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Interregional migration and labor market imbalances

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Abstract. This paper investigates the effects of internal migration in developed countries on widening wage inequality and high unemployment, and it addresses the geographical dimension of both problems. A two-region dynamic model is developed, which accounts for the skill composition of recent internal migration flows; it also innovates on the existing literature on migration by introducing capital-skill complementarity in the production function. The main conclusion is that migration can actually aggravate labor market imbalances. In a competitive set-up, migration temporarily amplifies the geographical dispersion of unskilled workers' wages and raises the average wage premium of the economy. When wage rigidities are introduced, labor mobility increases regional dispersion of unskilled workers' employment. In the short-run it may even reduce the total employment of the economy.

JEL classification: E24, J31, R23

Key words: Internal migration, unemployment, wage inequality

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1. Introduction

This paper develops a theoretical model to investigate the effects of internal migration in developed countries on widening wage inequality and unemployment. Furthermore it addresses the geographical dimension of both problems.

Greenwood (1997) notices that relatively few studies explore the labor market impact of internal migration in developed countries; most literature is concerned with migration in less-developed countries, as well as with international migration. This paper addresses the equilibrating role of labor mobility, by explicitly accounting for the skill composition of internal migration flows. Our model captures in the simplest way the higher internal mobility of skilled relative to unskilled workers; furthermore it innovates on the existing literature on migration by introducing capital-skill complementarity in the production function. Next section discusses these features of the model.

We reach two main conclusions. First, internal migration affects across-group wage inequality and total employment. Second, migration can actually aggravate labor market geographical imbalances.

We look first at a competitive labor market, with perfect wage flexibility and no unemployment. This can serve as a rough approximation of the US economy. We show that migration amplifies the geographical dispersion of unskilled worker's wages. We interpret the result as an increase in within-group inequality: identical workers receive different wages, depending on their location. Moreover, migration raises the average wage premium of the economy: the larger migration is, the higher the increase in across-group inequality.

As an alternative framework, we introduce wage rigidities, in order to capture some features of the Continental European labor markets. Our specification allows for both a wage-premium and a downward wage rigidity. It is shown that labor mobility increases the regional dispersion of employment, provided that wage rigidities do not respond to local labor market conditions. Migration might also temporarily reduce total employment.

These results can be particularly relevant for Europe, where labor market integration is generally expected to have a long-term beneficial effect and, along with capital mobility, to be the main mechanism for adjusting regional imbalances (this is, in fact, the prevailing view among policy-makers, as discussed in Begg 1995). It is well known that the most likely consequence of the European labor market integration - if any - is an even higher mobility of highly qualified workers, relative to the mobility of unskilled labor. Indeed, the European labor market liberalization is based on the recognition of professional qualifications awarded in other member states, the other legal barriers to migration having already been considerably reduced in the past. In this paper we argue that, if this is the case, the increase of internal mobility can paradoxically exacerbate labor market imbalances.

The paper is organized as follows: the next section offers some facts on internal migration, it discusses how they are captured by the current literature and it outlines our approach; it also briefly discusses the empirical relevance of the labor market imbalances this paper deals with. Section 3 presents the model; Sect. 4 analyzes the competitive regime; Sect. 5 introduces wage rigidities. Section 6 concludes. All propositions are proved in Appendix 1. Appendix 2 provides the details of the simulation of the model.

2. Internal migration and labor market imbalances

There is an impressive amount of evidence suggesting that, within developed countries, migration propensity rises with education. In fact, the skill composition is one of the main distinguishing features of recent internal migration flows in developed countries with respect to international migration from less developed to industrialized countries, which is characterized by a larger share of low-skilled migrants (ILO 1999). In this respect, recent internal migration flows also differ from patterns of internal migration in the past – when, incidentally, the labor market imbalances this paper deals with had not still emerged.

The higher internal mobility of skilled workers is documented by Greenwood (1997) for the US. For instance, looking at 25–29 year-old workers, the author finds that the group with 5 or more years of college has a migration propensity 4.6 times higher than that of the group with 0-8 years of elementary school. Similar patterns characterize intra-Europe migration flows. According to the evidence provided in Boeri and McCormick (2001), the skill composition of migration flows across European countries is, on average, higher than that of natives, and well above the skill composition of non-EU foreigners (see also Burda and Wyplosz 1992). The higher internal mobility of highly qualified workers is also confirmed by a number of country studies – see, for instance, Evans and McCormick (1994) and Hughes and McCormick (1994) for UK, Shioji (1996) for Japan and Devillanova and Garcia-Fontes (1998) for Spain. Furthermore, mobility of skilled relative to unskilled workers is expected to increase even more in the future: Soskice (1994) points out the fall in demand for unskilled labor; Mardesen (1994) stresses the increased importance of the internal market inside multinational firms, which is likely to increase mobility of a small number of highly-skilled workers; a further important effect can be played by the pressure of international migration (North Africa and the ex-socialist economies, for Europe; Latin America for the US). Empirical evidence also suggests that less mobile workers suffer the highest regional disparities. Topel (1986) finds that in the US within-groups wage dispersion is larger for less mobile workers; in Europe, regional unemployment disparities arise almost entirely in the market for unskilled labor.

At the same time, there has been increasing concern, among economists, on the labor market imbalances this paper deals with. For the last two decades, the US wage dispersion has been increasing both across skill levels and within categories; the increase was dramatic during the 80s. Consider, for instance, the returns to education. According to Gottschalk and Smeeding (1997), in 1979 the relative hourly wage of a recent college graduate was, on average, 23% higher than that of a recent high school graduate; by 1989 the wage premium had increased to 43%. Similar results in Acemoglu (2002), who finds that, between the early 80s and the late 90s, the US skill wage premium rose of about 90%. The experience across European countries is mixed but, whatever the measure adopted, wage inequality - both across skill levels and within categories - has been much lower and stable in Continental

Europe than in the US (see, among the others, Acemoglu 2002; Autor et al. 1998; Berman et al. 1998; Bertola and Ichino 1995 and Gottschalk 1997; Gottschalk and Smeeding 1997). However, Europe has been experiencing high and persistent unemployment, which is heavily concentrated among unskilled workers (see, for instance, Drèze and Malinvaud 1994). In 1999, the average unemployment rate in the EU was 11.5% for workers with less than upper secondary education; it was 5.1% for workers with tertiary education (see OECD 2001). (In fact, the negative effect of wage compression on low-skill employment is higher than reflected by relative unemployment rates across categories, due to the endogeneity of the participation decision; see Bertola et al. (2002) for references on this issue). Both problems have a clear geographical dimension. Topel (1986) finds that the US within-group wage dispersion is partly explained by regional productivity differentials; Bernard and Jensen (1998) and Topel (1994) report that across-group inequality has increased in the US, but the magnitude differs widely across regions. In Europe, substantial regional disparities in unemployment rates and income persist within and across countries. The problem is particularly evident in Italy: for instance, in July 2002 the unemployment rate was 2.8% in the North-eastern regions of Italy; it was 17.9% in the Mezzogiorno.

What consequences does the higher internal mobility of skilled relative to unskilled workers have on the problems this paper deals with? How does it affect wage inequality (within and across categories), total employment and regional employment rate differentials? Conventional wisdom among economists says that interregional labor mobility either does not affect labor market imbalances or it exerts a beneficial effect. More precisely, on the one hand, it reduces regional disparities, since workers move from low productivity to high productivity locations. On the other hand, the effect of internal migration on across-group inequality and total employment remains unclear and, to the best of our knowledge, this is the first attempt to explore the issue.[1] Remarkably, the above conclusions do not change when the skill composition of internal migration flows is taken into account.

This can be explained observing that the equilibrating role of internal labor mobility has been addressed using migration models[2] which share at least one of the following two assumptions on the production function. First, workers are perfect substitutes, once we adjust for their productivity differentials, as in Razin and Sadka (1995, 1999b) and Shioji (1995) - more often, only one type of labor is considered, as, for instance, in Bertola and Ichino (1995), Barro and Sala-i-Martin (1995) and Puga (1998). Second, the elasticity of substitution between capital and skilled labor is exactly the same as the elasticity of substitution between capital and unskilled labor, as in Canova and Ravn (1997), Devillanova and Casarico (2001), Razin and Sadka (1999a) and Storesletten (2000) - alternatively, there is no capital, as in Saint-Paul (1999). A widely used production function which embodies both assumptions is:

$$Y = \left[\sum_{j=1}^{J} \omega_j L_j\right]^{1-\alpha} [K]^{\alpha} \tag{1}$$

where Y is production, K is capital, L_j are J different types of labor, with productivity parameter $\omega_j, \omega_1 \geq \omega_2 \geq ... \geq \omega_J$ and $\alpha \in (0, 1)$.

These two assumptions lead to the conclusion that the heterogeneity of migration flows does not matter at all.

First, under the assumption of perfect substitutability of (adjusted for productivity differentials) workers, the heterogeneity of migration flows does not affect geographical inequality. Indeed, it is straightforward to show that this assumption implies that if the marginal productivity of one type of labor is equalized across regions, then the marginal productivity of all the other types does not depend upon location either. It follows that the integration of one segment of the labor market is a sufficient condition to reduce regional labor market imbalances.

Second, neither migration nor capital mobility affect across-group inequality, which is determined by the exogenously given (and constant) technological parameters ω_j.

The present paper shows that under less restrictive assumptions on the production function, the above conclusions do not hold and the higher mobility of skilled workers can affect both across-groups productivity differentials and the geographical disparities within (relatively immobile) categories. The technology we employ has two main properties. First, different types of workers are complementary production factors – i.e., blue collars and white collars do not simply differ in their relative productivity parameter; they do different jobs. Topel (1999) lists a number of studies that reject the assumption of perfect substitutability of workers with different skill levels. Second, capital better substitutes unskilled labor than skilled labor. This idea has a very old tradition and has recently received strong empirical support. For instance, Flug and Hercowitz (1999) use data from a wide range of countries and find evidence that investment in equipment raises the relative demand for skilled labor. Similar results are reported by Goldin and Katz (1998), Krusell et al. (2000) and Prasad (1994). Note, incidentally, that in our model there is only one type of capital, which is used as synonymous of equipment.

We model a two-region dynamic economy, with perfect capital mobility. The allocation of skilled labor responds to stochastic productivity differentials. We make the extreme assumption that unskilled labor is completely immobile. Allowing unskilled workers to move would not change the main insight of the paper, provided that skilled labor mobility is high enough (it would change the steady state properties of the competitive solution, as it will be argued in Sect. 4). It would be certainly worthwhile to model the migration decision of unskilled workers and get their (im)mobility as an equilibrium outcome. We leave this task for future research.

3. The model

We use a special case of the following production function:

$$Y = f(L, H, K) = \left[bK^{\theta} + (1-b)L^{\theta}\right]^{\frac{\alpha}{\theta}}[H]^{1-\alpha} \quad (2)$$

where Y is production, K is capital, L is low skilled (unskilled) labor, H is high skilled (skilled) labor, α, b and $\theta \in (0,1)$. This linearly homogeneous production function is Cobb-Douglas in two factors, skilled labor, with share parameter $(1-\alpha)$, and a composite factor. A CES technology combines capital and unskilled labor into an aggregate production factor; the share parameter of unskilled labor is $(1-b)$.

In (2) skilled and unskilled labor are complementary production factors, with elasticity of substitution equal to one. Moreover, for $\theta > 0$ capital better substitutes unskilled labor than skilled labor. Indeed, the elasticity of substitution between capital and unskilled labor is $\frac{1}{1-\theta}$, which, for $\theta > 0$, is greater than one. Define the **skill-premium** $\pi = \frac{f_H(L,H,K)}{f_L(L,H,K)}$ as the ratio of skilled to unskilled workers' productivity; if $\theta > 0$ then $\frac{\partial \pi}{\partial K} > 0$ and the skill-premium is increasing in the amount of capital.

There are two regions in the economy, A and B. One single good is produced in each region, using the common technology (2), with $\alpha = \theta > 0$. The assumption $\alpha = \theta$ is irrelevant for the qualitative results of the paper and it greatly simplifies the solution of the model, while the condition $\theta > 0$ (capital-skill complementarity) is crucial. By linear homogeneity, production per-skilled labor is:

$$y_t^i = f\left(l_t^i, k_t^i; z_t^i\right) = z_t^i\left[b\left(k_t^i\right)^\alpha + (1-b)\left(l_t^i\right)^\alpha\right] \tag{3}$$

where $i = A, B$ is an index of location, t is time and $y_t^i = \frac{Y_t^i}{H_t^i}, k_t^i = \frac{K_t^i}{H_t^i}, l_t^i = \frac{L_t^i}{H_t^i}$ are, respectively, output, capital and unskilled labor in terms of skilled labor. We refer to l_t^i as skills ratio: the higher the skills ratio, the more unskilled labor is employed in the economy relative to skilled labor. z_t^i is a region specific productivity disturbance. z_t^B follows a first order stationary Markov process, with $E\left[z_t^B\right] = 1$ and finite variance; $z_t^A = 1$ for every period (region A does not experience any productivity shock at all).

Three types of agents populate the economy. They all maximize $E_0\left[\sum_{t=0}^{\infty} \beta^t u(c_t)\right]$, where $u(\cdot)$ is a differentiable, strictly increasing and concave utility function, c_t is consumption at time t, $\beta \in (0,1)$ is the common discount factor and $E_0[\cdot]$ is the expectation operator conditional to time-zero information.

There are two **capitalist-entrepreneurs**, one in each region. As capitalists, they are endowed with an initial wealth S_0 and they take the saving-investment decisions. As entrepreneurs, they act competitively and rent labor services and capital to produce the good. The regions are small open economies with access to the international capital market at the constant world interest rate $\bar{r}$. We also assume $S_0 > \left(\frac{\alpha b}{\bar{r}}\right)^{\frac{1}{1-\alpha}}$, which is equivalent to assume that regions are relatively rich (developed country economy). There are no installation costs and new investments become immediately productive. Equating the marginal productivity of capital to the world interest rate, solving for k_t^i and substituting into (3) gives:

$$y_t^i = f\left(l_t^i; z_t^i\right) = z_t^i\left[b\left(\frac{z_t^i \alpha b}{\bar{r}}\right)^{\frac{\alpha}{1-\alpha}} + (1-b)\left(l_t^i\right)^\alpha\right] \tag{4}$$

hence production per-skilled worker is a function of the shock z_t^i and the skills ratio l_t^i.

Two **unskilled** workers inhabit the economy, one in each region. Both are endowed with N hours of labor, which are inelastically supplied in the region of residence - i.e., we assume that unskilled labor is completely immobile. The whole wage income is consumed in each period.

Finally, there is one **skilled** worker in the economy. At each date, the worker observes the realization of the shock and allocates his/her working-time between regions, paying a cost which is quadratic in the number of hours reallocated. Time endowment is normalized to one. The choice variable for the skilled worker - number of hours allocated in each region - can be taken literally for some very special types of high-skilled jobs. Alternatively, one can think of this set-up as resulting from a convexification of the decision set, through a mechanism similar to that developed in Hansen (1985) (details in Devillanova 2001). We stress that none of the results would change if we modeled a continuum of skilled workers of measure one, and we pursue this alternative for its simplicity.

We now study the migration decision. Since in this model gross migration and net migration coincide, without loss of generality we can focus on migration to region B. The value function of the skilled worker is:

$$V(z_t, H_{t-1}^B) = \max_{H_t^B} \left[u(c_{H,t}) + \beta E_t V(z_{t+1}, H_t^B) \right] \tag{5}$$

$$\text{subject to: } c_{H,t} = w_{H,t}^A H_t^A + w_{H,t}^B H_t^B - \frac{\psi}{2}(H_t^B - H_{t-1}^B)^2$$

$$H_t^A + H_t^B = 1$$

where $c_{H,t}$ is consumption of the skilled worker, $w_{H,t}^i$ is the hourly wage for skilled labor in region i, H_t^i is the number of working hours allocated in region i and $\psi > 0$ is the coefficient of the cost function. State variables are the observed realization of the shock and the current population distribution.

The first order condition is:

$$u'(c_{H,t}) \left[w_{H,t}^A - w_{H,t}^B + \psi(H_t^B - H_{t-1}^B) \right] = \beta E_t V'(z_{t+1}, H_t^B) \tag{6}$$

and the envelope condition gives:

$$V'(z_t, H_{t-1}^B) = u'(c_{H,t}) \psi (H_t^B - H_{t-1}^B) \tag{7}$$

where the prime indicates first derivatives. Combining (6) and (7) and solving forward yields:

$$H_t^B = H_{t-1}^B + \frac{1}{\psi} E_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} \frac{u'(c_{H,\tau})}{u'(c_{H,t})} \left(w_{H,\tau}^B - w_{H,\tau}^A \right) \tag{8}$$

where we assumed that $\lim_{\tau\to\infty} \left[\beta^\tau E_t \frac{u'(c_{H,\tau})}{u'(c_{H,t})} (H_\tau^B - H_{\tau-1}^B) \right] = 0$. Condition (8) simply says that today's location decision H_t^B depends on the inherited location H_{t-1}^B and the present value of the future skilled wage differences between the two regions, discounted with the intertemporal marginal rate of substitution. Thereafter the solution to problem (5) is denoted by:

$$m_t = m\left(z_t^i, H_{t-1}^i\right) \tag{9}$$

where $m_t = \frac{\partial H_t^B}{\partial z^B}$ is computed according to (8).

Note that migration is decreasing in ψ, the cost of moving. Note also that, from the assumption of quadratic costs it follows that, whenever some productivity differential is expected, then $m_t \neq 0$. It is well understood that linear or concave cost functions give rise to inaction zones and hysteresis phenomena. Quadratic costs guarantee an interior solution and greatly simplify the simulation of the model, without altering its main insights. However, our model can generate hysteresis even under quadratic costs.

As a final remark, in the model none of the two kinds of workers is allowed to save. Although this feature is shared by almost all existing models of migration[3] important connections do link the decision to save with that to migrate. Here, under the assumption of fixed world interest rate, if the skilled worker were allowed to save, he/she could completely smooth consumption across the cycle and there would be no migration at all.

4. The competitive regime

We start with perfect wage flexibility and no unemployment. This can serve as a first approximation of the US economy. Competitive wages at time t are:

$$w^i_{H,t} = \frac{\partial f\left(l^i_t\right)}{\partial H^i} = \left(z^i_t\right)^{\frac{1}{1-\alpha}} d + z^i_t g\left(l^i_t\right)^{\alpha} \tag{10}$$

$$w^i_{L,t} = \frac{\partial f\left(l^i\right)}{\partial L^i} = \left(z^i_t\right) q\left(l^i_t\right)^{\alpha-1} \tag{11}$$

where $w^i_{H,t}$ and $w^i_{L,t}$ are, respectively, the wages of skilled and unskilled labor at time t, in region i and where d, g and q are positive constants. We also assume that N is large enough to insure $w^i_{H,t} > w^j_{L,t}$, for every i, j and t.

The steady state of the economy is symmetric: i.e., $\bar{H}^A = \bar{H}^B = \bar{H} = 0.5$, $\bar{l}^A = \bar{l}^B = \bar{l}$ and $\bar{k}^A = \bar{k}^B = \bar{k}$, where the upper-bar indicates the steady state-value of the variables. This result comes from the existence of the fixed factor N. If we allowed unskilled workers to move (or if we considered international migration of unskilled workers) then a temporary shock would have permanent effects on the distribution of the population, because of the constant-returns-to-scale production function.

In order to study the dynamics of the system, we consider, without loss of generality, a shock making region B more productive than region $A\left(z^B_t > 1\right)$. Since the model is perfectly symmetric, all the results of this section extend easily to the case of $z^B_t < 1$.

We now illustrate graphically the relationship between the inter-region skilled wage differential $w^B_{H,t} - w^A_{H,t}$ and migration. The supply of skilled labor in region B is determined by (8). If we take

$$\frac{1}{\psi} E_t \sum_{\tau=t+1}^{\infty} \beta^{\tau-t} \frac{u'(c_{H,\tau})}{u'(c_{H,t})} \left(w^B_{H,\tau} - w^A_{H,\tau}\right)$$

as given for a moment, Eq. (8) is a straight line with slope ψ; we indicate it by Ω. At the same time, the skilled wage differential between regions depends on the allocation of working hours. From (10) we observe that $w^B_{H,t} - w^A_{H,t}$ is increasing in z^B_t and decreasing in H^B_t; we indicate this function by Γ. The equilibrium is determined by the intersection between the Ω and the Γ curves.

In the steady state the two curves cross at $\bar{H}^B = \frac{1}{2}$, with $\bar{w}^B_H = \bar{w}^A_H$. When a shock $z^B_t > 1$ occurs, ceteris paribus the Γ curve shifts upwards to Γ'. The skilled agent reacts to the inter-region skilled wage differential reallocating working hours from region A to region B $(m_t > 0)$ and H^B_t increases (intersection I in Fig. 1), leading to a skilled wage differential between the two regions smaller

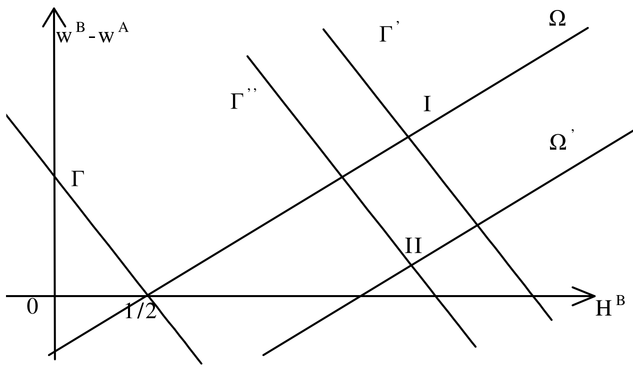

Fig. 1.

than the one in the absence of migration. It is clear that the smaller ψ, the more migration reacts to any wage differential. In the following period the Ω line shifts to the right (Ω'), because the initial condition H^B_{t-1} has changed. At the same time the Γ' curve shifts downward to Γ''. The new equilibrium depends on the persistency of the shock. The less persistent the shock, the larger the downward shift of the Γ' curve. In figure 1 the Γ'' and the Ω' lines cross at *II*, with a positive wage differential $w^B_{H,t+1} - w^A_{H,t+1}$ and further migration from *A* to *B* ($m_{t+1} > 0$) - the possibility that migration continues for more than one period depends on the assumption of quadratic migration costs. However, the equilibrium could perfectly imply a negative skilled wage differential between regions and return migration ($m_{t+1} < 0$). Anyway, as long as the shocks are temporary, the equilibrium will eventually settle back to the symmetric steady state and after some time, return migration to region *A* will occur. During the adjustment process $H^B \geq \bar{H} \geq H^A$.

As an example, we simulate the response of the economy to a one percent shock (see Fig. 2). In the first two periods, migration flows towards region *B*. Afterwards we observe return migration and the system eventually ends up in its symmetric steady-state.

A first important conclusion is that *migration amplifies the spatial dispersion of unskilled workers' wages, increasing their within-group inequality*. The unskilled wage differential between regions is $w^B_{L,t} - w^A_{L,t} = q\left[\left(z^B_t\right)\left(l^B_t\right)^{\alpha-1} - \left(l^A_t\right)^{\alpha-1}\right] \geq q\bar{l}^{\alpha-1}\left[z^B_t - 1\right]$ whenever $H^B_t > \bar{H}$, where $q\bar{l}^{\alpha-1}\left[z^B_t - 1\right]$ is the wage differential under no migration. Because of the complementarity between the two types of labor, the migration of skilled workers reduces the unskilled workers' wage in the sending region and it has the opposite effect in the destination region. Of course, wage inequality is reflected in utility differentials. Figure 3 compares the interregional utility gap of unskilled workers $\frac{u\left(c^B_{L,t}\right) - u\left(c^A_{L,t}\right)}{u\left(c^A_{L,t}\right)}$ with and without labor mobility.

In the competitive regime the wage premium *wp*, defined as the ratio between the wage of skilled and unskilled workers, equals the skill-premium π:

$$wp^i_t = \frac{w^i_{t,H}}{w^i_{t,L}} = \left(z^i_t\right)^{\frac{\alpha}{1-\alpha}} \frac{d}{q} \left(l^i_t\right)^{1-\alpha} + \frac{g}{q}\, l^i_t \tag{12}$$

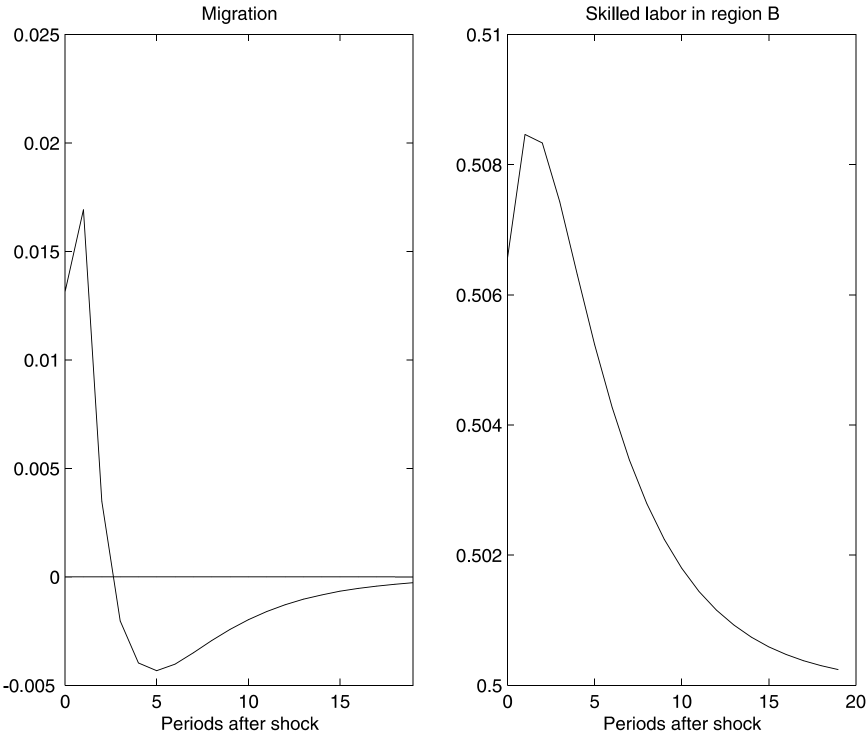

Fig. 2.

The wage premium is increasing in both z_t^i and l_t^i. An increase in the skills ratio l_t^i means that the amount of skilled labor employed in the region has decreased with respect to N. The complementarity between types of labor explains why wp_t^i is increasing in l_t^i. It follows that migration does affect the wage premium in each region. Remarkably, this result can not be generated in standard set-ups where high skilled and low skilled workers simply differ by their productivity level. Note also that the effect on l_t^i would be preserved in the presence of unskilled labor migration, as long as the skill composition of migration flows is higher than that of natives.

The relationship between the wage premium and the shock z_t^i is more tricky. A multiplicative shock proportionally raises the productivity of all three factors, K, L and H. If capital were immobile, then the wage premium would not change. However, in this model capital is internationally mobile: the productivity shock attracts new investments; the higher amount of capital in the region increases marginal productivity of skilled labor, leaving marginal productivity of unskilled labor unchanged, and the wage premium rises. This result is preserved under the more general production function (2) as long as $\theta > 0$.

Proposition 1. *Let $z_t^B > 1$ and $m_t > 0$; migration raises (lowers) the wage premium in the source (destination) region. Moreover, there exists a $\xi_t^B > 0$ such that, for $\frac{m_t}{H_t^B} < \xi_t^B$, the wage premium increases in both regions.*

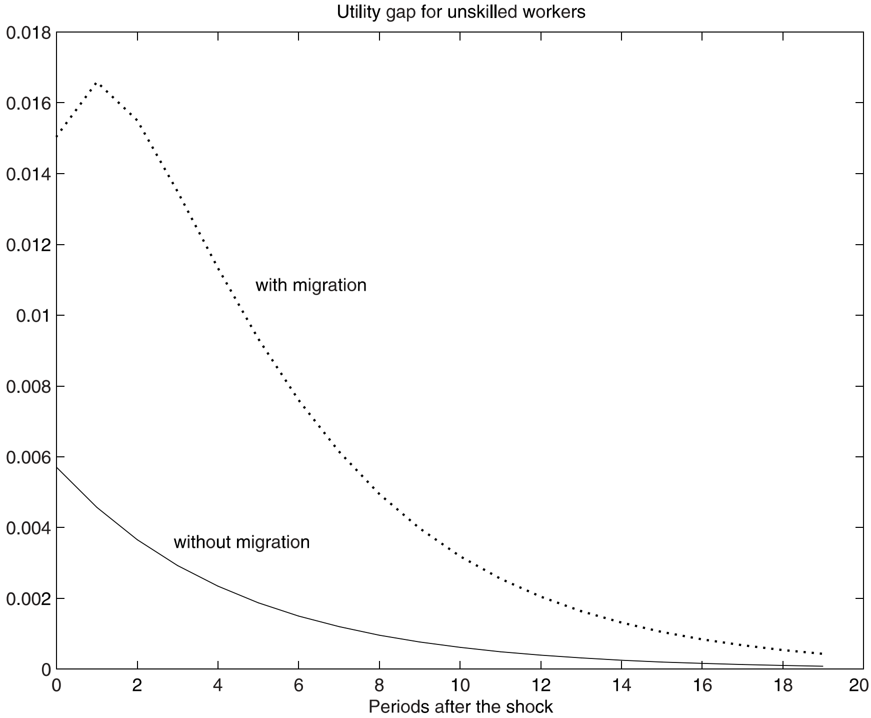

Fig. 3.

When region B experiences a positive shock, region A initially loses hours of skilled labor. This makes the skilled labor a relatively scarce factor in region A, unambiguously increasing the wage premium. In region B two effects are at work. The arrival of new investments increases the wage premium. Migration of skilled labor acts in the opposite direction. If the rate of immigration is small enough $\left(\frac{m_t}{H_t^B} < \xi_t^B\right)$, then the former effect prevails and the wage premium increases in region B too. Eventually, the wage premium monotonically returns to its steady state level $\overline{wp}$ in both regions.

Define the weighted average wage premium of the economy:

$$\widetilde{wp}_t = \frac{(N + H_t^A)wp_t^A + (N + H_t^B)wp_t^B}{2N + 1} \tag{13}$$

Proposition 2. *Let* $z_t^B > 1$ *and* $m_t > 0$; *there exists* $\widehat{H}_t^B \in (0, 1)$ *such that, whenever* $H_t^B \geq \widehat{H}_t^B$ *the average wage premium* $\widetilde{wp}_t$ *is increasing in migration.*

In the present model, people migrate always towards the most productive region. Since more capital is located in the more productive region and the wage premium is an increasing function of capital, migration always goes from the lower to the higher wage premium region, thus increasing the average wage premium of the economy (across-group wage inequality). Again, in the long-run, the average wage premium (like all the other variables of the economy) is independent of migration.

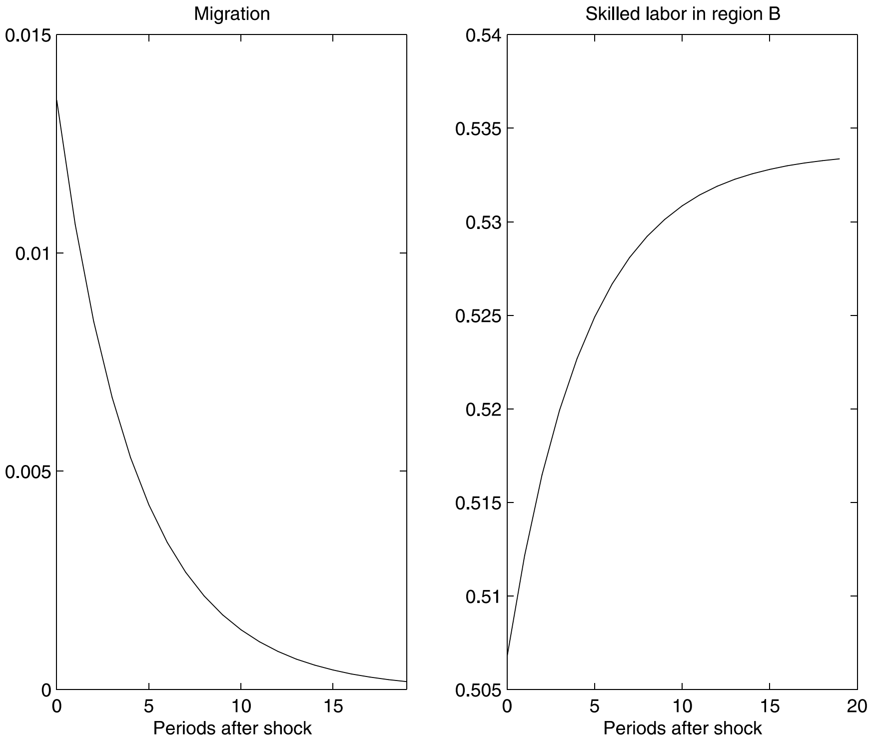

Fig. 4.

5. Allowing for unemployment

The competitive regime just described is characterized by perfect wage flexibility and no unemployment. In order to capture some features of the European labor market, we assume that the wage of unskilled workers is an exogenously given proportion of the wage of skilled workers:

$$wp_t^i = \frac{w_{H,t}^i}{w_{L,t}^i} = \mu\left(z_t^i\right) \geq 1 \tag{14}$$

with $\mu'\left(z_t^i\right) \geq 0$ and $\mu''\left(z_t^i\right) \leq 0$.

This specification of the wage-premium as a function of the business-cycle conditions allows us to consider two rigidities at the same time. First, a wage-premium rigidity: unskilled workers' wage is linked to that of skilled workers at the exogenously given level $\mu\left(z_t^i\right)$. Second, a downward wage rigidity: in bad times – small z_t^B – the wage of both skilled and unskilled workers goes down, but not proportionally. The idea is that the closer is the wage of unskilled workers to the minimum socially acceptable level, the lower is $\mu\left(z_t^i\right)$. To the best of our knowledge, existing economic models take into account either the wage-premium or the downward wage rigidity. In fact, both rigidities seem to be relevant in the Continental European labor market.

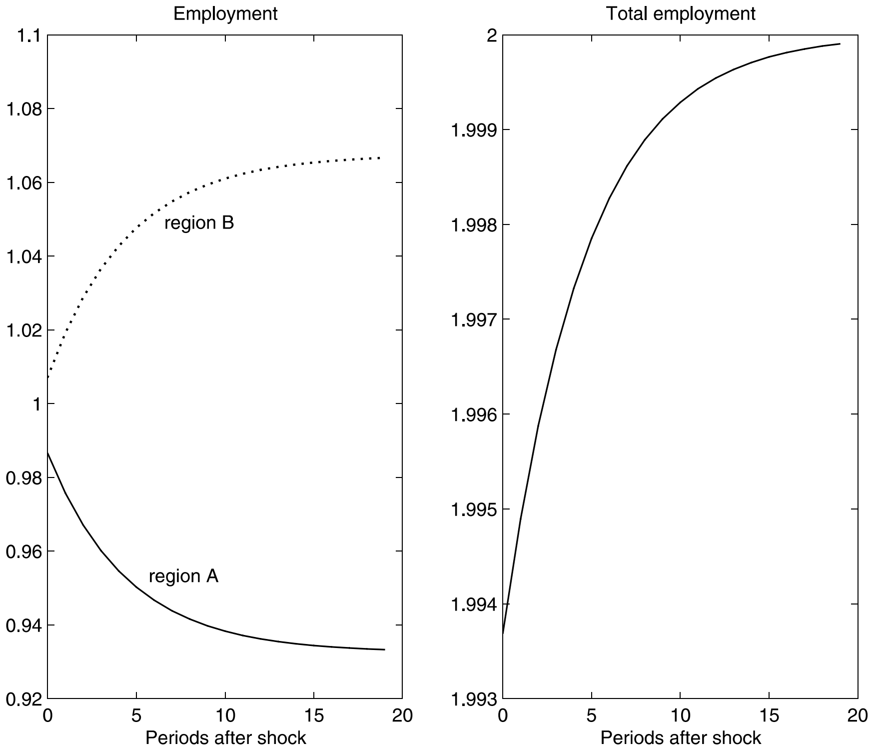

Fig. 5.

As usual in this type of models (see Saint-Paul 1999; Razin and Sadka 1995), we assume that the market of skilled labor is perfectly competitive, so that clearing conditions determine w_H^i. Given $\mu(z_t^i)$, the wage of unskilled workers is fixed by (14). Firms take w_L^i as given and marginal productivity determines the demand of unskilled labor and the skills ratio l_t^i. This can be interpreted as the outcome of a bargaining process in which firms and unions first bargain over wages and then firms set employment - on the "right to manage" model, see Layard et al. (1991), Ch.2. In this set-up, unlike in the competitive regime, productivity dynamics shows-up in employment of unskilled workers, rather than in wages. The skilled-agent's problem (5) specializes in a trivial way. Then, given the location decision of the skilled agent, the employment of unskilled workers in each region is determined by:

$$L_t^i = l_t^i \cdot H_t^i \tag{15}$$

where $l_t^i = l(z_t^i)$ is implicitly defined by:

$$\pi_t^i \equiv \frac{f_H}{f_L} = \left[\left(z_t^i\right)^{\frac{\alpha}{1-\alpha}} \frac{d}{q} \left(l_t^i\right)^{1-\alpha} + \frac{g}{q} l_t^i \right] = \mu\left(z_t^i\right) \tag{16}$$

In the steady state the two regions have the same skills ratio $\bar{l}^A = \bar{l}^B = \bar{l}$ and there is no reallocation of hours.

A first important result comes from (15): *migration caused by a temporary shock permanently reduces (increases) the employment of unskilled* *labor in the sending (destination) region*. Consider, as before, the case of a shock making region B more productive than region A. Hours are reallocated towards region B. The migration flow eventually stops, but, contrary to the competitive regime, it never reverses its direction. In the competitive framework the presence of a fixed factor $L_t^i = N$ gives rise to a congestion phenomenon and ensures a flow of return migration. In the non competitive framework, L_t^i is endogenously determined by (15). In the new steady state the distribution of population has changed, with $\bar{H}^B \geq \bar{H}^A$ and $\bar{L}^B \geq \bar{L}^A$ (see Fig. 4).

Here the assumption that the wage premium $\mu(z_t^i)$ does not depend on the level of employment in the region is crucial. This seems to be a reasonable description of the functioning of local labor markets, at least for some European country. Jimeno and Bentolila (1998) estimate a low responsiveness of wages to regional economic conditions in Spain; similar findings for the UK manual labor market - Evans and McCormick (1994).

The short-run effects of migration crucially depend on the nature of the shock and the rigidities in the labor market.

Proposition 3. *Define* $s_t^i \equiv \frac{\partial \pi_t^i}{\partial z_t^B}$ *the derivative of the skill premium with respect to* z_t^B. *If* $z_t^B > 1\left(z_t^B < 1\right)$ and $\mu'\left(z_t^i\right) < s_t^i$, *then the skills ratio is decreasing (increasing) in region B. Employment of unskilled workers decreases (increases) in region A; moreover, there exists a* λ_t^B *such that for* $\left|\frac{m_t}{H_t^B}\right| < \left|\lambda_t^B\right|$, *employment decreases (increases) in region B too.*

In order to give the intuition behind Proposition 3, we focus again on a shock making region B more productive than region A. Moreover, we consider a labor market where the wage premium is relatively rigid -i.e. it increases less than the skill-premium $\left[\mu'\left(z_t^i\right) < s_t^i\right]$. If the wage premium were constant, the above inequality would always be satisfied. In this case migration increases H_t^B relative to H_t^A; given $\bar{l}^A$, employment of unskilled workers in region A unambiguously decreases. In the long run, $\bar{l}^B$ reaches its steady state level and employment in region B is higher. However, in the short run the skill-premium rises in region B, due to the arrival of new capital; as the wage premium, by assumption, is rigid enough, the firm demands a lower proportion of unskilled workers and the skills ratio l_t^B decreases below its steady state level $\bar{l}$. Therefore, in region B two effects are combined: a direct effect of skilled worker migration, which increases L^B; a temporary decrease of $l(z^i)$, which depresses L^i. If the rate of immigration is small enough $\left(\frac{m_t}{H_t^B} \leq \lambda_t^B\right)$, the second effect dominates and employment decreases in region B.

The opposite case of a shock making region B less productive than region A gives symmetric results. In bad times, hours of skilled labor are reallocated towards region A. Since $\bar{l}^A$ is constant, employment unambiguously increases in the region of destination. As before, in region B two effects combine together. Given l_t^B, less hours of skilled labor implies lower employment. At the same time investments flow out of the region toward more productive locations, thus lowering the skill-premium π_t^B. The effect on the skills ratio l_t^B crucially depends on the rigidity of the wage premium. If, for instance, the downward wage rigidity is strong enough $\left[\mu'\left(z_t^i\right) > s_t^i\right]$, the wage premium decreases by more than the skill premium and the firm employs relatively less unskilled workers, lowering l_t^B and depressing the employment in region B even more. One would expect that if the fall in productivity is strong enough, then minimum wage considerations become relevant and $\frac{\partial l(z^B)}{\partial z} < 0$. This is what the concavity of $\mu(z_t^i)$ is intended to capture.

Proposition 4. *If* $z_t^B > 1\left(z_t^B < 1\right)$ *and* $\mu'\left(z_t^i\right) < s_t^i$, *then migration temporarily lowers (increases) total employment.*

Proposition 4 says that if the shock makes region B more productive $\left(z_t^B > 1\right)$, labor mobility lowers total employment, provided that the wage premium is relatively constant. The reason is that migration takes place towards the "lucky" region B, which, for the reasons just explained, employs a lower proportion of unskilled workers, thus lowering total employment. On the other hand, during recessions $\left(z_t^B < 1\right)$ migration increases total employment only if downward wage rigidity is strong. In this case we know that region B employs relatively fewer unskilled workers than region A $\left[\frac{\partial l(z^B)}{\partial z} < 0\right]$. Since migration flows towards region A, labor mobility increases total employment.

In the long run total employment reaches its steady state level; in this model migration only affects the steady state distribution of employment, but not the level.

In our numerical example, employment increases in region B. Total employment temporarily decreases after the shock (see Fig. 5).

6. Conclusions

The object of this paper is to investigate the labor market effects of internal migration within developed countries. A two-region dynamic economy is modeled, in which stochastic productivity differentials drive migration of high-skills workers; capital is internationally mobile. The paper also innovates on the existing literature on migration by introducing capital-skill complementarity in the production function.

Our theoretical analysis suggests that the skill composition of recent internal migration flows can actually exacerbate labor market imbalances. In our model, migration amplifies regional idiosyncratic fluctuations of unskilled worker's productivity. Furthermore, labor mobility increases the average productivity differential between categories of workers. In a competitive set-up, the above dynamics shows-up in wages: in the short-run migration raises unskilled-workers' wage dispersion between regions and increases the average wage premium of the economy. If, on the other hand, the labor market is characterized by wage rigidities, then migration decreases (increases) employment in the source (destination) region. Furthermore, it may temporarily reduce total employment.

The paper points out that labor markets integration is an entangled subject. It argues that the characteristics of migrants are as important as the size of the flows; increasing the mobility in just some types of workers may result in even greater labor market imbalances.

Appendix 1

Proof of Proposition 1. In region A $z_t^A = 1$, thus:

$$\frac{\partial wp_t^A}{\partial z^B} = \frac{1}{q}\left[d(1-\alpha)\left(l_t^A\right)^{1-\alpha} + gl_t^A\right]\frac{m_t}{H_t^A} \geq 0,$$

which is increasing in m.

In region B:

$$\frac{\partial wp_t^B}{\partial z^B} = \frac{1}{q}\left\{\left[d\frac{\alpha}{1-\alpha}\left(z_t^B\right)^{\frac{2\alpha-1}{1-\alpha}}\left(l_t^B\right)^{1-\alpha}\right] - \left[d(1-\alpha)\left(z_t^B\right)^{\frac{\alpha}{1-\alpha}}\left(l_t^B\right)^{1-\alpha} + gl_t^B\right]\frac{m_t}{H_t^B}\right\},$$

decreasing in m. Moreover

$$\frac{\partial wp_t^B}{\partial z^B} \geq 0 \text{ if } \frac{m_t}{H_t^B} \leq \xi_t^B, \text{ where } \xi_t^B \equiv \frac{d\frac{\alpha}{1-\alpha}\left(z_t^B\right)^{\frac{2\alpha-1}{1-\alpha}}\left(l_t^B\right)^{-\alpha}}{d(1-\alpha)\left(z_t^B\right)^{\frac{\alpha}{1-\alpha}}\left(l_t^B\right)^{-\alpha} + g}. \qquad \square$$

Proof of Proposition 2. Differentiating (13) with respect to z^B:

$$\begin{aligned}\frac{\partial \widetilde{wp}_t}{\partial z^B} = {} & (N + H_t^B)\frac{1}{q}\left[d\frac{\alpha}{1-\alpha}\left(z_t^B\right)^{\frac{2\alpha-1}{1-\alpha}}\left(l_t^B\right)^{1-\alpha}\right] + \left[wp_t^B - wp_t^A\right]m_t \\ & + \frac{1}{q}\left\{(N + H_t^A)\left[d(1-\alpha)\left(l_t^A\right)^{1-\alpha} + gl_t^A\right]\frac{m_t}{H_t^A} + \right. \\ & \left. - (N + H_t^B)\left[\left(z_t^B\right)^{\frac{\alpha}{1-\alpha}}d(1-\alpha)\left(l_t^B\right)^{1-\alpha} + gl_t^B\right]\frac{m_t}{H_t^B}\right\}\end{aligned}$$

The first addendum does not depend on m_t. The second term is always non-negative, since capital mobility increases wp_t^B with respect to wp_t^A. The term in braces is a monotonically increasing function of H^B. The limit of this expression for H^B going to zero is minus infinity; for H^B going to one is plus infinity. By continuity, there exists a $\widehat{H}_t^B \in (0,1)$ such that this term is zero. For any $H_t^B \geq \widehat{H}_t^B$ the whole expression is surely positive and the average wage premium is increasing in migration. $\square$

Proof of Proposition 3. We focus on the case of $z_t^B > 0$ (and hence $m_t > 0$). By implicit differentiation of (16):

$$\frac{\partial l_t^B}{\partial z} = -\frac{s_t^B - \mu'\left(z_t^i\right)}{(1-\alpha)\frac{d}{q}\left(z_t^i\right)^{\frac{\alpha}{1-\alpha}}\left(l_t^i\right)^{-\alpha} + \frac{g}{q}} < 0 \text{ if } \mu'\left(z_t^i\right) < s_t^i,$$

which proves that the skills ratio is decreasing in region B (note that l_t^A is constant at its steady state level $\bar{l}$).

From (15) : $\frac{\partial L_t^i}{\partial z^B} = \frac{\partial l_t^i}{\partial z^B}H_t^i + l_t^i\frac{\partial H_t^i}{\partial z^B}$.

In region A: $\frac{\partial L_t^A}{\partial z^B} = -\bar{l}^A m_t \leq 0$

In region B: $\frac{\partial L_t^B}{\partial z^B} = -\frac{s_t^B - \mu'(z_t^i)}{(1-\alpha)\frac{d}{q}(z_t^i)^{\frac{\alpha}{1-\alpha}}(l_t^i)^{-\alpha} + \frac{g}{q}} H_t^B + l_t^B m_t$

which is positive if $\frac{m_t}{H_t^B} > \lambda_t^B$, where $\lambda_t^B = \left[\frac{s_t^B - \mu'(z_t^i)}{(1-\alpha)\frac{d}{q}(z_t^B)^{\frac{\alpha}{1-\alpha}}(l_t^i)^{1-\alpha} + \frac{g}{q} l_t^i}\right]$.

The case of $z_t^B < 0$ (and $m_t < 0$) mirrors the former. □

Proof of Proposition 4. Again, consider the case of $z_t^B > 1$ and $m_t > 0$. Total employment in the economy is $L_t = 1 + L_t^A + L_t^B$. From (15):

$$\frac{\partial L_t}{\partial z^B} = m_t\left[l_t^B - \bar{l}^A\right] - \left[\frac{\frac{d}{q}\frac{\alpha}{1-\alpha}\left(z_t^B\right)^{\frac{2\alpha-1}{1-\alpha}}\left(l_t^i\right)^{-\alpha} - \mu'\left(z_t^i\right)}{(1-\alpha)\frac{d}{q}\left(z_t^B\right)^{\frac{\alpha}{1-\alpha}}\left(l_t^i\right)^{-\alpha} + \frac{g}{q}}\right] H_t^B$$

From Proposition 3 $l_t^B \leq \bar{l}^A$; it follows that the higher the mobility of skilled labor, the higher the fall in unskilled labor employment. The case of $z_t^B < 1$ mirrors the former. □

Appendix 2

The model has been simulated numerically around the steady state of the economy using linear-quadratic approximation. The utility function is logarithmic. $\alpha = \theta = 0.5$, which implies an elasticity of substitution between capital and unskilled labor equal to two, as in Stokey (1996). The annual real interest rate is 5%; $b = 0.3$, $\beta = 0.9$. $\log(z_t^B) = \rho \log(z_{t-1}^B) + \varepsilon_t$ where ε_t's are *iid* $\sim N(0, \sigma^2)$ and $\rho = 0.8$. The number of unskilled workers in each region is $N = 1$, so that $\bar{l} = \frac{N}{H^i} = 2$. Finally, $\psi = 0.8\bar{w}_H$. The steady state values for wages are $\bar{w}_H = 0.94$, $\bar{w}_L = 0.24$ and the wage premium is $\overline{wp} = 3.8$. In the fixed wage-premium regime μ is constant, set such that in steady state $\bar{l}^i = 2$, which implies that the steady state values of all the relevant variables coincide with that of the competitive regime. The cost parameter is $\psi = 4\overline{wp}$ (leaving ψ unchanged, would have implied an excessively large rate of migration). The initial population distribution is symmetric.

Endnotes

1 On the contrary, the effects of international migration on across-group inequality has been extensively studied; see, for instance, Borjas (1994), Winter-Ebmer and Zweimuller (1999) and Venturini (1999). On the labor market consequences of international economic relations more broadly defined (migration and trade) see Borjas and Ramey (1994), Burtless (1995) and Wood (1994). The links with international capital mobility are explored, among the others, by Feenstra and Hanson (1997).

2 An exhaustive review of the literature is far beyond the aim of this paper; see Saint-Paul (1999) for additional references on the relationships between regional wage differentials (and unemployment) and migration. In particular, we do not discuss the "brain drain" literature, inspired by the works of Bhagwati and Hamada (1974) and Rodriguez (1975). The differences with this paper are clear-cut, both in the analytical instruments and the purposes, as brain drain refers to the international migration of skilled workers from developing countries to advanced industrial nations and its economic effects in the sending country.

[3] Canova and Ravn (1996) develop a business cycle model with international migration, but in their set-up low skilled workers, which are the mobile factor, are not allowed to save. See Bertola (1999) for a model of job-to-job mobility with imperfect consumption smoothing over time.

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