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Migration and Wage Flexibility

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Abstract

The relationship between migration decision and migration equilibrium among two rather similar regions and the existence of differences in the workings of the two regional labour markets is the main focus of the paper. The reason for this choice is twofold: first, it enables us to readdress some of central questions of the literature on migration by isolating the interesting role played by institutional differences between the labour markets; second, it allows some light to be shed on the consequences of a monetary union in the presence of important differences in the workings of labour markets. Some interesting results not stressed by the existing literature on labour migration are obtained. First, it is shown that the presence of a difference in the rules that determine wages is an independent reason for migration and determines a positive migration equilibrium even when regions are identical in every respect and capital is perfectly mobile. Second, it is found that migration is not neutral as far as aggregate output and aggregate employment are concerned when the two semi-elasticities of wages with respect to unemployment rates are different among regions. Third, in this framework capital and labour tend to move together from the region with a lower semi-elasticity toward the region with a higher one. However, while the labour movement increases aggregate output and employment, the capital flow by contrast reduces aggregate output. Therefore capital mobility may be undesirable when labour markets work in different ways.

JEL Classification J161, R32 Keywords: migration, labour mobility, capital mobility

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1 Introduction

The issue of the geographical mobility of labour and, more generally, of human beings is increasingly attracting attention in the economic and political debate. There are several reasons for this: the problem posed by the migration flows determined by third-world underdevelopment (South-North migration), the relocation in the world economy of the former communist countries (East-West migration), the analysis of the consequences of European monetary union (inter-regional migration).

The literature on migration, starting with the pioneering work of Harris and Todaro, 1970, has analyzed different features of the phenomenon, its welfare consequences and the appropriate economic policy response. [1] There are several points in this literature, however, that warrant further analysis: one of the most important being, in my view, the way in which wage determination is considered. Almost all the studies develop models that assume either perfect flexible wages or fixed wages [2]. Both assumptions are no more than text-book cases and do not appear suited to analysis of the above mentioned forms of migration.

The literature on migration has paid little attention to this problem.[3] By contrast, the degree of wage flexibility, and specifically the nature of the relationship between wages and unemployment and its relationship with the decision to migrate, is the central question addressed by this paper. The reason for this choice is that here the main object of interest will be the determinants and the effects of labour force migration when it occurs between regions of the same country, or at any rate between very similar countries. Analysis of this kind seems especially relevant from both an Italian and a European point of view. As regards Italy, it is of interest, on the one hand, to study the reasons for the country's markedly low level of labour mobility despite the presence of large and persistent differences in unemployment levels and nominal wages between the Centre-North and the South, and on the other, to examine the contribution, if any, of labour force migration to nationwide output and to convergence between income and employment levels in the country's various regions. At the European level, it is of interest to analyse the effects of the developing single capital market in the presence of different labour market institutions and of monetary and non-monetary obstacles to labour force mobility.

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[1] An interested reader is referred to Stark, (1990) and Ghatak et al. (1996)

[2] In the original Harris and Todaro paper, they were both: a market clearing wage in the rural sector and a fixed wage in the urban sector (Harris and Todaro, 1970) .

[3] A notable exception is Krichel and Levine, 1997, although they address a different question, and Levine, 1999. The latter paper is quite similar to mine, although there are some important differences: for instance, in this paper I allow capital to adjust freely, while Levine assumes it to be constant.

The paper proceeds as follows. The following section introduces the formal model. Section 3 discusses the issue of the presence of an incentive to migrate determined by the presence of different wage rules in the labour market. In order to analyse the issue more formally, a linearised version of the model is presented. Section 4 addresses the issue of the effect of migration on aggregate employment and output. Section 5 is devoted to analysis of the consequences in the framework used of a capital flow between regions. Section 6 presents a numerical simulation of the model to shed light on issues left unresolved by the formal analysis. Section 7 contains some concluding remarks.

2 The model

As will be seen, the model is quite standard: the world depicted consists of two regions with the same technology and the same endowment of production factors. One region, called South, is denoted by the subscript S, while the other region, called North, is denoted by the subscript N. There are n identical firms which use a Cobb-Douglas technology to produce a single good Y, employing only two production factors: capital, K, and labour, L. The firms are distributed across the national territory so that a portion ω_S of them are located in the South while a portion ω_N are located in the North.[4] The production function of the typical firm operating in the South is:

(1) $$Y_{Si} = L_{Si}^{\alpha} K_{Si}^{1-\alpha}$$

Likewise the typical firm operating in the North has a production function defined as :

(2) $$Y_{Ni} = L_{Ni}^{\alpha} K_{Ni}^{1-\alpha}$$

Assuming that each firm believes that it has a negligible influence on the aggregate amount of employment, the maximization of profit entails that:

(3) $$w_{LS} = \alpha L_S^{\alpha-1} K_S^{1-\alpha}$$

(4) $$w_{LN} = \alpha L_N^{\alpha-1} K_N^{1-\alpha}$$

(5) $$r_S = (1-\alpha) L_S^{\alpha} K_S^{-\alpha}$$

(6) $$r_N = (1-\alpha) L_N^{\alpha} K_N^{-\alpha}$$

where w_{LG} and r_G respectively indicate the wage and interest rate in region G, with G=S,N,

At the beginning of the period each worker must decide whether or not to migrate: if s/he does, s/he may obtain the following expected income:

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[4] In truth, in the rest of the paper it is assumed that firms are distributed symmetrically across the country, so that $\omega_{S=}\ \omega_N$.

(7) $$Y_{mig} = (1 - \frac{U_{LN}}{OL_N + mig})w_N + \frac{U_{LN}}{OL_N + mig} wd - pc$$

where where Ol_G, Ul_G and $\omega_G nL_G$ respectively denote the labour supply, unemployment and aggregate labour demand in region G, with G=S,N, and mig denotes the migration of labour from the South to the North of the country and pc is the personal cost connected to the decision to migrate, while wd is the income received in the case of unemployment, which is assumed to be uniform throughout the country. $(1 - \frac{U_{LN}}{OL_N + mig})$ is the employment rate, and is taken to be indicative of the probability that the worker will find employment once s/he has emigrated.[5] If the potential migrant decides to remain in his/her region of origin, s/he may expect the following income:

(8) $$Y_{ori} = (1 - \frac{U_{LS}}{OL_S - mig})w_S + \frac{U_{LS}}{OL_S - mig} wd$$

Assume that all individuals display the same features and that they differ only in the irrecoverable costs arising from the decision to migrate. Assume also that the costs deriving from the decision to migrate are evenly distributed among the population with support [0,c]. It thus becomes possible to calculate the percentage of the population which emigrates:

$\frac{mig}{OL_S} = \int_0^{[Y_{mig} + pc - Y_{ori}]} \frac{1}{c} ds$ and therefore:

(9) $$\frac{mig}{OL_S} = \frac{1}{c}\left[(1 - \frac{U_{LN}}{OL_N + mig})w_{LN} - (1 - \frac{U_{LS}}{OL_S - mig})w_{LS} + (\frac{U_{LS}}{OL_S - mig} - \frac{U_{LN}}{OL_N + mig})wd\right]$$

After the decision of migrating has been taken, is always true that:

(10) $$OL_S - mig - \omega_S nL_S = U_{LS}$$

(11) $$OL_N + mig - \omega_N nL_N = U_{LN}$$

Equilibrium in the capital market and the hypotheses of perfect capital mobility and a perfectly flexible interest rate impose the condition rs = rn and

(12) $$\omega_S nK_S + \omega_N nK_N = K$$

where K is the capital endowment of the entire area.

Finally, wages are assumed to be not perfectly flexible and inversely dependent on the unemployment rate:

(13) $$w_{LS} = f_S(\frac{U_{LS}}{OL_S - mig})$$

[5] It is assumed that migrants have the same chances of finding work as natives.

(14) $$w_{LN} = f_N\left(\frac{U_{LN}}{OL_N + mig}\right)$$

with $f'_G < 0$ with G = N,S [6].

Equations 3-9 and 12-14 present a model where the exogenous variables are the labour supply in the two areas, the infraregional distribution of firms, and the overall capital endowment. It is thus possible to determine the level of migration, equilibrium employment in the firms located in the two regions, aggregate regional employment, as well as unemployment and wages in the two areas.

3 Wage flexibility and the decision to migrate

Were wages perfectly flexible and capital free to move without cost, there would be no incentive for labour to migrate between two countries using an identical technology. In such a world, in fact, the labour force would be fully employed in both countries, and the only reason for migration, even in the presence of very low migration costs, would be a difference in wages between the two countries. It is equally evident that in the presence of perfectly mobile capital, wages in the two countries would be identical even if there were a difference in the supply and/demand for labour in the two countries, and this would remove any incentive for migration. If there were, for example, greater demand in one country, this would reduce the capital/labour ratio in that country, causing capital to shift towards the other country, in which there is a higher capital/labour ratio and therefore greater remuneration of capital. The mobility of capital would therefore give rise to a harmonisation of the capital/labour ratio in the two countries and therefore to identical wages even if the labour demand and/or supply were distributed non-homogeneously between them:

$$r_S = r_N \Rightarrow k_S = k_N \Rightarrow w_S = w_N \text{ where } k_G = \frac{K_G}{L_G} \text{ with } G = N, S$$

On the other hand, if wages are non market clearing ones but endogenously determined by the unemployment rate, the assumption of perfect capital mobility is no longer sufficient to eliminate every incentive to migrate in a world in which wages are endogenously determined by unemployment rates and regions share the same technology [7]. If an inverse of the wage function exists, we have:

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[6] For discussion on justification and interpretation of wage functions of this type see, for example, Layard et al., 1991.

[7] It has been already shown that perfect capital mobility does not eliminate the incentive to migrate in the case in which there are differences in the levels of technology (see, for example, Galor and Stark, 1991).

$$\frac{U_{LS}}{OL_S - mig} = f_S^{-1}(w_S) \quad \text{and} \quad \frac{U_{LN}}{OL_N + mig} = f_N^{-1}(w_N)$$

Substituting these relations in the migration equation yields:

$$(15) \qquad mig = \frac{1}{c}\left[w_N - w_S + ws * f_S^{-1}(w_S) - w_N * f_N^{-1}(w_N)\right]$$

Proposition 3.1. If the presence of perfectly mobile capital is to eliminate the incentive to migrate, labour market rules must be identical in the two countries, so that f_S is equal to f_N.

Conversely, it is interesting to note that the presence of a different institutional framework for the labour market, and therefore a different functional link between unemployment and wage rates in the two countries, is an entirely independent reason for migration, even in a context where there is a wholly symmetric distribution of labour demand and supply and in which capital is perfectly mobile and therefore able to equalize the capital/labour ratio in the two countries. This outcome has important consequences regarding, for example, the creation of a single capital market in Europe. The free circulation of capital and the existence of a single currency will not cause the disappearance of the incentive to migrate in the presence of a different degree of wage elasticity to unemployment. Vice versa, the obstacle raised against intra-European migration by its high monetary and non-monetary costs may be an independent reason for an increase in aggregate European unemployment when a different degree of wage flexibility makes it desirable.

3.1 The model in linear form

In order to prove proposition 3.1, the previous model has been linearised. Starting from equation 13), we linearise it around equilibrium and divide both terms by $\overline{w}_{LS}$ (the value of wages in equilibrium) to obtain:[8]

$$(16) \qquad \frac{w_{LS} - \overline{w}_{LS}}{\overline{w}_{LS}} = \frac{f'_S(\frac{\overline{U}_{LS}}{\overline{O}_{LS}})}{\overline{O}_L \overline{w}_{LS}}(U_{LS} - \overline{U}_{LS})$$

which can be rewritten as

The novelty of the present approach is that the assumption of different technology levels is no longer necessary when labour market institutions are different.

[8] For the sake of simplicity, I assume that this initial equilibrium is characterised by perfect symmetry among regions, i.e. $\overline{w}_{LS} = \overline{w}_{LN} = \overline{w}$, $\overline{K}_S = \overline{K}_N = \overline{K}$, $\overline{L}_S = \overline{L}_N = \overline{L}$, $\overline{O}_{LS} = \overline{O}_{LN} = \overline{O}_L$; moreover I will assume that unemployment is zero in both regions, i.e. $\overline{U}_{LS} = \overline{U}_{LN} = 0$ and consequently that migration is nil as well.

(17) $$\tilde{w}_{LS} = \eta_S \frac{1}{\overline{O}_L} \tilde{U}_{LS}$$

where $\tilde{w}_{LS} = \frac{w_{LS} - \overline{w}_{LS}}{\overline{w}_{LS}}$, $\tilde{U}_{LS} = (U_{LS} - \overline{U}_{LS})$ and η_S is the semi-elasticity of wages with respect to the unemployment rate. Likewise, we have that

(18) $$\tilde{w}_{LN} = \frac{\eta_N}{\overline{O}_L} \tilde{U}_{LN}$$

Table 1 presents the model in linear form in full.

Table 1 The model in linear form

(17)	$\tilde{w}_{LS} = \eta_S \frac{1}{\overline{O}_L} \tilde{U}_{LS}$
(18)	$\tilde{w}_{LN} = \frac{\eta_N}{\overline{O}_L} \tilde{U}_{LN}$
(19)	$-(1-\alpha)\tilde{L}_S + (1-\alpha)\tilde{K}_S - \tilde{w}_{LS} = 0$
(20)	$-(1-\alpha)\tilde{L}_S + (1-\alpha)\tilde{K}_S - \tilde{w}_{LS} = 0$
(21)	$\alpha\tilde{L}_S - \alpha\tilde{K}_S - \alpha\tilde{L}_N + \alpha\tilde{K}_N = 0$
(22)	$\omega_S n\overline{L}\tilde{L}_S + m\tilde{i}g + \tilde{U}_{LS} - \tilde{O}_{LS} = 0$
(23)	$\omega_N n\overline{L}\tilde{L}_N - m\tilde{i}g + \tilde{U}_{LN} - \tilde{O}_{LN} = 0$
(24)	$\omega_S n\overline{K}\tilde{K}_S + \omega_N n\overline{K}\tilde{K}_N - \tilde{K} = 0$
(25)	$\frac{c}{\overline{O}_L} m\tilde{i}g - \overline{w}\tilde{w}_{LN} + \frac{\overline{w}}{\overline{O}_L}\tilde{U}_{LN} + \overline{w}\tilde{w}_{LS} - \frac{\overline{w}}{\overline{O}_L}\tilde{U}_{LS}$

Note: labour force employed, capital, wages, are measured as proportional deviations from equilibrium ($\tilde{x} = \frac{x - \overline{x}}{\overline{x}}$), while the other variables are measured as deviations from equilibrium ($\tilde{x} = x - \overline{x}$).

We now suppose that there is an exogenous shock with an increase in the labour force size in the southern region. It can be easily shown that the effect of this change on migration is equal to

(26) $$\frac{dm\tilde{i}g}{d\tilde{O}_{LS}} = \frac{\overline{O}_L \overline{w}(1-\alpha)(\eta_N - \eta_S)}{c\left[(1-\alpha)\overline{O}_L(\eta_N + \eta_S) + \overline{L}n\eta_N\eta_S\right]}$$

As already noted, in the presence of perfect capital mobility, the equalization of the capital-labour ratio should render migration independent of the distribution of the labour force among regions: an increase in the southern labour force would only require a transfer of capital from North to South to equalize the capital-labour ratio. The present analysis shows that this is not a general result when wages are not perfectly flexible; it is true if and only if $\eta_N = \eta_S$, i.e. when the two regions display identical semi-elasticity of wages with respect to the unemployment rate. In other words, the presence of a difference in the rules that determine

wages – for example, due to different institutional settings or due to a different role played by the unions – is an independent reason for an incentive to migrate to emerge and determine a migration equilibrium different from zero. It is also easily verified that the migration response to an increase in the southern labour force increases in size if, *ceteris paribus*, the semi-elasticity of wages in the northern region increases, while it decreases if it is the semi-elasticity of wage in the southern region that increases.

Proposition 3.2.: the migration flow is from the region with lower semi-elasticity toward the region with higher semi-elasticity.

The reason is straightforward: with perfect capital mobility we have equal wages in the two regions, therefore the incentive to migrate is entirely determined by the different unemployment rate, but this latter is greater in the region with lower semi-elasticity of wages. In fact, unemployment increases in both regions as result of the increase in the labour force of the southern region. However, the increase is higher in the region with lower semi-elasticity than it is in the region with higher semi-elasticity of wages:

$$\frac{d\tilde{U}_{LS}}{d\tilde{O}_{LS}} - \frac{d\tilde{U}_{LN}}{d\tilde{O}_{LS}} = \frac{\overline{O}_L(1-\alpha)(\eta_N - \eta_S)}{\left[(1-\alpha)\overline{O}_L(\eta_N + \eta_S) + \overline{L}n\eta_S\eta_N\right]} \tag{27}$$

Therefore, there must be a positive migration from the region with the lower semi-elasticity toward the region with the higher one if the incentive to migrate is to be eliminated.

Finally, this result can shed some light on the consequences of the creation of a single capital market between two countries. If there are different institutional features in the labour markets which determine a different responsiveness of wages to unemployment rates, the liberalization of capital markets and perfect capital mobility cannot be viewed as a perfect substitute for labour mobility. This may be of some interest to the European countries.

4 Wage flexibility, migration and employment

It is well known that migration is unable to affect aggregate employment by merely redistributing employment from one region to another. The effect of migration on aggregate employment is obtained in these models by generally assuming the existence of external economies of scale in the more advanced sector (see among others Reichlin - Rustichini, 1998). What can be shown using the present analytical framework is that differences in the workings of labour markets and specifically, in our context, a difference in the semi-elasticity of wages with respect to the unemployment rate are sufficient to determine a migration effect on aggregate output and employment without assuming any form of external economy.

In order to analyze the topic, I introduce two simplifications. The first considers migration to be a policy variable; this assumption has no consequences in terms of loss of generality. The second simplification is somewhat less neutral in terms of generality: I shall

assume, in fact, that capital is held constant. With a certain amount of imagination, we may conceive this as a short run version of the previous model.[9] On the other hand, the loss of generality will appear to be more hypothetical than effective when the results of the numerical simulation of the complete model are presented

The migration flow will decrease wages ($\frac{d\tilde{w}_N}{dm\tilde{i}g} = -\frac{(1-\alpha)\eta_N}{\overline{O}_L(1-\alpha)+\frac{\overline{L}n\eta_N}{2}}$) and consequently increase employment ($\frac{d\tilde{L}_N}{dm\tilde{i}g} = \frac{\eta_N}{\overline{O}_L(1-\alpha)+\frac{\overline{L}n\eta_N}{2}}$) in the North, while it will increase wages ($\frac{d\tilde{w}_S}{dm\tilde{i}g} = \frac{(1-\alpha)\eta_S}{\overline{O}_L(1-\alpha)+\frac{\overline{L}n\eta_S}{2}}$) and decrease employment in the South ($\frac{d\tilde{L}_S}{dm\tilde{i}g} = -\frac{\eta_S}{\overline{O}_L(1-\alpha)+\frac{\overline{L}n\eta_S}{2}}$). These various effects clearly depend on the value of semi-elasticity: the higher the latter, the greater in absolute value the former will be. Likewise, these effects, although symmetric in direction, are not symmetric in magnitude, unless the values of the two semi-elasticities are the same. This means that if $\eta_N > \eta_S$ the reduction in northern wages is larger than the increase in southern wages, and also that the increase in employment in the North is greater than its reduction in the South.

Proposition 4.1. Migration has an effect on aggregate output even in the absence of economies of scale when there is a difference in the semi-elasticity of wages with respect to the unemployment rate.

Proof: it can be straightforwardly verified that,

$$(28) \qquad \frac{d\tilde{Y}_A}{dm\tilde{i}g} = \overline{Y}\left(\frac{d\tilde{Y}_N}{dm\tilde{i}g} + \frac{d\tilde{Y}_S}{dm\tilde{i}g}\right) = \overline{Y}\,\frac{\overline{O}_L(1-\alpha)\alpha(\eta_N-\eta_S)}{\left(\overline{O}_L(1-\alpha)+\frac{\overline{L}n\eta_N}{2}\right)\left(\overline{O}_L(1-\alpha)+\frac{\overline{L}n\eta_S}{2}\right)}$$

where $\tilde{Y}_A = (Y_A - \overline{Y}_A)$, $Y_A = Y_S + Y_N$ and $\overline{Y} = \overline{Y}_S = \overline{Y}_N$

Therefore, in our framework the presence of a difference between the semi-elasticities of wages with respect to the unemployment rates of the two regions is sufficient to induce the non-neutrality of aggregate employment with respect to migration even in the absence of any economies of scale.

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[9] Since there is only physical capital in our world, the hypothesis seems less 'heroic' than if financial capital were present.

Proposition 4.2. The sign of the change in output is the same of $(\eta_N - \eta_S)$

Proof: it follows immediately from (28).

It is interesting to note that the sign of this effect will depend on the direction of the migration flow: if migration is from the country with lower semi-elasticity toward the one with higher semi-elasticity, aggregate output and employment will increase, while they will decrease in the case of the opposite migration flow. Moreover, it is evident that the values of the semi-elasticities affect the size of the effect as well: the latter will increase with the increase in η_N and will decrease with the increase in η_S.

This is a quite important result. It is well known in the literature on migration that the private decision to migrate quite often proves not to be optimal from the social point of view: this is due to the fact that each individual potential migrant is ignorant of the macroeconomic relationship that links migration to the probability of finding a job. Therefore, the social costs and social benefit of migration are not equated at margin. This paper shows another cause of inefficiency: the migration of a worker from the region with lower semi-elasticity towards the region with higher semi-elasticity of wages generates an external effect represented by the effect on average wages in the entire area.

5 Capital flows, migration, wage flexibility and employment

This section analyses the role of capital flows and their effects on employment and output. In order to isolate the effect of capital flows, I first assume that capital markets in the two regions are separated and then consider the effect on output and employment of a positive flow of capital from one region to the other. Because I have chosen a equilibrium point which linearises the model around, characterised by a perfect symmetry, as far as technology and factor endowment are concerned, this hypothesis does not imply an important loss of generality.

If we assume that the two semi-elasticities have the same value, even if we assume perfect capital mobility no capital flow will emerge. Likewise, were the two capital markets separated, and capital assumed to be immobile, an identical capital-output ratio and identical factor prices will arise even in the absence of effective capital mobility. By contrast, once we allow for a difference in the semi-elasticities, I have already shown that the unemployment rate is higher in the lower semi-elasticity country; therefore a flow of capital from the latter to the higher semi-elasticity country is necessary to restore the equality of the capital-labour ratio. If the two capital markets are separated and capital is immobile, the lower capital-labour ratio in the higher semi-elasticity region will give rise to a higher interest rate in this region (in the simple model presented here, we have $\frac{r_S}{r_N} = \left(\frac{K_N / L_N}{K_S / L_S} \right)^{\alpha}$).

The aim of this section is to analyze the effect of this capital flow on employment and output and the relationship, if any, of this effect with migration flows. For this purpose, the effect of an increase of capital (i.e. dK_N) of one region followed by an equal decrease of capital from the other region (i.e. $dK_S = - dK_N$) will be analyzed as if it were an autonomous change occurring between two regions in which capital is immobile.

As expected, a flow of capital from the lower semi-elasticity region, the southern one, to the region with higher semi-elasticity, the northern one, will increase unemployment in the former and reduce it in the latter.

$$\frac{d\tilde{U}_{LS}}{d\tilde{K}_N} = \frac{c\bar{O}_L \bar{L}(1-\alpha)\left(\bar{O}_L(1-\alpha) + \frac{\bar{L}n\eta_N}{2}\right)}{\bar{K}A} \quad \text{and} \quad \frac{d\tilde{U}_{LN}}{d\tilde{K}_N} = -\frac{c\bar{O}_L \bar{L}(1-\alpha)\left(\bar{O}_L(1-\alpha) + \frac{\bar{L}n\eta_S}{2}\right)}{\bar{K}A}$$

where $$A = \left\{ \left(\bar{O}_L(1-\alpha)\right)^2 \left[c\bar{O}_L + \bar{w}(2+\eta_S+\eta_N)\right] + \frac{\bar{L}(1-\alpha)}{2}\left[c\bar{O}_L(\eta_S+\eta_N) + \bar{w}(2\eta_S\eta_N+\eta_S+\eta_N)\right] + \frac{c\bar{L}^2 n^2 \eta_S \eta_N}{4} \right\}$$

The interesting point is that these effects are symmetric in sign but not in size, so that we can state the following proposition

Proposition 5.1: the sign of the effect of a capital flow, defined as above, on aggregate unemployment (output) depends on its direction; if it is from the lower to the higher semi-elasticity region, aggregate unemployment will increase (decrease) and vice-versa if the capital flows in the opposite direction

In fact, it is easily shown that $\frac{d\left(\tilde{U}_{LS} + \tilde{U}_{LN}\right)}{d\tilde{K}_N} = \frac{\frac{c\bar{O}_L \bar{L}^2 n(1-\alpha)}{2}(\eta_N - \eta_S)}{\bar{K}A}$. This result can be more easily understood if we consider that moving capital from southern towards northern region will increase marginal labor productivity, and then wages, in the latter region while decreasing it in the former region. Since the semi-elasticity of wage with respect to the unemployment rate is lower in the South, this implies that the southern unemployment rate decreases relatively more than the northern one increases. On the other hand, the increase in southern unemployment is perfectly compensated for by the decrease in northern unemployment, and the aggregate effect is null if and only if the semi-elasticities are the same.

Some remarks are in order. Firstly, when two regions are identical in every respect apart from the labour market, and they display a different semi-elasticity of wage with respect to unemployment rate, and they open each other up to factor movements, capital and labour will flow from the region with lower semi-elasticity to the other one. It is interesting to note, however, that while the labour movement – that is, migration – has a positive effect on aggregate unemployment and output, capital movement has a negative effect on these aggregate variables. In other words, creating a single capital market between two regions/countries which

are almost similar but different as far as the response of wage to unemployment is concerned, may have a cost in terms of capital misallocation. Capital responds to private incentives – that is, higher interest rates – and moves toward the higher semi-elasticity region, but it creates a social cost represented by lower aggregate output. Naturally, this result should be interpreted with care: firstly because the result cannot be surprising since it is merely an application of the second best theorem; secondly because the sole reason for capital to move, in the present framework, is the difference in the semi-elasticity of wage.

More interestingly, the aggregate effect of capital movement depends, among other things, on the migration costs, c, and therefore on the size of migration. Specifically, we have

$$\frac{d\tilde{U}_{LS} \big/ d\tilde{K}_N}{dc} = \frac{\frac{\bar{L}n}{2}\left[\bar{w}\bar{O}_L{}^2\bar{L}(1-\alpha)^3(\eta_N-\eta_S)(2+\eta_N+\eta_S)+(2\eta_N\eta_S+\eta_N+\eta_S)\right]}{(\bar{K}A)^2};$$

this means that the costs in terms of aggregate unemployment will depend on the degree of labour mobility. If migration costs were high, labor mobility would be low and wages would have to change more in order to reach equilibrium, and in turn aggregate unemployment would increase more substantially. By contrast, when migration costs are low, labour largely flows from the lower semi-elasticity region toward the higher one, the necessary wages adjustment is less important and aggregate unemployment increases less. It is clearly enough for the value of c to determine the distribution of the adjustment between price adjustment, wages changes**,** and quantity adjustment, labour movement. The higher the latter, the lower the aggregate unemployment variation. In this framework, quantity adjustment is to be preferred from an aggregate point of view since it moves factors from a less efficient system to a more efficient one. At the limit when labour is perfectly (that is, costlessly) mobile (c=0), there will be only quantity adjustment, and the labour movement caused by the outflow of capital will be equal to $\frac{d\tilde{m}\tilde{i}g}{d\tilde{K}_N} = \frac{\bar{L}}{\bar{K}}$, that is, perfectly proportional to the capital-labour ration existing in the initial equilibrium. Therefore capital outflow has no effect on wages, and unemployment changes are perfectly symmetric in size, leaving the aggregate unemployment rate unchanged.

The other polar case is interesting as well; by letting $c \to \infty$, we can analyze the case of perfect labour immobility – migration is nil. In this case both the wage gap and aggregate unemployment reduction is at the maximum, and specifically:

$$\frac{d\left(\tilde{U}_{LS}+\tilde{U}_{LN}\right)}{d\tilde{K}_N} = \frac{\frac{\bar{O}_L n\bar{L}^2(1-\alpha)}{2}(\eta_N-\eta_S)}{\bar{K}\left(\bar{O}_L(1-\alpha)+\frac{n\bar{L}\eta_N}{2}\right)\left(\bar{O}_L(1-\alpha)+\frac{n\bar{L}\eta_S}{2}\right)}$$

In previous sections of the paper I have shown that perfect capital mobility cannot be viewed as a perfect substitute for labour mobility and that the existence of obstacles to labour mobility may be costly in terms of aggregate output when the labour market institutions in the two regions are different; this is reflected in different semi-elasticities of wage with respect to unemployment. With the care made necessary by the shortcomings of the approach, the results of the present section moves the analysis forward: not only is it the case that capital mobility cannot perfectly substitute for labour mobility, but it may even be counterproductive as far as aggregate employment and output are concerned. Interestingly, the size of this counter-productive effect will depend on the size of the migration costs and therefore on the size of migration. Moreover, there are also redistributive effects; when capital markets are integrated in the region/country in which a less efficient labour market operates – that is, the region/country with lower semi-elasticity of wage with respect to the unemployment rate and which incurs employment and output costs while the other region/country sees its employment and output rise.

6 Numerical simulation

The previous sections have presented and discussed the results obtainable by analytically studying the model. Some questions are still open, however, and further information can be obtained by numerically simulating the model. The evident shortcoming of numerical analysis is that the results cannot be considered to be general, but they are contingent on the numerical values of the parameters. In the case presented here, however, this limitation does not seem particularly important, since the simplicity of the model reduces the number of arbitrary parameters. Table 2 presents the values of the parameters that will not be changed during the simulation experiment.

Table 2 Parameters values

Production sector			Labour supply	Aggregate capital
α= 0.67	ni=10	$\omega_S=\omega_N=0.5$	$O_{LS}=O_{LN}=4$	$\tilde{K}=100$

The number of firms, n, in fact, has no effect other than determining the size of the single firm, which is not of interest here, and it does not influence migration and the other aggregate variables. Both the capital stock and the labour forces are slightly more than scale parameters able meaningfully to modify the relative factor prices but unable to influence the aggregate variables to a significant extent. Therefore the only free parameter is the value of α in the production function. The value that I have chosen is in line with the value used in other empirical studies, and it is entirely reasonable since it implies a labour share of 0.67: a value amply confirmed empirically. It will be shown below that value the main result of the first part

of the paper – the effect of migration on output – is robust also when wide variations of the previous parameters are considered.

6.1 Migration and output

This section presents the effect of migration on output. It relaxes the assumption that migration is a policy instrument, controlling instead for change in output when migration costs decrease. In what follows I shall assume that the semi-elasticity of wages is greater in the northern region than in the southern one $-\eta_S = -1.86$ and $\eta_N = -2.7$. Clearly, migration, computed as a proportion of the southern labour force, increases with the decrease in migration costs (figure 1). Moreover, despite the absence of any external effect, the increase in migration has a positive effect on aggregate output (figure 2) This behaviour confirms the result obtained in the previous section by algebraically solving the model; in this case, however, there are no restrictions on capital, which is free to move among regions. Capital, in fact, moves from South to North in the same direction as labour, ensuring the equality of the capital-labour ratio (figure 3). The increase in aggregate output is clearly due to the fact that moving labour from the region with less semi-elasticity to the region with high semi-elasticity reduce wages (4), and it in turn reduces the inefficiency caused by the imperfect flexibility of wages increasing the aggregate unemployment rate (figure 5).

Figure 1

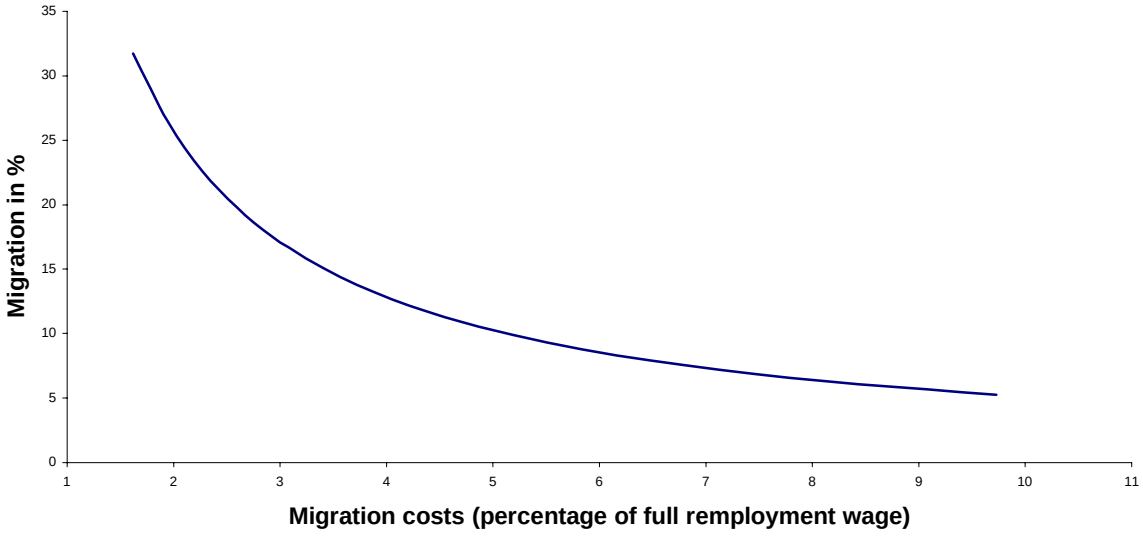


Figure 2

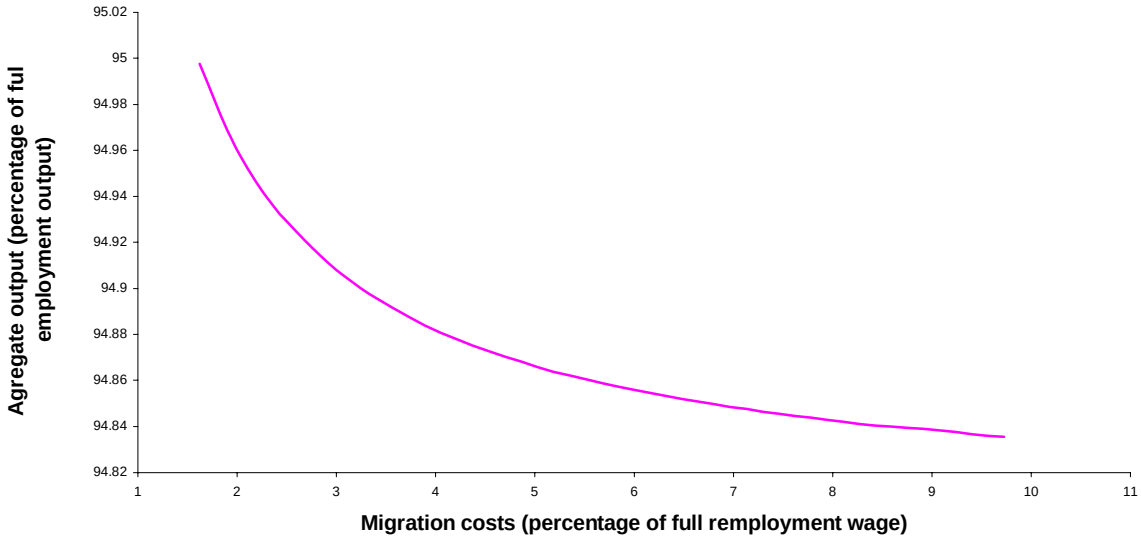


Figure 3

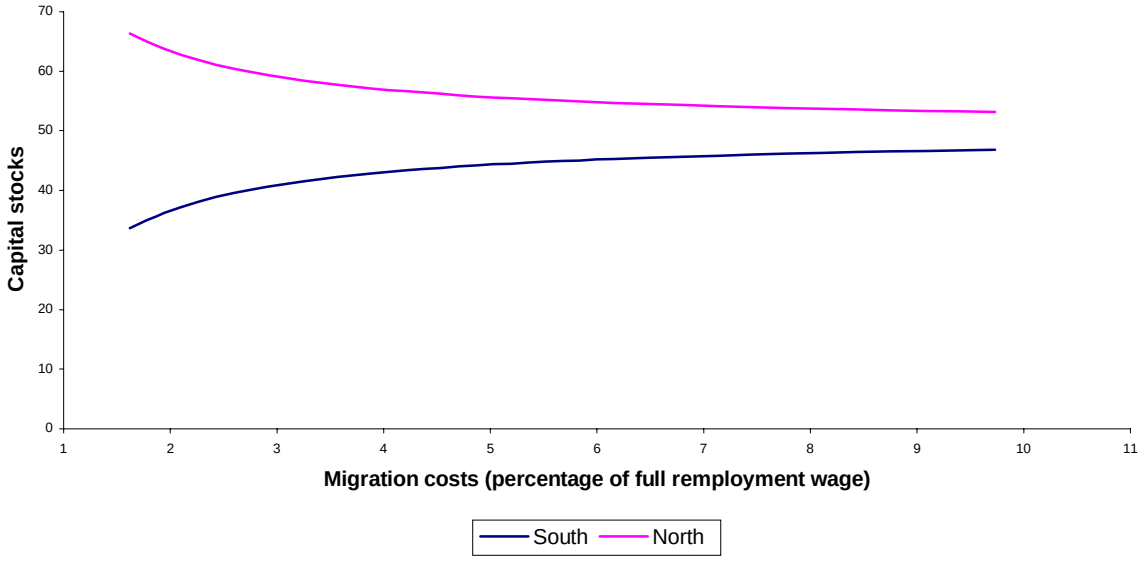


Figure 4

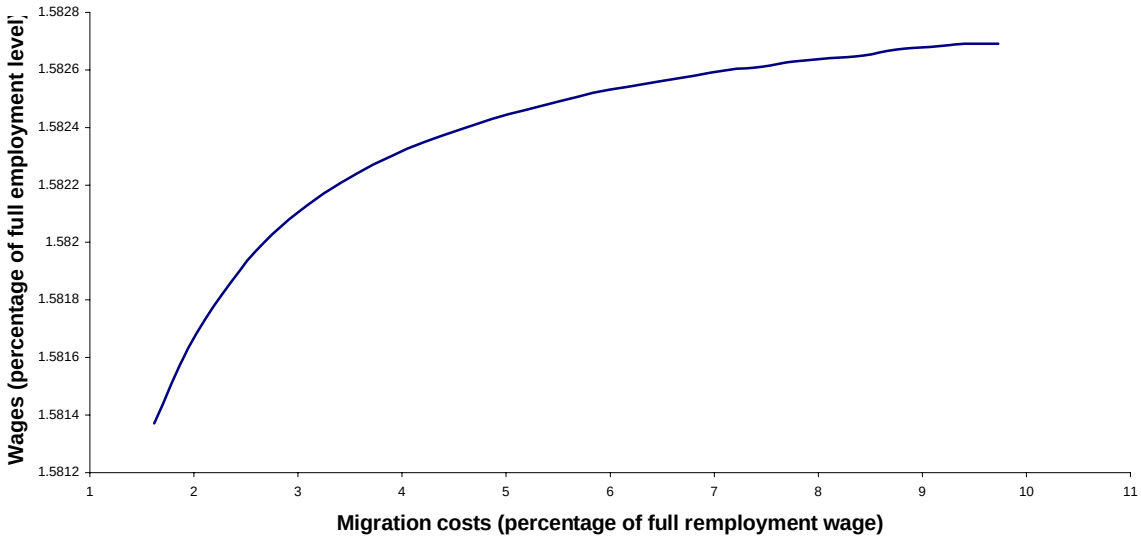
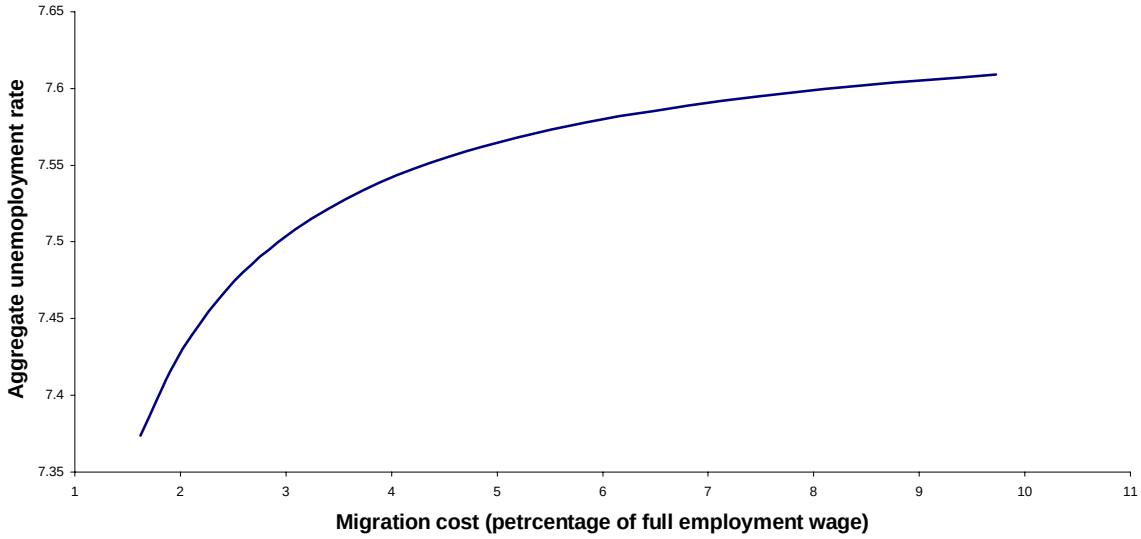


Figure 5



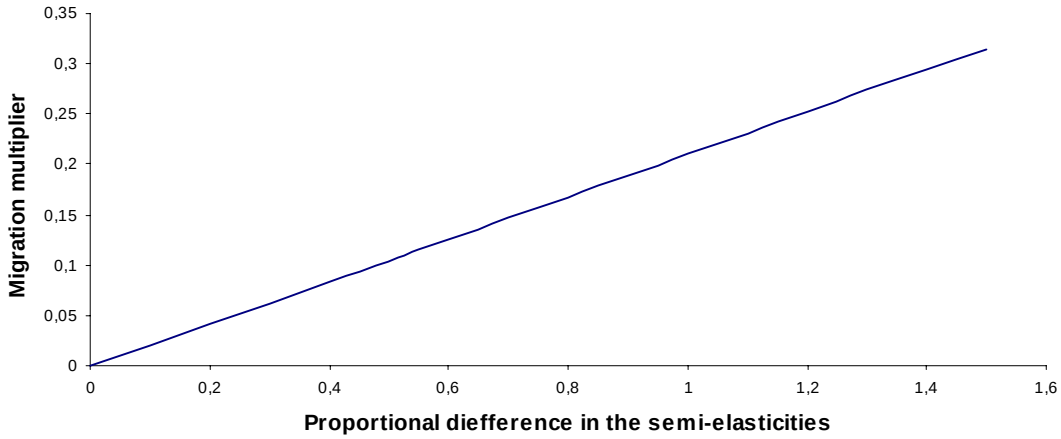
In addition, it should be noted that per capita output is reduced by the increase in migration in both regions; however it rises in aggregate terms because the population of the richer region increases.

The effect of migration on aggregate output can be analyzed by considering a value of what can be called the migration multiplier ($\mu = \frac{dY_A}{dmig}$). This value provides a numerical evaluation of the increase in output that follows an increase in migration.

It is interesting to note that the value of the migration multiplier increases with the increase in the proportional difference in the semi-elasticity of wages with respect to unemployment rates. The greater the latter, the higher the value of the migration multiplier will be: that is, the higher the effect of an increase of migration on output will be. Figure 6 shows the change in the migration multiplier when the value of the proportional differences in the semi-elasticities is changed. In other words, the ability of migration to affect aggregate output depends on $\frac{\eta_N - \eta_S}{\eta_S}$.The relationship seems to be almost linear.

In order to verify the robustness of the results when the parameters presented in table 2 are modified, given in table 3 is the value of the *migration multiplier*, that is, of the effect of migration on aggregate output when different values of the cited parameters are considered. It is evident that the result of interest to us, namely the effect of migration on aggregate output, preserves its sign with respect to the baseline case (presented in the first row), and its magnitude too is very slightly affected by ample variation of the original parameters.

Figure 6



On the other hand, the positive effect of migration on output increases with the increase in the value of α; that is, the higher the productivity of labour, the greater the effect on output by the transfer of labour from the region with low semi-elasticity to the region with high semi-elasticity. The explanation is straightforward: the higher α is, the greater the effect on an increase of aggregate employment on output.

Table 3 Migration multiplier with different values of parameters

Values of parameters	μ
$\eta_S = -1.86 \;\; \eta_N = -2.79$	0.0747
$\eta_S = \eta_N$	0
$\alpha = 0.675$	0.0751
$O_{LN} = 4.1, O_{LS} = 3.9$	0.0746
$O_{LN} = 3.9, O_{LS} = 4.1$	0.0748
$\tilde{K} = 105$	0.0766

Likewise, it is self-evident that an asymmetric initial distribution of the labour force will slightly increase the value of multiplier when it is the southern region that is most populated and trivially reduce it when it is the northern region that is the most populated. A higher capital stock increases the multiplier by making employment more productive, and the reverse is the case when the total capital stock is lower.

More generally, it is evident that the result which interests us – the effect of migration on output – appears to be robust when the initial parameters are perturbed. [10]

6.2 Numerical simulation: is capital mobility always desirable in the presence of imperfect labour mobility?

It is generally argued that capital mobility is always desirable. Although this statement has been questioned when some of the standard assumptions are relaxed, it appears difficult to dispute in a standard neoclassical framework like the one presented in this paper. However, in this section I present a simple counter-example to this widely accepted statement: capital mobility may be undesirable when there are high costs to labour mobility.

First of all, table 4 shows the simulation results for the most interesting variables when different assumptions on factor mobility are employed.[11]

The first column of the table 4 shows the case in which neither capital nor labour can cross the regional borders. Given the co-presence of a different wage function and of factor immobility, wages (row 3 of table), the unemployment rates (row 7), and interest rates (row 4) are different in the two regions. If the distribution of capital stocks between regions is symmetrical, we obtain the result shown in the table: that is, wage and unemployment rate are

[10] In the table the perturbation of parameter was indeed minimal in order to preserve comparison with the baseline case. But the model appear to be stable and the value of migration multiplier remains positive for almost any reasonable values assigned to the cited parameters.

[11] The values of the parameters are those of table 2 with c = 0.1, $\eta_S = -1.86$ and $\eta_N = -2.79$.

higher in the South while the interest rate is lower.[12] Consequently, per capita output is lower in the southern region (row 2). The second column of table 4 shows the case in which capital is mobile while labour remains immobile. Being free to move, capital will flow from the region with low semi-elasticity of wages with respect to the unemployment rate to the region with high semi-elasticity (row 2 of the table), equalizing the price of production factors in the two regions at an intermediate level with respect to values of the previous case. Note that while the wage in the South is lower under free capital mobility, the unemployment rate is higher because there is less capital to work with. The movement of capital from the southern region to the northern one (row 6 of the table) has equalized the factor price, but in the absence of labour mobility, it has increased the gap in the unemployment rate and also the aggregate unemployment rate.

Table 4

		Capital immob. Labour immob.	Capital mobility Labour immobility	Capital immob. Labour mobility	Capital mobility Labour mobility
Aggregate output		16.721	16.713	16.733	16.778
Regional per capita output	N	2.127	2.154	2.101	2.148
	S	2.053	2.024	2.082	2.018
Wages	N	1.602	1.617	1.588	1.614
	S	1.631		1.645	
Interest rate	N	0.056	0.0551	0.057	0.0553
	S	0.054		0.053	
Labour per firms	N	0.711	0.713	0.731	0.869
	S	0.675	0.670	0.657	0.524
Capital per firms	N	10	10.311	10	12.479
	S	10	9.689	10	7.520
Unemply. rate in %	N	11.075	10.755	11.399	10.824
	S	15.673	16.133	15.214	16.236
Migration in %		0	0	3.129	21.837

If one considers aggregate output, perfect capital mobility in the absence of labour mobility brings about an aggregate output which is less than in the case where capital is immobile (row 1). More specifically, the second row of the table shows that the increase in northern per capita output is not enough to counterbalance the decrease in southern per capita output.[13] In other words, the observed capital flow has redistributed the output in favour of the region with a more efficient labor market, without augmenting aggregate outcome. An explanation for this result is as follows: capital movement from South to North in response to

[12] As discussed later, other things remaining the same, the assumption on the initial distribution of capital stocks among regions is crucial for obtaining the result of counter-productivity of capital mobility. In fact, it need not to be perfectly symmetrical, but regional capital stocks must be not so different as to reverse the ranking between regional wages.

[13] The result also obtains if we consider income rather than output and assume that the income on capital originally staying in the South continues to go to southern residents.

higher returns has the well-known positive effect of reducing the difference in the capital-labour share, thereby enhancing efficiency. But moving capital from South to the North also has the effect of reducing marginal productivity of labour in the South and increasing it in the North: however, given the fact the semi-elasticity in the South is lower, this implies that the increase in the unemployment rate necessary to ensure wage equilibrium in the South must be relatively bigger than the reduction of the unemployment rate in North necessary to determine an increase in the aggregate unemployment rate and therefore lower aggregate output. This private decision to move capital from the South to the North, therefore, decreases the aggregate outcome, since employment in the southern region decreases more than the northern employment increases. In other words, factor prices are wrongly signalling the necessary factor movement. Since in the present simple model, $\frac{r_S}{r_N} = \left(\frac{K_N / L_N}{K_S / L_S} \right)^{\alpha}$, a necessary condition for this to happen is that the capital-labour ratio must be higher in the southern region before capital mobility is permitted, and therefore that the initial distribution of capital stocks among regions is consistent with this condition. Obviously, the difference in the capital-labor ratio must not be too large, otherwise capital mobility regains its desirability because the positive effect represented by the increase in efficiency overcompensates the negative effect due to the difference in the semi-elasticities. If the initial distribution of capital among regions is symmetrical ($K_N = K_S = 50$) the result is that displayed in table 4, but the same counter-productivity is confirmed when the Southern region is slightly under or over capitalized with respect to the Northern one.[14]

The third column of table 4 shows the case in which only labour is mobile. Although migration is modest with regard to the baseline case of perfect capital mobility (the last row of the table), this labour reallocation reduces the gap between the unemployment rates in the two regions and reduces the aggregate level as well, although it increases the wage gap. Positive migration also reduces the gap between per capita output in the two regions.

The last column of table 4 displays the case in which both capital and labour are mobile - although the usual hypothesis that labour mobility is costly while capital mobility is without cost is employed. This is the baseline case already discussed in the previous section. One also notes that the migration rate is now impressively larger than it was in the case in which capital was immobile: this is explained by observing that capital and labour move in the same direction. Finally, it is interesting to note that migration reduces the gap between regional per capita output levels. Moreover, the sign of the gap is reversed if we consider income rather than output

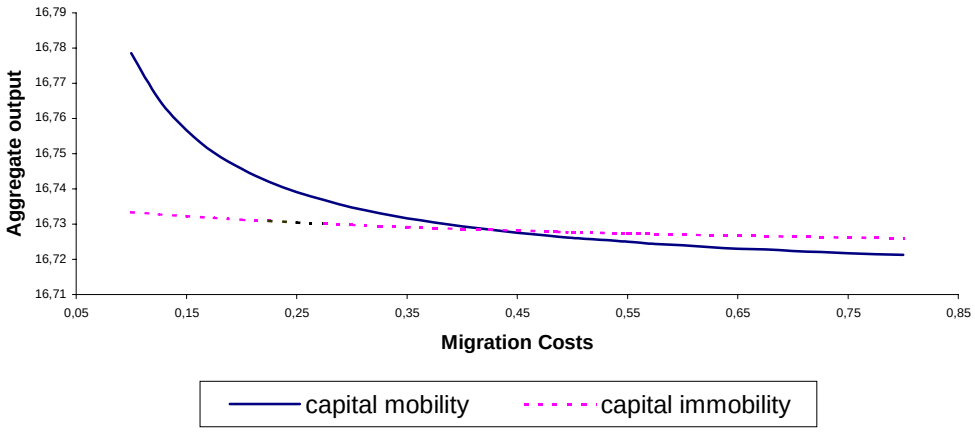
[14] Assuming that the capital of the entire area is still fixed at 100, one notes that the counter-productivity is confirmed when $488.445 < K_S < 55.25$

and assume that the income of capital originally staying in the South continues to go to southern residents.

Clearly, the result of sub-optimality of capital mobility in the presence of labour immobility is not a general one. In order for this result to arise, it is necessary for the wage, and therefore the marginal productivity of labour, to be higher in the southern region than it is in the other region. In turn, it crucially depends, other things remaining equal, on the initial stock of capital present in the two regions.

However, this remark does not undermine the interest of this counter-example which rather than stating a universal result, signals a possible outcome. The example may be of some interest to the European countries which – in that they are quite similar as far as factor endowments and technology are concerned – have formed a single capital market, when there are, however, different institutional rules governing national labour markets and very high migration costs. The foregoing analysis seemingly suggests that the presence of high migration costs may jeopardize, or at least reduce, the advantages represented by the liberalization of capital movement. In particular, it may be quite costly for a country with a lower semi-elasticity of wage with respect to unemployment rates to enter a unified capital market in the presence of high migration costs.

Figure 7



It is thus evident that the existence of an aggregate advantage from capital liberalization depends, ceteris paribus, on the size of migration costs: the higher the latter, the less mobile labour becomes, and the less likely it is that capital liberalization will improve aggregate welfare. In figure 7 aggregate output levels in the case of capital mobility and capital immobility are plotted against different values of migration costs. When migration costs are low, labour mobility is high and capital mobility is to be preferred to capital immobility. On the other hand,

when migration costs are sufficiently high, labour mobility is reduced and capital mobility is undesirable.

7 Concluding remarks

The paper has addressed the issue of the migration decision and migration equilibrium among similar regions when wages are endogenously determined and regions diverge as far as the working of the labour market is concerned. In particular, I have assumed that there is a difference in the semi-elasticity of wages with respect to unemployment rates in the two regions. The literature on migration has paid little attention to this problem, concentrating its analysis on other important determinants of migration. The reason for the choice adopted in this paper is twofold: first, it enables us to readdress some of central questions of the literature on migration by isolating the interesting role played by institutional differences between the labour markets; second, it allows some light to be shed on the consequences of a monetary union among rather similar countries which present, however, crucial differences in the workings of their labour markets. Obviously enough, my argument is not that the presence of a difference in labour markets is the sole or the most important factor in the migration decision. People decide to migrate because the difference in the expected income between the region/country of origin and the region/country of destination exceeds the costs of migration, and the latter can emerge for many causes other than the one considered in the present paper. On the other hand, it seems that the analytical strategy put forward here yields interesting findings not grasped by the existing literature on labour migration.

First, the presence of a different institutional framework for the labour market, and therefore a different functional link between unemployment and wage rates in the two countries, has been shown to be an entirely independent reason for migration, even in a context where there is a wholly symmetric distribution of labour demand and supply and in which capital is perfectly mobile and therefore able to equalize the capital/labour ratio in the two countries. Put differently, if there are different institutional features in the labour markets which determine a different responsiveness of wages to unemployment rates, the liberalization of capital markets and perfect capital mobility cannot be viewed as a perfect substitute for labour mobility.

Second, in the present framework, migration can have effects on aggregate employment and output even in the absence of external economies of scale in the more developed region. It has been shown that differences in the workings of labour markets and specifically, in our context, a difference in the semi-elasticity of wages with respect to the unemployment rate are sufficient to determine a migration effect on aggregate output. The explanation of this result is quite simple: migration, moving labour from less efficient labour markets – that is, those with lower semi-elasticity of wages with respect to unemployment – toward more efficient ones,

increases the overall efficiency of the entire area. An important corollary is that an increase in migration costs has a negative effect on aggregate employment: the greater migration costs are, the greater aggregate unemployment becomes.

Third, when the semi-elasticity of wages with respect to unemployment rates differs between regions, capital and labour tend to move together from the region with lower semi-elasticity toward the region with higher one. However, the paper's results suggest that while labour movement has a positive effect on aggregate employment and output, capital flow, instead, has a negative effect on aggregate output. Moving capital from the southern to the northern region, in fact, will increase marginal labour productivity, and the wage, in the latter region while decreasing them in the former region. Since the semi-elasticity of the wage with respect to the unemployment rate is lower in South, this implies that the southern unemployment rate decreases relatively more than the northern one increases. Moreover, the negative impact of capital flow on aggregate income will depend on the size of migration and therefore on migration costs: the higher migration costs, the smaller the migration, and the larger the effects of capital flow on aggregate employment and output. In this framework, then, capital mobility is not desirable as far as the welfare of the entire area and the welfare of the region with lower semi-elasticity are concerned. On the other hand, a capital flow in the opposite direction to the private one, that is, from the higher semi-elasticity region to the lower one, has a positive effect on aggregate welfare by decreasing aggregate unemployment.

Finally, it is interesting to verify whether policy implications can be drawn from the foregoing analysis. In the model used here, there is a sole cause of inefficiency: the existence of a labour market imperfection which caused the wage to be higher than the level necessary to ensure full employment and unemployment to emerge. Therefore the only reasonable policy prescription should be elimination of this inefficiency by reforming labour markets.

If this first best policy is not available for reasons not discussed here, two main suggestions can be made. The first concerns the region/country with lower semi-elasticity, whose policy makers should carefully assess the advantages of creating a single capital market with another region/country in which the labour market performs more efficiently before reforming their own labour market; and this is especially true if there are major obstacles against labour migration. As far as the entire area is concerned, the present analysis suggests that the overall employment rate may also depend on the degree of labour mobility and then on the level of migration costs. With the necessary caution, this may shed light on the differences in unemployment rates between, for example, the USA and Europe.

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