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MIGRATION AND REGIONAL DISPARITIES: THE ROLE OF SKILL BIASED FLOWS

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n. 5 March 2004

Edito e stampato in proprio da:
Università Commerciale Luigi Bocconi – CERTeT, Piazza Sraffa, 13, 20136 Milano, Italia
Anno: 2004

Migration and Regional Disparities: the Role of Skill Biased Flows*

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March 2004

JEL Codes: J24, J61, R23, R58.
Keywords: Regional Disparities, Skills Selective Migration Flows.

*An earlier version of this paper was presented at the XXIV Conference of the Italian Regional Science Association at Perugia. Comments from the participants are gratefully acknowledged, as those from participants to seminars held in Padua and Milan.

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Abstract

The persistence of disparities is one of the most striking features of regional development. We argue that movements of labour force, instead of being an always equilibrating mechanism, can also make persistent or even reinforce such inequalities. The most advanced regions are in fact generally more attractive, in terms of opportunities, especially to more qualified workers, who, in turn, are an essential ingredient of regional development and competitiveness because of the human capital they bear.

We set up a two-regional framework, with a continuum of different skill-type individuals. Each agent's utility function depends on the wage she earns through her skills, leaving the process of human capital formation out of this paper. Within this framework, we identify and model two complementary mechanisms for skill biased migration flows to take place.

The first one resides in the way wages are set. If, in fact, the most skilled workers are not paid their productivity because of wage compression, they will have an incentive to move towards regions with a more dispersed wage scheme. The second mechanism dwells in the existence of some regional specific immobile assets, which make workers differently productive in different regions; this happens to a larger extent for those endowed with highest skills, which will therefore be more likely to overcome the mobility costs.

Hence a Kaldor-type cumulative process bearing persistent regional disparities is set up.

1 Introduction

Policy makers have started to pay increasing attention to the importance of human capital as a primary source of economic development given some consolidated theoretical insights (Lucas, 1988, Romer, 1986). At a regional level, the role of human capital stock as a pre-condition for regional growth and competitiveness has been emphasised in many studies (Camagni, 1995, Malecki, 1999, De la Fuente and Ciccone, 2002). Besides, the prospective EU eastward enlargement, the ongoing European integration process and their consequences in terms of factor mobility, rise the question of regional disparities and their determinants, in particular the interplay between national convergence and regional inequalities (Boldrin and Canova, 2001, Martin, 1998). Under a normative point of view, policy makers have stressed the importance of education and training policies. At the same time, an important driver of regional integration has being identified in factor mobility, in particular labour. Attention is here paid to the skill composition of migration flows, which can lead to regional redistribution of human capital. In order to understand this process, three crucial questions should be addressed:

1. what are the effects of educational attainment[1] on the likelihood of migrating?

2. How is the geographical distribution of human capital affected by these skill biased migration flows?

3. How does this disparity affects economic performances and in particular the persistence of regional inequalities?

Within a classical paradigm, it is a general finding that alignments in wage differentials can be achieved through inter-regional migration acting as an

[1]In the reminder of this paper, for the sake of simplicity, we decide not to distinguish among education, training and other forms of human capital formation, and in particular no metric for skills is explicitly provided. Though a crucial point in understanding the returns to scholarly lies in their effectiveness in terms of abilities, in this paper wages are generally proportional to skills which in turn are either acquired through education or constitute an endogenous individual feature. The education process is not explicitly taken into account, since this is not the focus of this paper.

adjustment mechanism and can thus be conceived as a policy tool for counterbalancing regional disparities (Blanchard et al., 1992). We hereby controvert this issue and ask whether migration flows play a role in the persistence of regional disparities. How can the capital endowment affect the potential attractiveness of regions? Although net migration from poorer to richer region can be expected to help towards the narrowing of regional disparities (Bentivogli and Pagano, 1999), the evidence is that the role of migration in adjusting labour markets is very sluggish.

Moreover, labour flows bear movers' human capital, so that the regional capital endowment can be affected by labour flows (Ritsila and Ovaskainen, 2001). This capital inflows increase production in the receiving region, showing an upward shift in production (Dolado et al., 1994). Labour flows may be seen as the way regions respond to wage differentials. Different implications are possible: migration flows can be either an adjustment mechanism towards equilibrium (see figure 1) or a boost for positive cumulative effects in the receiving region (see figure 2); the net effect will depend on the skill content embedded in outward labour flows and different implications are shown in the reminder of this paper. The way regional fixed endowment can affect regional welfare is analysed in section 4, where the interplay between skills and capital is the main driver for regional disparities to persist.

2 The Importance of Human Capital

In the 20th century, a new paradigm of production raised, characterised by a sharp shift from the relevance of physical elements to the relational dimension of the structure and the dynamics of the economic system (Castells, 2000). Those relational aspects here discussed constitute important ingredients of regional development (CERTeT-Bocconi, 2002). It is currently recognised that disparity in productivity and growth has far less to do with the abundance of natural resources and more and more with the ability to improve the quality of human capital and factors of production, to create new knowledge and ideas and incorporate them in equipments and people (David and Foray, 2002); these features define the 'knowledge society'. This perspective stresses the fact that the most valuable assets are intangible investments (human and social capital) and that knowledge and creativity are key factor.

The rise of the Knowledge Economy lies in the observation that 'knowledge', 'skills' or 'information' based activities are playing an increasingly significant role in economic growth. Capital, labour, and natural resources are essential ingredients for firms, but, lately, economists have come to recognise the role of technology, as well as information, innovation, and creativity, in expanding economic potential. Human capital is widely acknowledged as one of the main economic growth engines; besides, large differences exist within/between countries in terms of both quantity and quality of educational structure and institutions (Wossmann, 2002)[2]. That has resulted in a relevant number of people flowing within countries and between countries (and within and between regions) in order to get a better qualification. More analysis should be devoted to identifying a way of detecting such a process with special reference to its effect in terms of the 'brain drain' and 'skimming' process which may foster further existing regional disparities through a positive feed-back circuit which originates a virtual circle in the 'richest' region (better educational institution - attraction of the most talented workers - higher growth - larger investment in education - better educational institution) at the expense of the 'poorest' regions (Wood and Ridao-Cano, 2002). A related though distinct issue concerns the existence of different regional structures, reflecting in interregional wage differentials. This difference can be seen as a boost for labour migration. McCann (2001) suggests the following frameworks to explain how workers can respond to such regional wage differentials:

Equilibrium Model The term 'equilibrium' refers to the Walrasian equilibrium. Thus the implications rely on the hypotheses of agents rationality, information completeness and price-taking behaviour. This model is somehow naïf, since unemployment is not observed because it occurs out of equilibrium; nevertheless important hints to understand adjustment forces towards equilibrium are provided.

Disequilibrium Model The disequilibrium model of inter-regional labour migration aims at providing some explanation about unemployment, without giving up to a notion of 'equilibrium', though not a Walrasian

[2]Which are the main, but not the only drivers for human capital formation and accumulation.

one. The main implication is that the clearing market condition will not hold anymore, even if all markets but one are cleared.

Endogenous Human Capital Model The endogenous human capital model of migration considers that movers bear with them 'human capital' and then hosts' capital endowments are affected. In particular, if for some reasons movers are relatively more skilled, the host region will expand its production by a net increase in capital, so widening — instead of reducing[3] — the interregional gap. This framework offers useful insights about forces that can counterbalance adjustment mechanisms and set cumulative effects.

In the present paper, the arguments supporting the micromotives for workers to move in response to regional wage differentials, are based on the first and the third explanation: a skill bias of migration flows (endogenous human capital model) can account for a cumulative growth process; the argument behind the equilibrium model, instead, prevents cumulative effects to prevail over adjustment mechanisms. In practice, both forces work and the relative size of skills borne in movers determine the net effect on host and sending regions.

Suppose that a two regions (West and East) setting holds and that for some reason the *West* is experiencing higher wages. The disequilibrium borne in the wage differential $w_w - w_e$ (see fig. 1) will increase the probability for workers to move to the *West*. On the basis of the considerations hereby outlined, West-ward migration flows are more likely to concern high skilled labour force, which is more sensitive to wage differentials and can more easily overcome moving costs. As a result, the labour supply will expand in the *West* and shrink in the *East*; besides, the marginal productivity of labour and hence the Western wage rate will fall[4].

In-migration flows should imply an increase in the capital stock in the host country and hence a shift in its production function. Such an explanation can by provided by the endogenous human capital model. It is hence relevant, for the purposes hereby pursued, to focus on the skill bias migration flows

[3] In the reminder of the paper the mechanism will be shown in detail.

[4] The *East* will be experiencing a symmetric phenomenon until the equilibrium will be reached at $w_e^* = w_w^*$.

forecasted within such model.
If the following hypotheses hold:

- individuals maximise their expected wage according to the human capital they are bearing (Becker, 1975);
- individuals adopt a search strategy and are willing to accept a job only when the match with labour demand allows them to earn their reservation wage (Tedeschi, 1992).

Then, the reservation wages tending to increase for individuals with higher human capital and the job search period being likely to be longer for high-skill workers, under a spatial perspective this will result in highly skilled workers being characterised by a higher propensity to move (Ritsila and Ovaskainen, 2001). Their returns to human capital will so be maximised. Higher propensity to move for higher human capital individuals will make more complex the conclusions of the equilibrium model, where it acts as a pure adjustment mechanism, trigging a cumulative process in the host region, mainly by a capital increase in its production function.
If outward flows are highly skill biased, the cumulative effects are more likely to prevail. Now, one reason for migration flows to be skill biased lies in the existence of wage differentials, due to external economies working in the most advanced region, which make productivity higher. Later, this will be related to heterogeneities in regional production structures (see section 4).

3 Skill Biased Migration Flows

The core of the paper presents a model with two features focusing on two complementary explanations for the selectivity of migration flows: first we will show that wage dispersion/concentration has different effects on the migration choices of differently endowed individuals; then we will illustrate how the existence of some region specific and unevenly distributed factors can be one additional cause of skill selective migration flows.

We have argued that wage differentials are an important driver for the attraction of high skilled workers. In fact, if high skilled workers cannot receive as much as their productivity, then they might decide to afford some mobility costs and move to other regions where their salary is higher. Why

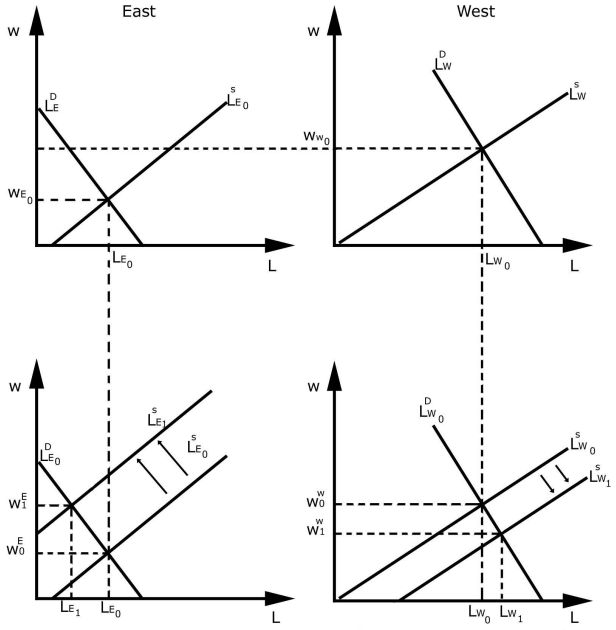

Figure 1: Labour migration: the equilibrium model.

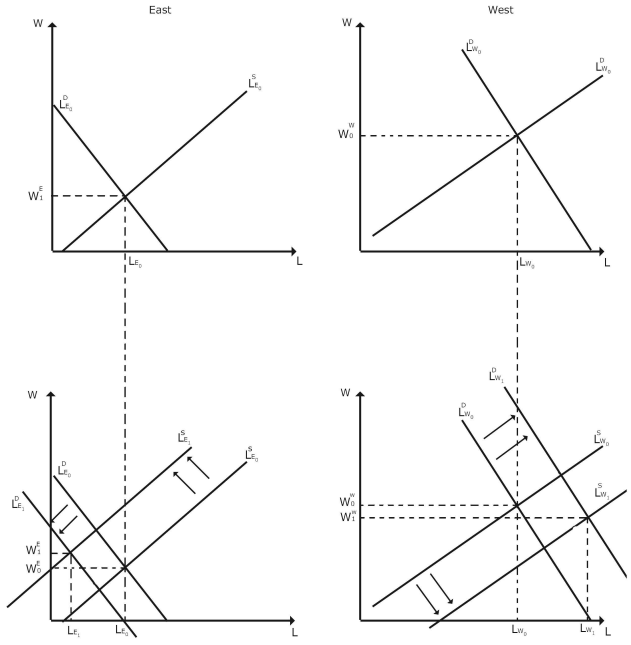

Figure 2: Labour migration: the human capital model.

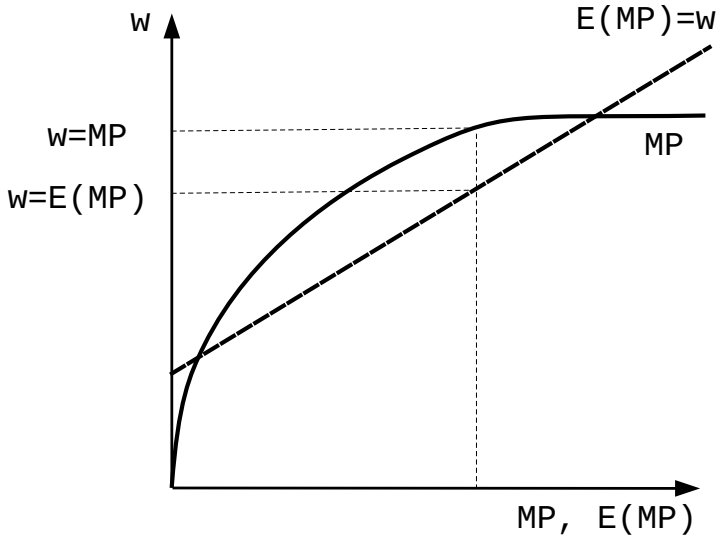

Figure 3: Wage function: expected versus real productivity.

should workers receive less or more than their productivity? The basic answer hinges in the information asymmetries between firms and workers, such that firms set wages (w) equal to workers expected productivity ($E(MP)$). Under regularity conditions, the concavity of the wage function ensures that the wage equation is as depicted in fig. 3. In this situation, under perfect information, firms would pay according to the concave curve. In reality, firms can assess workers' productivity on average, whereas it is hardly done on each individuals' productivity. Then, firms set a simplified wage scheme, such that workers are paid proportionally to their productivity and such that wages equal (on average) the marginal productivity, but individual marginal productivities can differ from individual wages. This is represented through the straight line in the same figure.

Hence, if the worker exactly knows her productivity and the firm is only able to assign her to a productivity range, each worker is paid the average productivity of the group she is assigned to.

As a basic case of skill biased migration flows, compare a region (West) with a pure market economy, in which each worker receives her productivity as a wage, to a region (East) in which the salary will be the same for all workers and equal to the average regional productivity. Regions are assumed

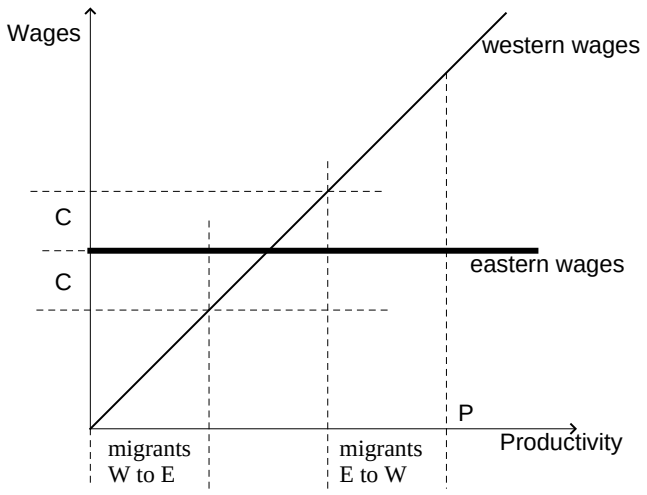

Figure 4: Regional migration flows: pure market wages and flat wages.

to be identical in any other feature, in particular we are not assuming that the total payroll is different across regions, nor that regions are differently capital or labour endowed. In particular, assume that the skill distribution function of workers is the same in both regions, and, for simplicity, that individual skills s_j are uniformly distributed in the interval [0,P].

The wage for workers in the West will be equal to their productivity, i.e. $w^w(s_j) = \pi(s_j)$; workers in the other region (East) will instead get their average productivity $w^e(s_j) = E(\pi(s_j))$. If this is the case, any worker with productivity higher than the average, will have an incentive to move from the East to the West, whereas those with productivity less than the average will have an incentive to move from the West to the East. If some fixed sunk mobility costs C are taken into account (see fig. 4), not all the workers will get a net benefit if they decide to move, but only those who are able to overcome mobility costs, i.e. those for which $w^w(s_j) - w^e(s_j) = \pi(s_j) - E(\pi_{s_j}) > C$ will move from the East to the West and those for which $w^e(s_j) - w^w(s_j) = E(\pi_{s_j}) - \pi(s_j) > C$ will move from the East to the West. Thus, human capital tend to increase in the West at detriment of the East.

With more complex wage settings, for example because there exist wage layers in each region (but different across regions), composite results may rise. Let us now turn to the case in which one region (the East) decides to have

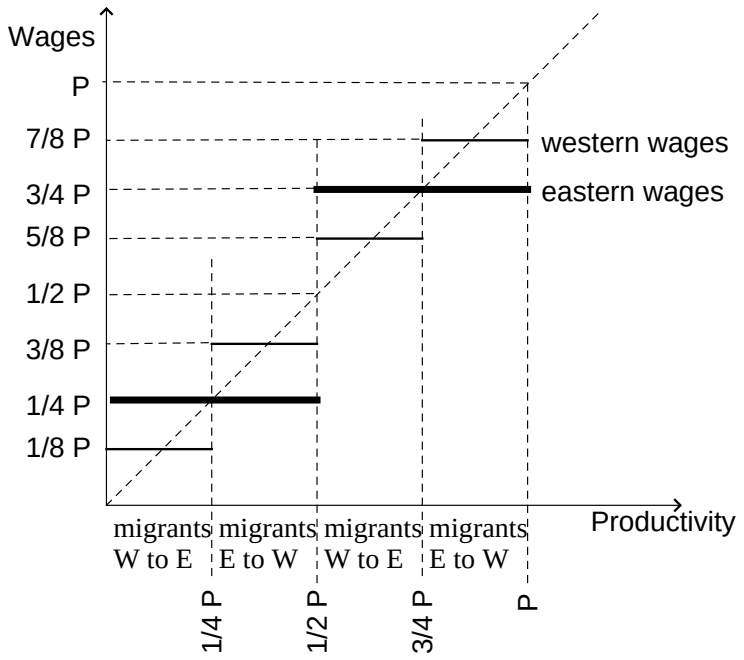

Figure 5: Regional migration flows: two wage levels in the East versus four in the West.

just two possible wage layers, one for the high productivity workers and one for the low ones, giving workers a salary proportional to the group average; assume that the other region (the West) decides for a more dispersed wage setting, so that four possible wage layers exist, with a similar mechanism. Without loss of generality, we assume that in both regions the distribution of skills across workers is uniformly distributed in the interval from 0 to P (where P represents the productivity of the most productive worker): the salary in the East will be equal to $P/4$ for the workers whose productivity is below $P/2$ and up to $3/4P$ for those workers whose productivity is larger than $P/2$; in the West the salary will be:

- $w_L^w = P/8$ for the workers with $\pi(s_j) \leq P/4$
- $w_{LM}^w = 3/8P$ for the workers with $P/4 < \pi(s_j) \leq P/2$
- $w_{MH}^w = 5/8P$ for the workers with $P/2 < \pi(s_j) \leq 3P/4$
- $w_H^w = 7/8P$ for the workers with $\pi(s_j) > 3P/4$

In this case (Fig. 5) workers in the West with $0 \leq \pi(s_j) < P/4$ or $1/2 \leq \pi(s_j) < 3P/4$, will have an incentive to move to the East; at the same time workers in the East with $P/4 \leq \pi(s_j) < P/2$ or $3P/4 \leq \pi(s_j) < P$ will have a benefit if they decide to move to the West. These results show that, even if not all the westwards migrants are more productive than the eastwards migrants, this is true on average, and that the most skilled workers still have an incentive to move to the region whose structure of salaries is more dispersed. This result also holds if sunk mobility costs are introduced, provided that this cost is below the ceiling of $P/8$; above this level, in fact, given the wage structure supposed, the cost of mobility is so high that nobody can get a net benefit from moving.

The magnitude and structure of mobility costs, however, can affect these results. We can show this with another example: assume that the East has now three equally spaced wage layers instead of two and that the wage structure of the West remains identical as in the previous example (Fig. 6). The wage structure of the East is therefore now as this:

- $w_L^e = P/6$ for workers with $\pi(s_j) < P/3$
- $w_M^e = P/2$ for workers with $P/3 \leq \pi(s_j) < 2P/3$

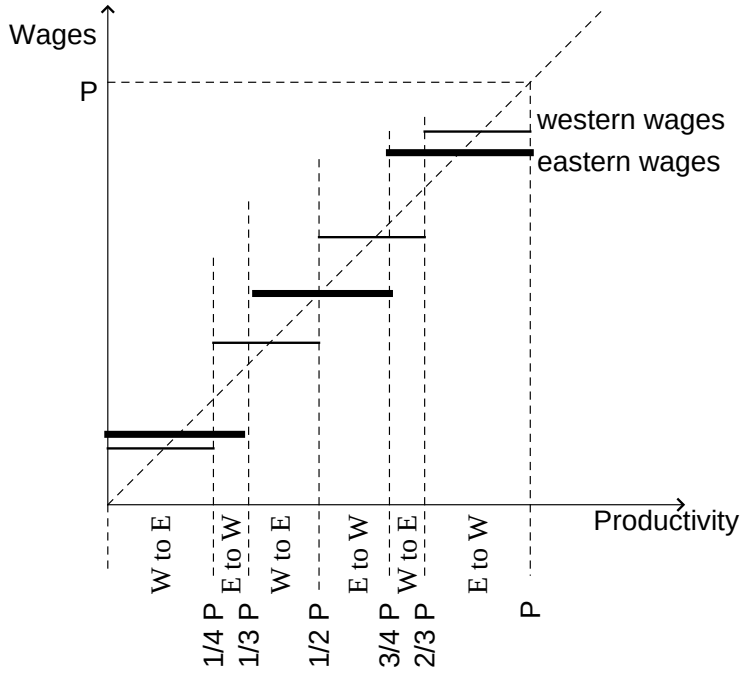

Figure 6: Regional migration flows: three wage levels (East) versus four (West).

- $w_H^e = 5P/6$ for workers with $\pi(s_j) \geq 2P/3$

In this case, without migration costs, there are three intervals of productivity $[P/4; P/3);[P/2; 2P/3);[3/4P; 1]$ in which workers in the East decide to move to the West and three intervals $[0; P/4);[P/3; P/2);[2P/3; 3P/4)$ for which workers in the West decide to move to the East, with brain gain for the West as a result. However, these results are sensitive to the mobility costs and to the way mobility costs are modelled; for instance, for migration costs above $P/24$, there will no longer be brain drain (the most productive workers will not move) and, for $C > P/8$ the migrants from the region with more dispersed wages (West) will be, on average, more skilled than the migrants from the region with more concentrated wages (East), a result which partially contradicts the one obtained with no mobility costs. For very high mobility costs (above $P/3$) migration will not take place any more.

Nevertheless, apart these special cases, the framework here outlined is consistent with a quite general finding that highly skilled workers are more likely to move (Coppel et al., 2001, Davis and Weinstein, 2002, Guellec and Cervantes, 2001, Salt, 1997, Shields and Shields, 1989, Maurel and Sedillot, 1999). Moreover, in the majority of the cases, labour mobility benefits the region with a more dispersed wage scheme because high skilled workers can get as much as possible (the maximum being their marginal productivity).

4 Regional Endowment Attractiveness

In the previous section, we focused on the capability of workers to get a part of their own marginal productivity as a wage. We now turn to explain skill biased migration flows in the case each worker receives her own productivity. In particular, differences in labour productivity are now due to regional specific immobile assets, stemming an incentive to move which is increasing in workers' skills.

The recent literature has focused on the relation between personal/regional characteristics and migratory behaviour (for example Borjas (1994)); the general inference concerns the selectivity of migration processes under personal, regional and industrial characteristics (Beine et al., 2003). There exists a number of economic, social and psychological factors that contribute to or

prevent the decision to move. Personal and family traits, as well as the characteristics of the origin and destination regions, shape the outcome of individual decisions to migrate or stay (Venturini, 2001). Ultimately, positive migration decisions at the individual level aggregate into considerable population flows and significant changes in the regional stock of human capital (Barro and Sala-i-Martin, 1992). From the standpoint of regional human capital reallocation, the effect of educational attainment (as a proxy of skills) on migratory behaviour is of special interest. A common result is that a higher level of education increases individual's migration likelihood (Molho, 1987). We hereby stress the role that skills play; at the same time, we decided to take aside all personal motivations that can affect a decision to move.

Suppose the same two region ($i = 1, 2$) setting discussed above hold. Both regions share the same technology, with the following Cobb-Douglas production function:

$$Y_i = {S_i}^{\alpha} {K_i}^{1-\alpha} \tag{1}$$

where Y_i is the total production for region i, K_i is the regional endowment of immobile factors, α is the technological parameter and:

$$S_i = \sum_{j=1}^{n_i} s_j \tag{2}$$

where s_j defines the individual skills for any worker j. We assume that the production of a region is a function of the total skills (S_i) borne in the workers of region (n_i).

The definition of regional endowment is here broad and encompasses all immobile production factors coming from technological, financial and institutional constraints: this can include physical infrastructure, past investments in physical capital, patents, regional institutional traits, regional best practices and established routines. Only for the sake of simplicity, in the rest of the paper the regional fixed endowment will be sometimes referred to as 'capital'.

Both regions are assumed to experience a perfectly competitive framework in which workers are paid their marginal productivity for each skill unit held. For this reason, since $\frac{\partial Y_i}{\partial S_i} = \alpha(\frac{K_i}{S_i})^{1-\alpha}$, the individual wage for worker j, endowed with s_j skill units in region i will be (see figure 7):

$$w_{ji} = s_j \alpha (\frac{K_i}{S_i})^{1-\alpha} \tag{3}$$

Skills being territorially equally distributed, the relative wage of two workers endowed with the same skills but working in different regions is:

$$\frac{w_{jw}}{w_{je}} = \frac{(\frac{K_w}{S_w})^{1-\alpha}}{(\frac{K_e}{S_e})^{1-\alpha}} \tag{4}$$

Hence, for any individual skill endowment, the inter-regional wage ratio depends on the interregional capital to skills ratio. As a consequence, the monetary net benefits (B) for a worker deciding to move from one region to the other is proportional to her skills and again dependent on the capital to skills ratio of the two regions[5]:

$$B = w_{jw} - w_{je} = s_j\alpha[(\frac{K_w}{S_w})^{1-\alpha} - (\frac{K_e}{S_e})^{1-\alpha}] \ . \tag{5}$$

Graph 7 depicts wages as a function of skills in both regions, before workers actually move. In particular, it is evident that the same individual j endowed with s skills, receives $w_{jw}(s_j)$ if she stays in the West and $w_{je}(s_j)$ if she stays in the East. After migration flows have taken place, wages as a function of skills will be equalised across regions somewhere between the two lines. The adjustment mechanism at the basis of this equalisation process will be tackled in detail in section 5. Within this framework, we can allow for spatial skills depreciation. In fact, not all individual skills are transferrable, due to regional differences[6]. Nevertheless, it is worthwhile to notice that this point is empirically less important for high-skill workers, whose capabilities can be more easily transferred (Borjas, 1994). In particular, if only a fixed fraction $(1-t)$ of individual skills are transferrable with worker j, net monetary benefits will reduce from eq. 5 to:

$$B = w_{jw} - w_{je} = s_j\alpha[(1-t)(\frac{K_w}{S_w})^{1-\alpha} - (\frac{K_e}{S_e})^{1-\alpha}] \tag{6}$$

The more similar the regions, the lower the share of non transferrable skills, i.e. the lower t. As a consequence, the loss from moving will be negatively (positively) related to interregional contiguities (dissimilarities)[7].

[5]Notice that eq. 4 (West to East wage ratio) already represents the monetary net benefits from moving, with logarithm terms.

[6]There are usually environment/milieux differences, local production systems require to some extent region specific skills and, in case of international migration, cultural and language differences.

[7]We hereby mean territorial proximity not simply in terms of spatial closeness but beyond, we take into account social and economic ties hindering the perfect factor mobility.

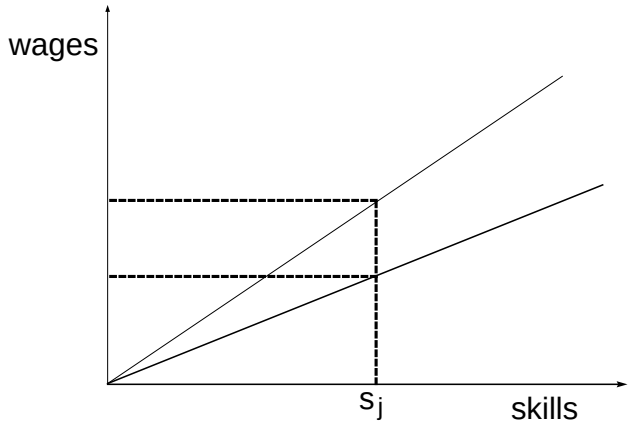

Figure 7: Individual skills and their returns in case of movement.

Assume now that any mover bears a cost. In particular, for the whole population, this cost will be distributed as a function Φ with average μ and variance σ^2. We also assume that this cost is independent on the region and on skills, so that for any s_j, the distribution of the mobility cost of any subsample of individuals endowed with s_j is the same if the parameters are not different. It is reasonable to think that μ is positive, since on average individuals are likely to incur in a positive cost when moving, but it is not necessary to assume this cost to be lower bounded (for example at 0), since the cost is also due to personal characteristics, so that there may exist individuals for which the personal benefit of moving exceeds costs even when wage increases are not taken into account, for example for personal ties and other amenities which are otherwise neglected. Consistently with the three models defined in section 2, individuals move if $B > C$ with $C \sim \Phi(\mu, \sigma^2)$, and this allows to draw a function which, for any value of the skills s_j (assume $s_j \geq 0$) gives the correspondent share of people willing to move. We define this function M, since it represents the propensity to move as a function of individual skills.

Let us work out the case in which $\frac{K_w}{S_w} > \frac{K_e}{S_e}$. In the special case of no individual costs variance (i.e. $\sigma^2 = 0$ and Φ collapses to a constant value), the function M for individuals living in the East will be stepwise (fig. 8) and $C = \mu$, $B > C$ are both verified for only individuals living in the East with skills $s_j > s^*$; these individuals wish to move from the East to the

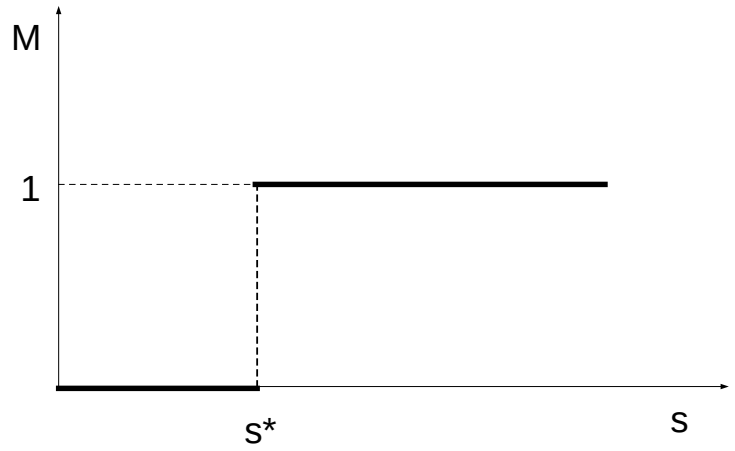

Figure 8: M function with homogeneous mobility preferences.

West. For people living in the east, the condition of indifference in the case of homogeneous preferences gives us s^*, which can be calculated from eq. 6 as:

$$s^* = \frac{\mu}{\alpha[(1-t)(\frac{K_w}{S_w})^{1-\alpha} - (\frac{K_e}{S_e})^{1-\alpha}]} \ . \tag{7}$$

Notice that S_w and S_e being the sum of individual skills within each region, s^* is actually endogenous. If the migration flows are conceptually thought as a stepwise process this problem is ruled out. Suppose that first, workers decide whether they would move or not, but they cannot do it at this early stage. Second, only one of them can actually do it. This movement is enough to change the incentive system to move and workers assess their new indifference condition (again expressed in equation 7). For every worker moving, all the others evaluate their incentive to move. This mechanism continues until the incentive to move vanishes for everybody. In the end, only a proportion of people initially willing to move will actually do it, and this share is enough to bring inter-regional equilibrium.

When we allow for individual heterogeneity, the function M for individuals living in the East will be a curve with shape similar to a logistic, as the one in fig. 9, upper bounded at $M = 1$ (the maximum share of population that can move). The higher μ, the lower the intercept A; the higher σ^2, the smoother the increase of the function M; the higher t, the lower the curve

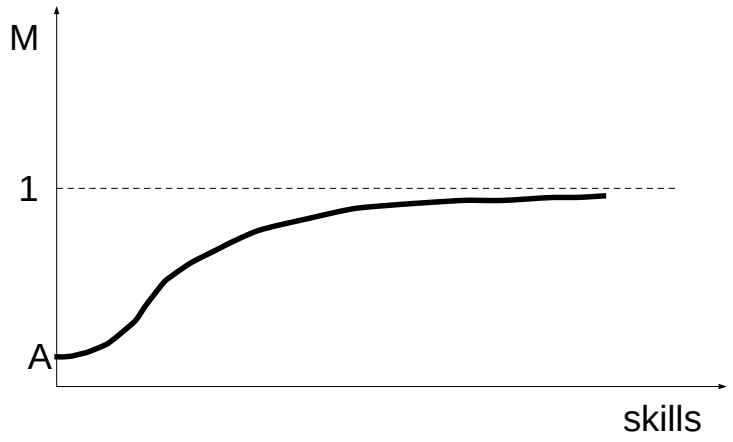

Figure 9: M function with heterogeneous mobility preferences.

(but notice that in this case the height of point A is not affected). When the ratio $\frac{K_w}{S_w}$ is equal to $\frac{K_e}{S_e}$, for example after that a migration flow of sufficient width has taken place, and it has worked as an adjustment, the function M becomes flat; this occurs because the benefit B will be nil for everyone and, therefore, only the fraction of people with negative moving costs will be willing to move.

5 Adjustment to the Equilibrium

As in section 3, the adjustment to the equilibrium can reinforce regional differences of per capita income, though wages are equalised for workers with the same skill content (the ratio expressed in eq. 4 tends to 1).
In order to show that, let us define n_w and n_e the populations living in the two regions ($i = E, W$). Before the adjustment has taken place, the regional income per capita is: $\frac{Y_i}{n_i} = \frac{{S_i}^{\alpha}{K_i}^{1-\alpha}}{n_i}$. If the workers of the two regions are initially identically endowed of human capital, then $\frac{S_w}{n_w} = \frac{S_e}{n_e}$ and, as a consequence, the ratio between the two incomes per capita will depend on the amount of capital per person possessed in the two regions:

$$\frac{Y_w/n_w}{Y_e/n_e} = \left(\frac{K_w/n_w}{K_e/n_e}\right)^{1-\alpha} \tag{8}$$

Once we introduce the movement of people, the equilibrium with skill selective migration flows will tend to equalise the ratios $\frac{K_w}{S_w{}^*}$ and $\frac{K_e}{S_e{}^*}$ (rather than the capital to labour ratio); when the two ratios are equal, in fact, any single unit of skills in the two regions will be paid the same, therefore neutralising the monetary incentive to move for all workers. Notice, however, that these two ratios become identical only when skills depreciation (t) is 0.

Due to the mechanics described above, in particular the structure of the M function, the more skilled a worker, the higher the incentive to move from the poorer to the richer region. For this reason, the skills needed for the adjustment of the capital to skills ratio, will be embedded in relatively few migrants, whose skills will be higher than the average population, that is $\overline{s_m} > \frac{S_w}{n_w} = \frac{S_e}{n_e}$. If, again, the West is the region more endowed with capital, this flow of skilled people will move mainly from the East to the West, and only a smaller group (with average productivity below $\frac{S_w}{n_w}$) will move to the East. At the end of the process not only $n_w{}^* > n_w$, $n_e{}^* < n_e$ but, since movers are more skilled, $S_w{}^* >> S_e{}^*$, and $\frac{S_w{}^*}{n_w{}^*} > \frac{S_e{}^*}{n_e{}^*}$, that is the average capability of workers in the West will be higher than in the East.

Assume for simplicity that no skill depreciation will take place ($t = 0$), and remember that K represents an immobile factor. In equilibrium the ratio between the total incomes of the two regions becomes:

$$\frac{Y_w{}^*}{Y_e{}^*} = \frac{(S_w{}^*)^\alpha K_w{}^{1-\alpha}}{(S_e{}^*)^\alpha K_e{}^{1-\alpha}} > \frac{Y_w}{Y_e} \tag{9}$$

We call this result *agglomeration*, since the total output is now more concentrated than before in the richer region.

Let us now analyse the effects that labour mobility brings on income per capita. The ratio of per capita incomes, after the adjustment has taken place becomes:

$$\frac{Y_w{}^*/n_w{}^*}{Y_e{}^*/n_e{}^*} = \frac{(S_w{}^*)^\alpha K_w{}^{1-\alpha}}{(S_e{}^*)^\alpha K_e{}^{1-\alpha}} \frac{n_e{}^*}{n_w{}^*} \tag{10}$$

Recalling that in equilibrium $\frac{K_w{}^*}{S_w{}^*} = \frac{K_e{}^*}{S_e{}^*}$, the ratio of eq. 10 can be decomposed and simplified, as follows:

$$\frac{Y_w{}^*/n_w{}^*}{Y_e{}^*/n_e{}^*} = \frac{\frac{(S_w{}^*)^\alpha}{(n_w{}^*)^\alpha} \frac{K_w^{1-\alpha}}{(n_w{}^*)^{1-\alpha}} \frac{(S_w{}^*)^{1-\alpha}}{(S_w{}^*)^{1-\alpha}}}{\frac{(S_e{}^*)^\alpha}{(n_e{}^*)^\alpha} \frac{K_e^{1-\alpha}}{(n_e{}^*)^{1-\alpha}} \frac{(S_e{}^*)^{1-\alpha}}{(S_e{}^*)^{1-\alpha}}} = \frac{S_w{}^*/n_w{}^*}{S_e{}^*/n_e{}^*} \tag{11}$$

We observe that, allowing for migration, income disparities can fade out, but can also increase. The latter happens if (comparing equations 9 and 11):

$$\frac{{S_w}^*/{n_w}^*}{{S_e}^*/{n_e}^*} > \left(\frac{K_w/n_w}{K_e/n_e}\right)^{1-\alpha} \tag{12}$$

Thus, the adjustment process induced by labour migration can be decomposed in two counteracting effects:

Push force The migration of people and skills towards the region more endowed of capital. This equalises the productivity of each skill unit and, consequently, the wage earned by workers endowed with the same amount of skills. This force narrows income disparities (increase in n_w, decrease in n_e).

Pull force The existence of selective migration flows, with the consequent increase of the average skills of workers living in the already richer region. This force widens income disparities (increase in S_w, decrease in S_e).

Migration flows increase income disparities when the second effect overcomes the first one. This happens when eq. 12 is verified. The condition becomes clearer if worked out algebraically and using $\frac{K_w}{S_w^*} = \frac{K_e}{S_e^*}$:

$$\left(\frac{K_w/n_w}{K_e/n_e}\right)^{\alpha} > \frac{{n_w}^*/n_w}{{n_e}^*/n_e} \tag{13}$$

This means that differences in income per capita increase if the relative increase of population is lower than the initial capital per capita ratio; in this case, the migration of workers is highly biased towards the upper skill segment, and the right hand side of eq. 13 is closer to 1 than the left hand side. This result implies that not only the economy is more agglomerated after the migration adjustment, but also that there are wider differences in income. It could be argued that these differences are not completely unfair, since they partly reflect a different skill endowment of the workers, but an important criticism to leave this happen resides in the concentration of most skilled people along with the most efficient means of production in one place at detriment of the other region.

		Total income (Agglomeration)	
		Narrowing disparities	Widening disparities
Income per capita (Regional Disparities)	Narrowing disparities	Equilibrium models (Barro et al., 2003; Blanchard and Katz, 1992) and Brain Gain	Most NEG models with labour mobility (Core-Periphery; Puga, 1999)
	Widening disparities		Skill biased migration flows as a trigger for cumulative processes

Figure 10: Localisation and labour mobility: typology of models.

The mobility of workers, in presence of strong skill biased migration flows, gives very different results from those previewed by traditional models and also from those of most new economic geography models. These insights are summarised in table 10. If in a classical framework (Blanchard et al., 1992), decreasing the mobility costs for workers makes regions more similar in terms of both income and per capita income, in a number of more recent models of the New Economic Geography, the mobility of workers, although increasing agglomeration, still decreases differences of per capita income.

The basic core-periphery model (Krugman, 1991, Fujita et al., 1999), is an example: workers of the manufacturing sector move in response to wage differentials and, in this way, equalise their wages across regions and, at the same time, foster agglomeration; a "migration equation" is often designed to study the dynamic equilibrium properties of the model and workers move in response to real wage differences. We have to notice, however, that in this model there is a different production factor which, in the Krugman (1991) version, is called "peasants"; this factor produces agricultural goods and is completely immobile across regions. Although these peasants also consume goods (and are in this way negatively affected by agglomeration in the other

region), we believe (differently from Commander et al. (2003)), that this is not enough to classify this model as a model with brain drain. The fact that (1) peasants are by hypothesis not allowed to move; (2) they produce a different good (without any sectorial mobility of workers) and (3) that they produce goods with constant returns to scale, makes them behave more similarly to a factor that can be called just "land".

More recently, Puga (1999) explicitly explored the role of labour mobility in agglomeration; in his model, agglomeration is possible both with and without migration, depending on the transport parameters. In particular, his paper finds that, if migration is possible, income disparities fade out, but agglomeration is the outcome when transport costs are low enough; if, on the contrary, migration is not allowed, regional income disparities persist but, then, agglomeration is an equilibrium only for intermediate transport costs, since for lower transport costs firms become increasingly sensitive to wage differentials and this makes them spread again.

A different result comes from the Footloose Entrepreneur model (Baldwin et al., 2003, Forslid and Ottaviano, 2002), but it is built with workers' heterogeneity as an hypothesis; in this model there exist two types of workers, of which only the entrepreneurs are allowed to move in response to wage differentials. The consequence is the possibility of agglomeration, of which only the workers in the agglomerated region, and all the entrepreneurs, take advantage. The footloose entrepreneur model is more similar than the Core-Periphery to a model with brain drain; however, workers are by assumption heterogeneous, and ordinary workers are not allowed to move. Moreover, also labour is by definition a heterogenous factor, since only entrepreneurs can provide the fixed cost in the production function of the firms.

This paper, differently from the previous ones, does not assume any heterogeneity of labour (any worker can be substituted by another, or more if needed), nor it assumes that by definition some workers are immobile. On the contrary, without using any of the above hypotheses, we are able to show that:

- The incentive to move is higher for workers with higher skills.
- This leads to skill biased migration flows.
- If particularly skill biased, migration flows can reinforce regional income disparities, instead of being an adjustment mechanism.

6 Integrating the two mechanisms

The two mechanisms defined in sections 3 and 4 are complementary, rather than alternative, and can be easily integrated to see their joint effects. The outcome is that more complex behaviours can be observed, but still skill biased migration flows result.

As a first and easier example, the case in which two regions are differently endowed of fixed and immobile factors and implement the same wage structure (for instance four wage layers), with the same initial skill distribution among workers and the same individual and skill-independent variability of mobility costs. In this case (Fig. 11) the M-function is stepwise increasing for the workers who live in the lagging region, and stepwise decreasing for those living in the advantaged region; if mobility between regions is allowed, the migration flows from the lagging to the already advantaged region will therefore be biased towards the higher skilled. At the same time, another migration flow, much smaller in size and biased towards the lower skilled will go in the opposite direction. This second migration flow is due to the hypothesis that personal mobility costs are not lower bounded and can also be negative (section 4). In this sense the M-function represents the propensity to move as a function of skills.

If the two regions have a different wage structure, more complex results arise. For instance, if the advantaged region has a more compressed wage scheme, it is possible that the incentive to move is maximum not for the highest skilled but for other high skilled workers. The M-function, however, remains generally increasing in the level of skills for those living in the disadvantaged region. Fig. 12 plots the case in which the West (advantaged region) has 3 wage layers and the East has 4 of them. If it is possible for workers to move, there will be a flow of workers with higher than average personal skills towards the West. There will also be a migration flow in the opposite direction, much smaller in size and with average personal skill endowment lower than the average.

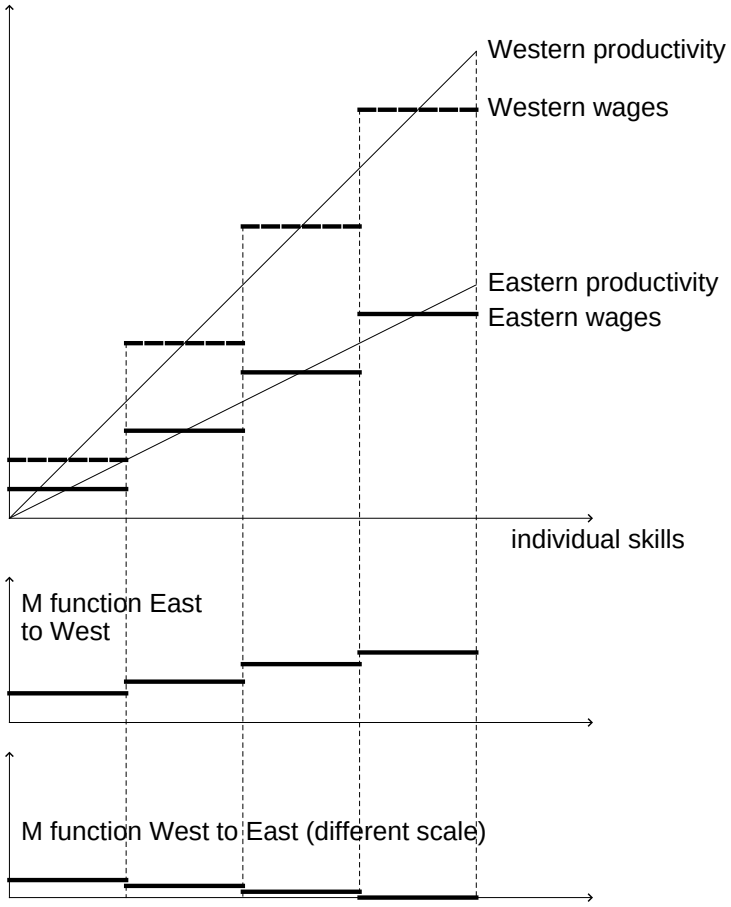

Figure 11: Integrating the two mechanism: regions with the same wage structure.

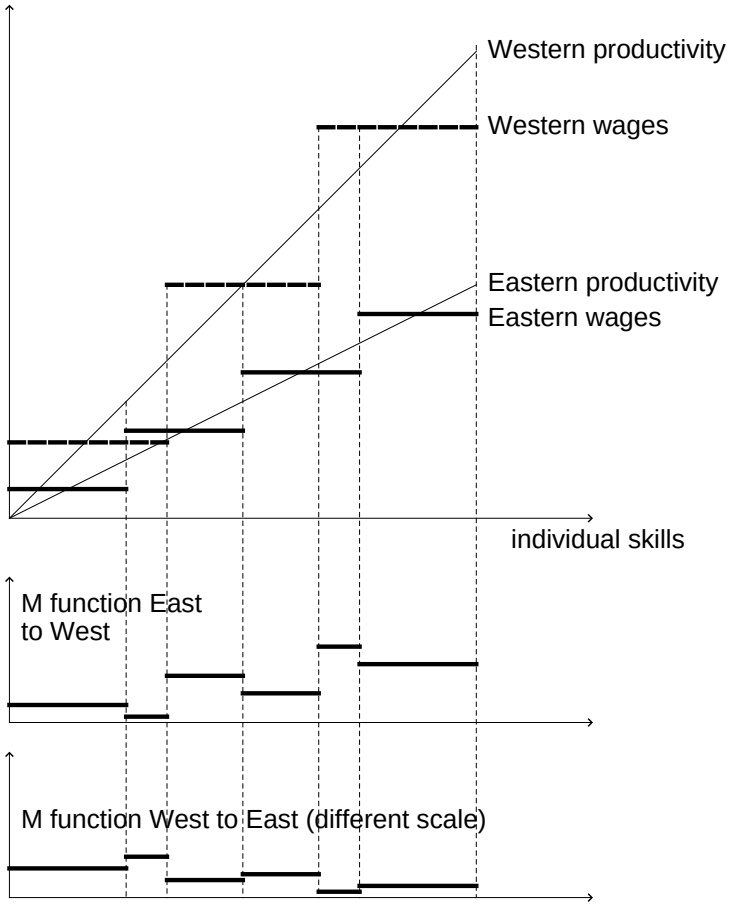

Figure 12: Integrating the two mechanism: regions with different wage structure.

7 Conclusions

The traditional argument according to which migration is an adjustment mechanism of regional income per capita disparities is here controverted. Two features are described to explain why migration flows can be skill biased. In both, assuming skills as a part of human capital, migration flows affect regional capital endowment. In the first case, migration flows stem from interregional wage differences, due to different wage settings mechanisms in the two regions; high skilled workers are so pushed to move and get higher wages. The receiving region being the favoured one, regional disparities widen instead of narrowing as a classical framework predicts. In the second case, even if workers receive their marginal productivity, regional disparities persist if region specific and unevenly distributed assets exist. In this case, the high skilled workers will be more likely to overcome mobility costs and therefore those that move towards the more endowed region. As a result, the demand for skills of the richer region, is compensated by few highly productive workers instead of many whose productivity is low or just average. The richer region (the West) will drain from the other region the skills needed to exploit the potential of its region specific assets. This allows the richer region's production to further expand at detriment of the poorer. In addition to this, the skills borne in workers that move from one region to the other will be incorporated in relatively few migrants but bearing on average higher productivity than the average of the source region.

The richer region will so end with a workforce which is relatively scarce in number (relatively to the fixed factors) but endowed with an average higher productivity. The mobility of workers, therefore, instead of decreasing regional per capita income disparities, widens them. These two settings are then unified, but the findings are substantially confirmed.

Policy makers should take this argument into account in implementing cohesion policies: in particular, non distortionary compensation mechanisms for weaker regions should be thought, or actions to counteract naturally working trends should be undertaken. In particular, training policies can reveal ineffective when they are not integrated with appropriate structural intervention affecting the complementarities of skills with other physical production features.

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The paper is the result of joint intuitions and has been written in tight collaboration; nevertheless sections 2 and 4 are to be attributed to M. Riggi, sections 3 and 5 are to be attributed to U. Fratesi. Sections 1, 6 and 7 are to be attributed to both authors.

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