semiparametric Models" in R.E. Engle and D.L. McFadden, *Handbook of Econometrics*, Amsterdam, Elsevier Science

Robison C. and N. Tomes (1982) "Self-Selection and Interprovincial Migration in Canada" *Canadian Journal of Economics*, vol. 15, pp. 475-502

Roy A.D. (1951) "Some Thoughts on the Distribution of Earnings" *Oxford Economic Papers*, vol. 3(2) pp. 135-146.

Sjaastad L.A. (1962) "The Costs and Returns of Human Migration" *The Journal of Political Economy*, vol. 70(5) pp. 80-93

Tunali I. (1986) ""A General Structure for Models of Double-Selection and an Application to a Joint Migration/Earnings Process with Re-migration" in R. Ehrenberg, *Research in Labor Economics*, Volume 8, Part B, Greenwich, JAI Press

Vella F. (1998) "Estimating Models with Sample Selection Bias: A Survey" *Journal of Human Resources,* vol.33(1), pp. 127-169

Zaiceva A. (2005) "Self-Selection and the Returns to Geographic Mobility: What can be learned from German Unification" Mimeo, European University Institute

# Notes

[1] The authors do not try to analyse the first emigration choice, which is occurring when individuals leave their countries for advanced studies, but they analyse only the second one, when individuals decide the place to work, whether home or abroad.

[2] The scenario analysed by Kwok and Leland, which gives rise to a positive selection, is characterised by asymmetric information in the emigrants' home country and by a small wage differential between home and destination markets.

[3] Dahl (2002) presents a list of authors who develop the Roy model of self selection applied to alternative settings: for example in female labour force participation; union versus non union employment decision; college attendance decision; occupation or industry choices; training program participation and internal migration.

[4] A second condition which needs to be satisfied in both cases is that $\rho = \frac{\sigma_{FH}}{\sigma_F \sigma_H}$ is positive and sufficiently large. This condition requires that the employers in different countries value the same individual attributes in a consistent way.

[5] Borjas, however, clarifies that in the original Roy model the type of dispersion which determines the outcome refers to opportunities dispersion, given socioeconomic characteristics, rather than income dispersion. In fact, the analytical condition that determines the direction of the selectivity depends, as stated, on $\sigma_F / \sigma_H$.

[6] In fact, $r_S = \frac{w_{FU} - w_{HU}}{C_{fU} + \frac{C_d}{1+k}}$ and $r_U = \frac{w_{FU} - w_{HU}}{C_{fU} + C_d}$

[7] Provided high and positive correlation between income and level of education, migrants with low level of schooling are likely to face higher borrowing costs, because of higher expected probability of default.

[8] According to the function specified by Chiswick the assimilation process is captured by the variable years since migration.

[9] Given the latent Index function: $M_i^* = Z_i\gamma + u_i$, if $M_i^* > 0$, $M_i$=1, and if $M_i^* < 0$, $M_i$=0. The estimated probit function is: Prob($M_i$=1)= $\Phi(Z_i\gamma)$.

[10] The author extends the framework developed in Ahn and Powell (1993) to allow for multiple-index model, in place of a single index-model.