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Migration: A burden or a blessing for the natives ?*

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Abstract

We analyse the effects of migration on the production of public goods, income taxes, and on the welfare of residents in the sending and in the receiving country. Migration is based on income differences between countries. Different alternative scenarios are considered. In the first, we assume fully flexible wages in both countries and we show that migration is welfare detrimental only for origin country. In the second scenario, wages are rigid. With upward wage rigidity, migration has detrimental effects for natives of the origin country but it brings benefits to the natives of the destination country. Finally, migration can be welfare detrimental for both countries, under downward wage rigidities.

Key words: migration, public goods, income taxes, labor market rigidities.

JEL codes: F2, H2, H4.

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1 Introduction

The present paper is an essay to disentangle in a simple two-period general equilibrium model the welfare effects of migration that takes place due to income differences between countries, and thereby to give an answer to the question: which country loses and which one gains from migration?

One among the most pregnant problems faced by nations are population movements resulting from income differences among countries. When economic circumstances are favourable, rich countries are fond of receiving migrants coming from the poor ones to perform the drudgery that the residents in rich countries are not willing to execute. On the contrary, under recession, when unemployment is present even in prosperous areas, rich countries seem to be reluctant to welcome migrants, in particular because they occupy vacancies no longer available for their own residents. Thus, such population movements impact the economic welfare of residents in both countries, the receiving country and the sending one, but this impact varies according to the economic circumstances characterizing the economic activity. Among these characteristics, one plays a crucial role: the wage rate, and how it reacts to the pressure coming from the excess supply (resp. demand) that migration generates on the labor market. The wage rate itself depends on technological productivity and on the relative rigidity of the labour market when adapting its value to the difference between labour supply and demand. These effects influence the level of public goods supplied in the destination and the origin country and, consequently, the income taxes that have to be levied to finance the production of public goods.

The basic ingredients we have just evoked constitute the building blocks of the model in which we analyze the impact of migration on residents' welfare in the destination and the origin countries. As stressed above, the economic environment matters. How the income tax is selected by the governments and how the wage rate is determined generate several different scenarios. We assume that the income tax in each country is selected by the Government in order to maximize the residents' welfare *via the* production of a public good financed by the tax proceeds. As for the wage rate, several alternative scenarios are considered.

In the first one, it is assumed to adjust in each country instantaneously at its equilibrium value after migration has taken place. In the destination country, a larger labour force is now available so that, with a wage rate at equilibrium before migration, instantaneous adjustment entails a smaller wage rate *ex-post* migration. On the contrary, in the origin country, less workers are now available, and the wage rate has to increase under instantaneous adjustment.

In the second scenario, we assume that the wage rate is rigid and differs at the start from its equilibrium value. Two subcases must immediately be distinguished in this scenario. If the *ex-ante* wage in the destination country is lower than its equilibrium value, there is excess demand on its labour market and there are some unfilled vacancies. These vacancies can then be filled in with migrants arriving from the origin country. On the contrary, when the *ex-ante* wage is higher or equal to its equilibrium value, there is unemployment in the destination country and the arrival of migrants magnifies unemployment. To each of these scenarios corresponds a different impact of migration on the welfare of residents and it is precisely this impact which is analyzed in the following sections.

Our findings are as follows. In the first scenario, when the wage rate adjusts instantaneously to its new

equilibrium value after migration, migration is welfare detrimental for the origin country but welfare improving for the destination country. In the destination country, migration generates at the *ex-post* equilibrium an increase in the public good produced and, accordingly, an increase in the income tax needed to finance this extra public good production. Furthermore, due to the labor market flexibility assumption, the flow of migrants yields a decrease in *per capita* income. These combined effects reflect an overall positive impact on natives' welfare level: the benefit resulting from the higher level of public goods dominates the other two effects. As for the origin country, migration generates an increase in the income tax at equilibrium as well as in the public good level. Simultaneously, instantaneous adjustment of the wage rate entails an increase in the wage rate since less natives are still remaining in the origin country after migration. The overall effect on the residents' welfare in the origin country turns out to be negative: the loss in utility resulting from the increase in the tax rate dominates the benefit resulting from the wage increase, the level of public good remaining invariant.

In the second scenario, we must distinguish whether, before migration, there is excess demand or excess supply of labour at the fixed existing wage rate. In the first case, vacancies are observed in the destination country and arriving migrants can fill in these vacancies. We show that, as a result, immigration is always beneficial for natives in the destination country. This "win-win" solution corresponds to intuition. With excess demand of labour in the destination country, migration from abroad due to income differences between the two countries increases the home production of the public good while it provides a higher net income to the migrants. The result is not so clearcut in the origin country. In fact, assuming upward rigidity of wages, whether migration is beneficial or not in the origin country, depends on the size of the productivity gap between the destination and the origin country.

Going on with the second scenario, with downward rigidity of the wage rate in the destination country, unemployment is initially observed there. We assume that, after migration has taken place, those who work are randomly selected among the natives and the migrants in the new pool of the labour force. We also assume that an unemployment benefit is provided to those who do not find a job. Then we prove that, under downward rigidity of the wage rate, immigration is always welfare detrimental for the natives of the destination country. Thus, in most cases, it seems that migrations are detrimental to both countries: it is only when there is excess demand for labour in the destination country that labour mobility improves the welfare simultaneously in both the receiver and sending countries. In the other cases, natives see a dim when migrants arrive from the origin country or leave their own country to benefit from a higher salary abroad.

The existing literature is detailed in the next section. The model is defined in section 3. Flexible wages are considered in section 4. Rigid wages are analyzed in section 5, with two subsections, downward and upward rigidity. Finally a short conclusion closes the paper.

2 Relation to existing literature

Our approach is devoted to the welfare effects of migration, depending on the labor market rigidities and the governments' choice of the level of public good. By contrast, the existing literature examines the welfare effects of migration as a consequence of *(i)* the type of technology, assuming either complementarity or substitutability

of immigrant workers with other factors of production as capital or native workers; *(ii)* the pure flexibility of the labor market; and *(iii)* the time horizon of the analysis (long *versus* short run perspective).

Borjas (1995, 1999), assuming a perfectly competitive labor market and *production complementarities* between immigrant workers and other factors of production, calculates that a stock of immigrants equal to 12% of the total work force yields a native welfare gain between 0.1% and 0.5% of GDP in the United States. A more sophisticated model of the production theory is provided in Borjas (2003). Borjas (2003) increases the number of labour aggregates using a three-level CES technology. The bottom level combines similarly educated workers with different levels of work experience into labour supply for each education group. The second stage aggregates workers across education groups into the national workforce. Finally, the upper level combines labour with capital. Estimating elasticities of substitution for each stage of the CES technology, Borjas (2003) calculates the wage impact of the immigrant influx that entered the USA between 1980 and 2000. Results show a wage decrease for the average native worker by 3.2%. Workers at the bottom and top of the education distribution are most affected with wage decreases of 8.9% and 4.9%, respectively. Card (2009) provides a survey of the empirical literature that measures the inequality of wages among natives and immigrants by estimating the degree of subtitutability and complementarity of domestic and immigrant workers among high skilled and low skilled, and within each group.

In absence of technology complementarities among workers, but introducing capital as a second factor of production, Michael (2003) finds that immigration is welfare detrimental. Indeed, migrants are net fiscal beneficiaries, namely, they receive more from the host government than what they pay in taxes. Instead, in presence of *international mobile capital*, immigrants make the marginal revenue product of capital increase, causing a capital inflow that increases income for native capitalists and tax receipt, making immigration welfare improving.

We depart from these works along several aspects. We assume a unique factor of production in both countries, i.e., labor, and moreover, we assume rigid labor markets. Furthermore, our focus is on the welfare effects of migration when such effects pass through the contribution of migrants to the production of the public good.

The second assumption that crucially affects the conclusions on migrants' effect concerns the labor market. This may look natural, but a majority of theoretical works so far has assumed competitive labor markets. An exception is Fuest and Thum (2000), the closest existing paper to our work. These authors consider a two-sector, small open economy assuming that wage in one sector is defined by a wage bargaining between unions and employers. In the other sector, wage is fixed at the marginal product. Then, immigrant workers find employment in the unionized sector and drive out some of the native workers. Instead of the high union wage, natives then receive either unemployment benefits or the lower competitive wage of the sector with competitive labor market. In our paper, we take a more general view on the rigidities of the labor market by assuming downward and upward rigidities, whatever their source. Furthermore, differently from Fuest and Thum (2000), our attention is on the governments' decision on public good levels and corresponding taxes that are affected by the flow of migrants. Finally, a crucial difference with Fuest and Thum (2000) follows from the way migration is generated in the model. We assume *à la* Tiebout that individuals decide where to reside as a consequence of income differences but, contrary to Tiebout (1956), they are assigned initially to a specific country. This allows

us to derive the consequences of migration both in the receiving and the sending country.

The third relevant assumption of migration theory concerns the time horizon of the analysis. To account for the future impact of current immigrants and their offspring, a dynamic model is necessary. In a dynamic setup, existing papers have analysed the fiscal effects, welfare effects as well as growth effects of migration. For instance, using a quality ladder growth model, Lundborg and Segerstrom (2002), find that immigration increases the growth rate but it lowers the static utility level and the discounted welfare of the natives in the destination country. Razin and Sadka (2000) isolate a different effect of migration using a dynamic setup, as well. Introducing a pension system, authors show that even though at the start migrants are net beneficiaries of the welfare state, in a dynamic setup with a pension system, immigration is beneficial to all income and all age groups, when the economy has good access to international capital markets. Miller and Lee (2000) measure the long run fiscal effect, empirically finding that for around 16 years the fiscal effect on natives of the destination country is negative, being immigrants net beneficiaries of the welfare state, but then the effect becomes positive. This is in line with the theoretical findings of Wildasin (1994). Even though we have a two period model to compare the welfare level before and after migration, the long run effects of migration go beyond the scope of our paper.

Finally, a large body of literature is now built in public economics to study the effects of capital mobility. The main reason for capital mobility are differences in capital tax rates, which have become an important policy instrument for the local and central governments. In fact, the corresponding literature of the effects of capital mobility is built using a fiscal competition framework (for surveys and references see Wilson (1999), Wilson and Wildasin (2004), Wildasin (2006)). Governments compete to attract capital investments to alleviate unemployment, to increase employment, or simply to nourish and develop a competitive banking sector. This fiscal competition among states or local jurisdictions suffers from externalities because the tax base is mobile. Then, fiscal competition leads to a race to the bottom of capital taxes that may determine a suboptimal level of public goods supplied.

We depart from this literature because we neglect competition in income taxes. As a matter of fact, the percentage of migrants remains still quite low in almost all countries (OECD, 2013), with the exception of Switzerland or Luxembourg, who importantly depend on cross-border workers. This could suggest that the decision on income taxes reflects more a national policy rather than the result of a fiscal competition among nation-states. For this reason, we have chosen to model income taxes as the residual of the decision of each government on public investment and not as a consequence of strategic behaviour of governments, as it is depicted for capital taxation.

3 The model

Consider two countries, H and F: each imposes income taxes t_i $i = H, F$ on their residents with the aim of using tax proceeds to supply *local* public goods Y_i, $i = H, F$. Individuals are free to choose where to live. Population in each country is distributed over types and the set of types is represented in each country by the

$[0,1]$ interval. Heterogeneity of population captures heterogeneity on the cost of migrating x, $x \in [0,1]$. The higher x, the higher the cost of living abroad. The reasons why the cost of moving abroad is not the same across the population of residents are many. Some of them are strongly attached to their relatives living in their residential area, while others are considerably more mobile, simply because they have weaker links with people living around them (see Beine *et al* (2011) for the role of diasporas on migration). National traditions, patriotism, and historical origins constitute significant values for some individuals, while they let others, -who feel like *citizens of the World*-, almost indifferent.

The utility of an individual who is a native of country i and who lives in country i, $i = H, F$ is

$$U_i = (2 - Y_i)Y_i + w_i(1 - t_i), \;\; i = H, F$$

The first component of the function captures the utility derived by the consumption of the public good, which is a non-decreasing function when $Y_i \leq 1$ and a decreasing function for $Y_i > 1$. This property captures the idea that when population of the country increases, residents first enjoy the consumption of a higher level of public good and then they start to suffering from congestion in consumption. The second component of the above utility function is the amount of private good consumed when the price of this good is normalized to one. The variable w_i denotes the real wage obtained in exchange of participating in production of the private good. Each agent owns exactly one unit of labor L that he/she splits eventually between the production of the public good and that of the private good. Let the technology in each country be $2k_i\sqrt{L}$ with $k_i > 0$, $i = H, F$, and $k_H > k_F$. For simplicity, assume $k_H = 1$. This simply says that there exists a *technology gap* between the two countries: the marginal product of labor is larger in country H than in country F. Only if the labor market is competitive, the equilibrium level w_i^* of the real wage equals the marginal product of labor. Nonetheless, we assume that the wage w_i can be fixed at any level and entailing either unemployment in case of excess labor supply, or free vacancies in case of excess labor demand. Since taxes are levied with the aim of financing the public good, the budget constraint of each government is given by

$$Y_i = t_i w_i^0, \;\; i = H, F \tag{1}$$

where the superscript 0 refers to the initial period when no migration has taken place. Then, using (1), we have

$$t_i^0 = \frac{Y_i}{w_i^0}, \;\; i = H, F.$$

In order to decide the amount of public good to be produced, the government in country i maximises the level of utility of its residents under the budget constraint, namely:

$$\max_{Y_i} \;\; (2 - Y_i)Y_i + w_i^0(1 - t_i)$$
$$\text{s.t. } t_i^0 \;\; = \;\; \frac{Y_i}{w_i^0}.$$

The objective function is concave; so using the first order condition, we get

$$Y_i^{*0} = \frac{1}{2} \qquad t_i^{*0} = \frac{1}{2w_i^0} \quad i = H, F. \tag{2}$$

The tax rate should satisfy $0 < t_i^* < 1$, which holds when $0 < \frac{1}{2w_i^0} < 1$ implying that wages should not exceed 1/2, $w_i^0 > \frac{1}{2}, i = H, F$, which we assume hereafter.

Consequently, the level of utility U_i^{*0} corresponding to the choice of taxes and public good level is given by

$$U_i^{*0} = w_i^0 + \frac{1}{4},\ i = H, F.$$

It follows that the level of utility of an individual living in country H is strictly higher than the level of utility of an individual living in country F, if and only if $w_H^0 > w_F^0$. This difference in wages incites all individuals in country F to leave their country and migrate towards country H to take advantage of the higher level of utility in this country. It is easy to see that the set of migrants is exactly given by the interval $[0, x]$ where x is defined by[1]

$$x = w_H^0 - w_F^0.$$

The flow of migrants should not exceed 1 by construction, so it must hold that $w_H^0 - w_F^0 < 1$. All individuals at the left of x on the unit interval have a cost of migration that is inferior to $w_H^0 - w_F^0$, and thus they will migrate from F to H. It follows that, after the migration, individuals whose type belong to the interval $[0, x]$ who live in H is now doubled. Both governments anticipate this migratory flow. Hence, country H anticipates that its population after migration will be

$$\begin{cases} 2 \text{ over the interval } \left[0, w_H^0 - w_F^0\right] \\ 1 \text{ over the interval } [0, 1], \end{cases}.$$

with w_H^0 on the interval $[0, 1]$ et w_F^0 on the interval $\left[0, w_H^0 - w_F^0\right]$.

The effects of migration on the production of the public good in the destination country and corresponding taxes, and accordingly on the resulting welfare of natives, depends crucially on the mechanism of wage adjustment in the labor market, depending whether there is excess labor demand or excess labor supply after migration has taken place.

In the following sections we analyze two scenarios. In the first, we assume that the wage after migration adjusts to the new labor supply in both countries, so full employment is reached before and after migration. In the second scenario we assume that wages are rigid. Downward rigidity implies that the flow of migrants creates unemployment in the destination country. On the contrary, upward rigidity generates an excess demand for labour, implying that migration reduces the number of vacancies in the destination country. Corresponding to each of these scenarios we ask the question: who wins and who loses from migration?

4 Flexible wages

In this section, we assume that wages always instantaneously adjust in each country in order to clear the labor market. Consequently, the equilibrium wage in country H (resp. F) corresponds initially to the competitive

[1] Assimilating the set of migrants to this interval implicitly assumes that migration is only motivated by differences in gross wages, which does not take into account that migrants could also anticipate the level of future real income taxes, serving in the production of the public good.

wage, namely $w_H^0 \equiv w_H^* = 1$ (resp. $w_F^0 = w_F^* = k_F$): $w_H^0 > w_F^0$. These wages now adapt to the new labor market conditions after migration.

Let us first consider the destination country H. The new labor supply in country H is $1+x \equiv 1+(w_H^0-w_F^0) = 2-k_F$, and the corresponding level of wage at the new full employment equilibrium after migration, in country H is $w_H^{1*} = 1/\sqrt{2-k_F}$. Similarly, the new labor supply in country F is $1-x \equiv 1-(w_H^0-w_F^0) = k_F$, and the wage level at the full employment equilibrium is now $w_F^{1*} = \sqrt{k_F}$.

Thus, citizens in both countries *ex post* migration in period 1 face a new wage differential which does not generate a new flow of migration, by assumption.

The government in country H decides the level of public good in accordance with the new level of wage w_H^{1*} on which the income tax will be levied. The new budget constraint writes as

$$Y_H \leq t_H w_H^{1*} + t_H(w_H^0 - w_F^0)w_H^{1*}.$$

Solving the above for the tax rate we find:

$$\hat{t}_H^1 = \frac{Y_H}{w_H^{1*}\left(1+(w_H^0-w_F^0)\right)}.$$

Then the problem solved by the government in country H is

$$\begin{aligned} & \text{Max}_{Y_H}\ (2-Y_H)Y_H + w_H^{1*}(1-t_H) \\ \text{s.t. } t_H^1 \quad = \quad & \frac{Y_H}{w_H^{1*}\left(1+(w_H^0-w_F^0)\right)} \end{aligned}$$

Using the first order condition and substituting $w_H^0 = 1$,$w_F^0 = k_f$, $w_H^{1*} = 1/\sqrt{2-k_F}$, we obtain

$$\hat{Y}_H^1 = \frac{3-2k_F}{4-2k_F} > 0, \tag{3}$$

and the corresponding tax is

$$\hat{t}_H^1 = \frac{1}{2\sqrt{2-k_F}}\frac{3-2k_F}{2-k_F} > 0. \tag{4}$$

Hence, we claim the following proposition.

Lemma 1 *Assuming flexible wages, migration leads to an increase in the public good and taxes in the destination country.*

Proof. Directly comparing (3) and (4) with (2). ■

The comparison of the level of utility between period 0 and period 1 with flexible wages is ambiguous. Directly comparing the level of utility of the residents of country H before and after migration yields the following result.

Proposition 1 *Assuming flexible wages, free immigration is always welfare improving for residents in the destination country.*

Proof. The sign of the difference in utility before and after migration is determined by the sign of $k_F^2 - 8k_F + 4\sqrt{-k_F+2}\,(k_F-2) + 11$ which is negatively signed for all admissible values of k_F, namely $k_F < \frac{1}{2}$. ■

The intuition behind this result is as follows. According to Lemma 1, migration entails in country H an increase in the public good but also an increase in income tax. Furthermore, due to labor market flexibility the flow of migrants yields a decrease in income. These combined effects reflect a negative impact on natives' welfare level.

Now we turn our attention to the origin country, country F. Following the same procedure as for the destination country, we identify the optimal solution for the public good level and the resulting income tax before migration, namely $\hat{Y}_F^0 = \frac{1}{2}$ and $\hat{t}_F^0 = \frac{1}{2k_F}$ and after migration, i.e., $\hat{Y}_F^1 = (2k_F - 1)/2k_F$ and $\hat{t}_F^1 = (2k_F - 1)/2\sqrt[5]{k_F^2}$. Taking the difference between the level of welfare after and before migration, we obtain

Proposition 2 *Assuming flexible wages, emigration is always welfare detrimental for residents in the origin country.*

Proof. The sign of difference in welfare before and after migration is given by the sign of $k_F + 2k_F^{\frac{3}{2}} - 1$ which is always positive for all admissible values of $k_F : k_F < \frac{1}{2}$. ■

As in the case of the destination country, migration entails an increase in the income tax while the public good level remains constant, whereas the wage rate increases. The overall effect of the residents' welfare of the origin country results to be negative. This means that the loss in utility resulting from the increase in taxes dominates the benefit resulting from the wage increase, the level of public good remaining invariant. To summarize, the above propositions establish that, in our model, flexible wages combined with free migration lead to welfare losses only in the origin country.

Now that we have fully elucidated the effects of migration under a flexible wage regime, we move to the analysis of migration when wages are rigid. As we explained earlier, two possible regimes can be envisaged at any pre-existing wage level w_i^0, $i = H, F$. In the first, upward wage rigidity at the level w_H^0 generates free vacancies *ex ante* migration. In the second regime, downward rigidity at the level w_H^0 generates unemployment *ex post* migration. We start with the first regime.

5 Rigid Wages

5.1 Excess demand of labor

Assuming upward wage rigidity at the level of w_H^0, the budget constraint of country H after migration becomes

$$Y_H \leq t_H w_H^0 + t_H(w_H^0 - w_F^0)w_H^0.$$

Hence, the government receives a tax receipt from the native population equal to $t_H w_H^0$ and, in addition, a tax receipt equal to $t_H(w_H^0 - w_F^0)w_H^0$ from the migrants whose flow is precisely $w_H^0 - w_F^0$.Solving the above for

the tax rate we find:

$$t_H^1 = \frac{Y_H}{w_H^0 + (w_H^0 - w_F^0)w_H^0}.$$

where the superscript 1 indicates the period after migration has taken place.[2]

The objective function of the government of country H is the utility of its residents before migration takes place[3]. The problem of the government in H writes as :

$$\begin{aligned} &\max_{Y_H} \ (2 - Y_H)Y_H + w_H^0(1 - t_H^1) \\ \text{s.t. } t_H^1 \quad &\geq \quad \frac{Y_H}{w_H^0 + (w_H^0 - w_F^0)w_H^0}. \end{aligned}$$

Using the first order condition we obtain:

$$Y_H^{1^*} = \frac{1}{2}\frac{1 + 2\left(w_H^0 - w_F^0\right)}{1 + (w_H^0 - w_F^0)} > 0 \tag{5}$$

The corresponding level of taxes in country H is given by

$$t_H^{*1} = \frac{1}{2}\frac{1 + 2\left(w_H^0 - w_F^0\right)}{w_H^0\left(w_F^0 - w_H^0 - 1\right)^2}. \tag{6}$$

Then, directly comparing the equilibrium levels of the public good and taxes before and after migration, we conclude that

Lemma 2 *Migration increases both the level of public good and the level of taxes in the destination country.*

Proof. Directly comparing public goods levels and taxes in (5) and (4) with (2). ■

Thus, the result in this Lemma does not allow us to conclude whether migration is welfare detrimental or improving in the destination country, since migration increases the level of public good but increases the tax as well. To clarify this ambiguity, we compare the level U_H^{*0} and U_H^{*1} of the utilities obtained by natives before and after migration. We claim the following

Proposition 3 *Assuming upward wage rigidity, immigration is always beneficial for natives of the destination country.*

Proof. The welfare difference writes as $U_H^{*1} - U_H^{*0} = \frac{1}{4}\left(3\left(w_H - w_F\right) + 2\right)\frac{w_H - w_F}{(w_F - w_H - 1)^2}$,which is positive because $w_H - w_F > 0$ is true by the definition of migration flow. ■

Under upward wage rigidity, the destination country is fond of welcoming migrants because it allows to fill available vacancies: it is not surprising that the increase in the production of public good offsets the increase in the income tax, leading to an increase in welfare.

[2] Notice that in this section, we assume that the flow of migrants $w_H^0 - w_F^0$ does not exceed the number of vacancies in the destination country. If that would be the case, then we would fall into the unemployment scenario that is analysed in Section 5.2.

[3] This assumption could be justified for instance by supposing that the existing government must be reelected and that the future voters in the election consist only of the native residents.

Now, we turn the attention to the effects of migration on the *origin* country. Similarly, to the above analysis, we can identify the optimal choice of the government in F as follows $Y_F^{*1} = \left[1 - 2\left(w_H^0 - w_F^0\right)\right]/2\left(1 - \left(w_H^0 - w_F^0\right)\right)$ and $t_F^{*1} = \left[1 - 2\left(w_H^0 - w_F^0\right)\right]/2w_F^0\left(w_F^0 - w_H^0 + 1\right)^2$ that both require $w_H^0 - w_F^0 < \frac{1}{2}$ for positivity. As before, it is unclear whether emigration generates a decrease or an increase in the welfare of the residents of the origin country, being the level of public good and taxes higher after migration. To clarify this ambiguity we make the direct comparison between the level of the utility ex ante and ex post migration. It turns out that

Proposition 4 *Emigration is always welfare detrimental for the residents in the origin country.*

Proof. The welfare difference sign $U_F^{1*} - U_F^{0*}$ depends on the sign of $3\left(w_H^0 - w_F^0\right) - 2$, which is always negative, implying $U_F^{1*} < U_F^{0*}$, iff $w_H^0 - w_F^0 < \frac{2}{3}$. This is always true since $w_H^0 - w_F^0 < \frac{1}{2}$ for positivity of Y_F^{*1} and t_F^{*1}. ■

5.2 Unemployment: downward rigidity of wages

In this section, we assume that due to downward wage rigidities in the labor market, namely wages do not adjust to the new supply of labor after migration[4]. We examine this situation by assuming that the wage before migration is equal to the competitive wage $w_H^0 = w_H^*$. Consequently, the flow of migrants and the rigidity of the wage at the level w_H^0 entails unemployment in country H at a level equal exactly to the level of migrants entering this country. We assume that some random mechanism selects those among the population of native and migrants who will be employed or unemployed[5]. Thus, the employed in country H after migration are native who were not fired as well as migrants who were hired. Furthermore, we assume that the unemployed workers of mass x receive an unemployment benefit b exogenously defined, with $b \leq w_F^0 < w_H^0$.

The budget constraint of country H after migration is then given by

$$Y_H \leq t_H w_H^0 - b\left(w_H^0 - w_F^0\right).$$

Solving the above for the tax rate we find:

$$t_H^1 = \frac{Y_H}{w_H^0} + b\frac{w_H^0 - w_F^0}{w_H^0}.$$

where the superscript 1 indicates the period after migration has taken place.

Remind that country H maximizes the utility of its residents. The unemployment rate in country H is given by $\frac{x}{1+x}$. Then, a portion of $\frac{1}{1+x}$ native residents is employed after that migration has taken place. Accordingly, the preferences of a resident in country H now appears as an expected utility with probabilities to be employed or unemployed. Thus, the problem faced by the government in country H is then

$$\max_{Y_H} \frac{1}{1+x}\left[(2 - Y_H)Y_H + w_H^0(1 - t_H)\right] + \frac{x}{1+x}\left[(2 - Y_H)Y_H + b\right]$$
$$\text{s.t. } t_H^1 = \frac{Y_H}{w_H^0} + b\frac{w_H^0 - w_F^0}{w_H^0}$$

[4] This rigidity can be due to a bargaining between the government and the trade unions in the country of destination that takes place before migration, as in Fuest and Thum (2000).

[5] This assumption was introduced by Schmidt *et al.* (1994).

Using the first order condition, we find that the optimal level of public good $\tilde{Y}_H^1$ is given by

$$\tilde{Y}_H^1 = \frac{1}{2}\frac{2\left(w_H^0 - w_F^0\right) + 1}{w_H^0 - w_F^0 + 1}. \tag{7}$$

The corresponding tax $\tilde{t}_H^1$ obtains as

$$\tilde{t}_H^1 = \frac{\tilde{Y}_H^1}{w_H^0} + b\frac{w_H^0 - w_F^0}{w_H^0}. \tag{8}$$

It can be easily checked that

Lemma 3 *Migration with downward wage rigidity increases both the level of public good and the income tax in the destination country.*

Proof. Directly comparing (7) and (8) with (2). ■

As before, whether migration is welfare improving or welfare detrimental is ambiguous. We then directly compare the level of utility *ex-ante* and *ex-post* migration.

Proposition 5 *Assuming downward wage rigidity, immigration is always welfare detrimental for natives of the destination country.*

Proof. Using (7) and (8) to evaluate the level of utility after migration and then directly comparing the level of utilities after and before migration, it can be readily verified that the difference is always negative for $0 < w_F^0 < 1$. ■

With downward wage rigidity, immigration causes unemployment among the natives and an increase in income tax for those who still work after migration. It turns out that the increase in the production of public is not sufficient to offset these two negative effects.

We turn now the attention to the origin country F. The welfare effect of emigration is again ambiguous and depends on the size of the flow of migrants. We state that

Proposition 6 *Assuming downward rigidity of wages, emigration is welfare improving for the residents in the origin country if and only if the flow of migrants quitting the country is sufficiently small. Otherwise, emigration is welfare detrimental.*

Proof. Welfare difference boils down to $3\left(w_F^0\right)^2\left(w_H^0\right)^2 + \left(-3w_F^0\left(\left(w_F^0\right)^2 - w_F^0 + 1\right) - w_F^0\left(3\left(w_F^0\right)^2 - w_F^0 + 3\right)\right)w_H^0 + \left(\left(w_F^0\right)^2 - w_F^0 + 1\right)\left(3\left(w_F^0\right)^2 - w_F^0 + 3\right)$ in w_H^0 whose roots are $\frac{-w_F^0 + \left(w_F^0\right)^2 + 1}{w_F}$ and $\frac{-w_F + 3\left(w_F^0\right)^2 + 3}{3w_F}$, with $\frac{-w_F^0 + \left(w_F^0\right)^2 + 1}{w_F^0} < \frac{-w_F^0 + 3\left(w_F^0\right)^2 + 3}{3w_F^0}$. Hence, for $w_H^0 < \frac{-w_F^0 + \left(w_F^0\right)^2 + 1}{w_F^0}$ namely $w_F^0(w_H^0 - w_F^0 + 1) < 1$ emigration is welfare improving[6]. Otherwise, i.e., for $w_F^0(w_H^0 - w_F^0 + 1) > 1$ and for $w_F^0(3(w_H^0 - w_F^0) + 1) < 3$ emigration is welfare detrimental. ■

To summarize our results, the following figure represents the effects of migrations on welfare in both the destination and the origin countries for the different labour market regimes.

[6] Notice that the other interval in which migration could be welfare improving namely for $w_H > \frac{\left(-w_F + 3w_F^2 + 3\right)}{3w_F} \Leftrightarrow w_F(3(w_H - w_F) + 1) > 3$ is not acceptable , because $w_H^0 - w_F^0 < 1$ since $w_H^0 = w_H^{0*} = 1$ and $w_F^0 = k_F < 1$.

	Destination country	Origin country
Flexible wages	↑	↓
Upward rigidity	↑	↓
Downward rigidity	↓	↓ ↑

The welfare effects of migration in the destination and in the origin country.

6 Conclusion

In the general equilibrium model defined above, we have explored the welfare effects of migration when this migration is caused by income differences between the receiving and sending country. We have fully elucidated the benefits and losses between them, as a consequence of resulting income taxes and wages. We did it for the different regimes in which the labour market of the higher wage country stands initially: fully flexible wage, excess demand or excess supply of labour.

Of course, this elucidation must be taken cautiously. The first caveat concerns the fact that the sole engine of migration considered here is the income difference between the countries. In most real situations, migrations are motivated by several different incentives, not taken into account in our analysis. Also we assume that, except for the costs of migration, all individuals are identical while migration behaviour varies across different segments of the population (skilled-unskilled workers, retired-non retired individuals, brain drain, capitalists-workers a.s.o.). Our model has also strong specificities, like constant returns-to-scale in the production of the public good, which makes our conclusions more than particular.

The model would certainly be more realistic if mobile capital would also be introduced and different types of workers, like skilled and unskilled, would be considered. Such improvements of the model would permit the analysis of the combined effects on welfare of capital and labour mobility, like in Michael (2003). It would also allow to consider migrations, in which skilled and unskilled workers are differentiated. Then the welfare effects of migrations would certainly be more complex to disentangle, since migrations can then be beneficial for the receiving country relative to one type of workers and detrimental relative to the other.

Nevertheless, our simplified approach gives a rigorous theoretical appraisal to the often passionate debate about the pro and cons of migration related to income differences among countries. Introducing more improvements to the model and analyzing how it alter its main conclusions, would certainly constitute an attractive

topic for further research.

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