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**MIGRATION AND INCOME TRANSFERS IN THE PRESENCE OF
LABOR QUALITY EXTERNALITIES**

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Abstract:

In this paper, a worker's productivity is assumed to depend on his own quality and on the average quality of other workers in the same country. The external effects associated with worker quality give rise to increasing returns to average worker quality. As a result, free migration generally reduces world output. Within each country, social benefits that induce low quality workers to leave the labor force can increase national income. Moreover, the operation of such a benefit scheme financed by a proportional income tax can increase everybody's net-of-tax income. The political economy of a system of transfers within a country is analyzed. In particular, the level of transfers is assumed to be determined by popular vote. In this setting, small migration flows can bring about large changes in transfer levels and in labor participation rates. The anticipation of migration generally reduces the level of transfers to the unemployed.

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1. *Introduction*

International migration has been an important phenomenon in modern times. The migration of people from Europe to the United States, peaking between 1880 and 1910, has been of gargantuan size. In the post-world war II period, the countries of Northern Europe have faced a significant influx of people from Southern Europe and elsewhere. By 1982, the shares of foreigners in the total population in Germany, France, and Switzerland were 7.6, 8.2 and 14.3 per cent, respectively.¹ The shares of foreigners in employment for these countries were even larger. Lower transportation costs and better information about conditions abroad may have contributed to a higher international mobility of people. In recent years, the fall of communism in Eastern Europe has provided an additional impetus to international migration to Western Europe.

Immigrants generally seek employment in the destination country or, if eligible, they receive unemployment benefits or other income support. International migrants differ widely in their age and education and thus in their ability to find employment. The private pay-off to migration, therefore, depends importantly on the migrants' personal characteristics. The economic impact of immigration on the source and recipient countries likewise depends on who the migrants are. Migration of the most productive workers represents the greatest loss to the source country and at the same time the greatest gain for the recipient country. Not surprisingly, many countries restrict legal immigration only to people with sufficient work experience and education. In practice, many international migrants, however, receive some income support in the destination country. Migrants may also benefit from publicly provided education, housing and health care. As a result, immigration threatens to put considerable strain on the social security systems in some Western European countries. These pressures may ultimately lead to a partial dismantling of the social welfare state in these countries. As a result, international migration has become an important political issue.

This paper presents a model of international migration that recognizes that workers are of heterogeneous quality.² The model assumes that a worker's productivity in a country depends

positively on the average quality of co-workers in the same country. In this setting, international migration affects the productivity of non-immigrant workers in the source and the recipient countries, if it changes the average quality of workers in these countries. The model displays what can be called increasing returns to average quality, as a country's aggregate output increases more than linearly with average worker quality.

The paper first considers international migration in the absence of any policy intervention. If two countries have different average worker qualities, then all workers in the country with low average worker quality wish to migrate to the other country. The migration incentive ceases to exist, once both countries have equal average worker qualities. This leveling effect following international migration reduces aggregate world output as a result of the increasing returns to average worker quality. The reduction in average worker quality in the immigration country following free migration provides a rationale for restricting immigration to high quality foreign workers.

In the present model, national output can be increased by retiring low quality workers from the labor market by offering them sufficiently high unemployment benefits. Similarly, Sala-i-Martin (1992) shows that the retirement of older, less productive workers can increase aggregate output. The benefits to unemployed workers are assumed to be financed by a proportional income tax on all incomes. Interestingly, transfer payments to the unemployed generally can increase all agents' net-of-tax incomes. At higher benefit levels, however, there is the expected trade off between the net incomes of the employed and the unemployed. Previous studies of income redistribution with migration (see Brown and Oates (1987), Epple and Romer (1991), Crane (1992), Persson and Tabellini (1992), and Wildasin (1991)) or without migration (see Meltzer and Richards (1981)) have ignored the output enhancing potential of income transfers. The present analysis also differs from Meltzer and Richards (1981), Epple and Romer (1991) and Persson and Tabellini (1992) in that income transfers only go to the unemployed. As result, there is no conflict of interest among the working population. Following earlier contributions, we assume that the

transfer level is determined by popular vote. The median voter possibly favors a positive transfer even if he himself is employed, as redistribution can yield sufficiently large efficiency gains to offset the income taxes necessary to finance the income transfers.

Interestingly, the median voter potentially is indifferent between working with low benefits, or not working with high benefits. Such a knife-edge indifference between two distinctly different transfer levels evolves into a strict preference for one of the two following a small inflow of immigrants. In this instance, small migration inflows can have large implications for the system of unemployment benefits. A discrete change in benefit levels and income tax rates generally has non-negligible implications for agents' welfare, even if the median voter's net income changes very little with the discrete break in the benefit system. Corresponding to a discrete change in unemployment benefits, the rate of labor participation also changes significantly.

The paper finally considers how the benefit system is affected by an anticipation of potential immigration flows of benefit recipients, following Brown and Oates (1987), Epple and Romer (1991), and Wildasin (1991). Specifically, the implications for the transfer level, the income tax rate, the labor participation rate and the distribution of income are considered. A prospected influx of foreign benefit recipients following higher benefit levels generally leads to a lower benefit level. The income distributional effects and also the total output effect depend on whether the median voter is employed or unemployed. In the former case, lower benefits generally reduce all agents' net incomes and thus also aggregate income. In the latter case, lower benefits imply that income is redistributed from the unemployed to the employed, while aggregate income increases. The result that higher factor mobility reduces the scope for taxation for purposes of income redistribution is also obtained in Persson and Tabellini (1992) who focus on the implications of higher capital mobility.

The remainder of this paper is organized as follows. Section 2 sets out the basic model of international migration in the absence of income transfers. Section 3 introduces income transfers for an economy without migration. Section 4 focuses on the political economy of income transfers

in such an economy. Section 5 examines how (exogenous) migration flows affect the politically determined transfer system. Section 6 considers the adjustment of the transfer system in anticipation of international migration motivated by differences in income transfers. Section 7 concludes.

2. *Migration without transfers*

The world consists of two countries: home and foreign, with stars denoting foreign variables. In each country, there is a population of workers that are heterogeneous in their quality, which can be in part innate and in part the result of education. Let a denote the quality of a domestic worker. The variable a is distributed on the interval $[\underline{a}, \bar{a}]$ with density $f(a)$, and distribution function $F(a)$. The size of the domestic population is denoted S so that $S = F(\bar{a})$. Let μ be the mean domestic worker quality. The quality distribution and total size of a country's population can be altered through migration. A worker's productivity is assumed to be positively related to his own quality, a , and to the mean quality of other workers in the same country, μ , on account of peer group effects in the work force.³ Peer group effects may arise as lowly skilled workers learn from highly skilled workers, or they may be purely psychological. Henderson, Mieszkowski and Sauvageau (1978) and Arnott and Rowse (1987) have demonstrated that peer group effects are important in educational settings. Let us assume, specifically, that a worker's output is equal to the product $a\mu$. National income, denoted Y , is the sum of all agents' individual products as follows,

$$\begin{aligned} Y &= \int_{\underline{a}}^{\bar{a}} a\mu f(a) da \\ &= \mu^2 S \end{aligned} \tag{1}$$

Equation (1) indicates that national income, Y , is quadratic in average worker quality, μ , while it linear in work force size, S . The model thus displays what can be called increasing returns

to average worker quality, while there are only constant returns to scale.

The two countries generally differ in their distributions of worker quality. In particular, let us assume that domestic workers on average are of higher quality than foreign workers, i.e. $\mu > \mu^*$. In this instance, all the world's workers potentially have a higher individual productivity in the home country than in the foreign country. Consequently, all foreign workers have an incentive to migrate to the home country if migration is costless. Migration generally affects the productivities of the migrants as well as of non-migrants. Let us consider that foreign workers of quality a^* migrate to the home country. Let Y_m^* denote the income of these foreign migrants, while Y_{-m} and Y_{-m}^* are the incomes of domestic and foreign non-migrants. An increase in the range of foreign migrants starting from a quality level a^* affects the income variables Y_m^* , Y_{-m} and Y_{-m}^* as follows,

$$\frac{dY_m^*}{da^*} = (\mu - \mu^*) a^* f^*(a^*) \quad (2)$$

$$\frac{dY_{-m}}{da^*} = (a^* - \mu) \mu f^*(a^*) \quad (3)$$

$$\frac{dY_{-m}^*}{da^*} = (\mu^* - a^*) \mu^* f^*(a^*) \quad (4)$$

Equation (2) confirms that foreign workers of any quality can increase their private incomes by migrating to the home country if $\mu > \mu^*$. Equation (3) indicates that immigration raises home income levels, if immigrant workers are of higher average quality than the average original home country worker, i.e. if $a^* > \mu$, and vice versa. Similarly, emigration lowers foreign incomes of those staying behind, if the average quality of emigrant workers exceeds the average quality of original foreign workers, i.e. if $a^* > \mu^*$, and vice versa.⁴

Worldwide income, denoted Y_w , is the sum of the individual incomes of migrants and of

non-migrants in the two countries. Formally, this means that $Y_w = Y_m^* + Y_m + Y_{-m}^*$. Adding (2)-(4), we see that international migration affects world income as follows,

$$\frac{dY^w}{da^*} = [2a^* - (\mu + \mu^*)](\mu - \mu^*)f^*(a^*) \quad (5)$$

From (5), we see that migration increases world output if $a^* > (\mu + \mu^*)/2$, and vice versa.

The effects of migration on the incomes of non-migrants suggests that countries have strong incentives to regulate international migration. Equation (3), specifically, suggests that the home country optimally admits only foreign workers of quality a^* exceeding the average domestic worker quality, μ , if it only cares about its original inhabitants.⁵ Countries, indeed, typically favor the immigration of individuals with high level skills and education. The United States, for instance, grants H-1 work permits to highly trained foreigners for whom no counterparts are available in the U.S. labor market. The authorities of the foreign emigration country may care about the incomes of their non-migrant population or, alternatively, about the incomes of their entire original population. In the first case, the foreign authorities optimally allow only citizens of quality a^* less than μ^* to emigrate from (4). In the latter case, the foreign country allows the emigration of relatively low quality workers with a^* less than $\mu^{*2}/(2\mu^* - \mu)$ if $2\mu^* > \mu$ from (4) and (5), while no emigration restriction is called for if $2\mu^* \leq \mu$. For this second foreign country objective, emigration policy is clearly less restrictive. Note that we always have that $\mu^{*2}/(2\mu^* - \mu)$ exceeds μ , which implies that there originally is a non-negligible quality range of workers that both countries will allow to migrate. As agents within this range are migrating from the foreign to the home country, one of the two countries' migration restrictions will become binding. In principle, either the foreign emigration or the domestic immigration restriction can be binding first.

To conclude this section, let us consider the implications of completely free international migration. The incentive to migrate ceases to exist once the average worker qualities in the two countries are equal, i.e. $\mu = \mu^*$.⁶ It is evident that free migration increases (decreases) the incomes

of all original foreign (home) country workers. Interestingly, world income unambiguously declines. To see this, let μ_0 (μ_0^*) and S_0 (S_0^*) be the pre-migration home (foreign) country average worker quality and population size. Relative post-migration world income, denoted θ , is calculated to be as follows,

$$\theta = \frac{(S_0\mu_0 + S_0^*\mu_0^*)^2}{(S_0 + S_0^*)(S_0\mu_0^2 + S_0^*\mu_0^{*2})} \quad (6)$$

Relative post-migration income, θ , in (6) is less than unity if $\mu \neq \mu^*$. This result is a direct implication of the increasing returns to average quality evident in equation (1). The existence of increasing returns to average quality suggests that workers optimally are stratified by their quality if the objective is to maximize world output.⁷

3. *The introduction of transfers*

The present model implies that a worker's productivity increases, if other workers of below average quality leave the labor force. Such exits from the labor force may lead to higher total output, if the quality of exiting workers is sufficiently below the average. Exits from the labor market, however, are never privately advantageous, unless the exiters are provided with an alternative source of income. This section considers income transfer schemes with the aim of retiring low quality workers from the labor force for a country with a fixed population. Let us assume, in particular, that non-active individuals receive a pre-tax unemployment benefit, b . To finance these benefits, the authorities impose an income tax at a rate τ on all income including unemployment benefits. At a given benefit level, b , individuals below a certain critical quality level (if any) leave the work force. The quality level a_c of the marginal worker indifferent between working and receiving unemployment benefits is given by,

$$a_c = b/\mu \quad (7)$$

A higher benefit level, b , implies a higher critical quality level, a_c . With individuals of quality exceeding a_c employed, aggregate income, Y , is given by,

$$Y = \int_{a_c}^{\bar{a}} \mu a f(a) da \quad (8)$$

Government budget balance requires that the unemployment benefit outlays are equal to the income tax receipts as follows,

$$b F(a_c) = \tau [b F(a_c) + \mu^2(S - F(a_c))] \quad (9)$$

Not surprisingly, a higher benefit level, b , implies a higher income tax rate, τ . Next, let us consider how a change in the critical quality level a_c (and correspondingly changes in the benefit level, b , and the income tax rate, τ) affect aggregate income, Y . Differentiating Y in (8) with respect to a_c yields,

$$\frac{dY}{da_c} = (\mu - 2a_c)\mu f(a_c) \quad (10)$$

National income, Y , is highest if $a_c = \mu/2$ from (10), provided that $2a_c \leq \mu$. Next, let us consider how changes in the income transfer scheme affect the distribution of income. The net incomes of employed and unemployed workers, denoted n_e and n_u , are given by $a\mu(I - \tau)$ and $b(I - \tau)$, respectively. Note that a change in the income transfer scheme affects the net incomes of all employed workers proportionately. After some manipulation, we see that changing the critical quality level, a_c , affects net income levels, n_e and n_u , as follows,

$$\frac{dn_e}{da_c} = a\mu \frac{\mu - 2a_c - (1 - \tau)F(a_c)}{a_c F(a_c) + \mu(S - F(a_c))} \quad (11)$$

$$\frac{dn_u}{da_c} = \mu \frac{a_c(\mu - 2a_c) + \mu(1 - \tau)(S - F(a_c))}{a_c F(a_c) + \mu(S - F(a_c))} \quad (12)$$

Equations (11) and (12) immediately imply that slightly increasing a_c above \underline{a} increases the net incomes of active as well as non-active workers if $2\underline{a} < \mu$, as $F(\underline{a}) = 0$. Introducing low level unemployment benefits thus generally is Pareto improving. This result reflects that in the present model an income transfer scheme can increase total income rather than merely redistribute income. Equations (11) and (12) imply that the net income of the employed (unemployed), n_e (n_u), reaches a maximum for a value of a_c below (above) $\mu/2$. Let the benefit levels that are consistent with maximizing n_e and n_u be denoted b_e and b_u , respectively. For benefit levels between b_e and b_u there exists the usual trade off between the net incomes of the two classes of workers. Not surprisingly, the value of the benefit level, b , that maximizes Y lies in between b_e and b_u .

4. *Voting on transfers*

In this section, we examine how the transfer system is determined by the political process. In particular, we will assume that the benefit level, b , is determined by popular vote. To start, let us examine the preferences of workers of varying quality over possible values of b . First note that the electorate will never set the benefit level, b , either below b_e or above b_u , as in these instances all voters' net incomes can be enhanced by either increasing and decreasing the benefit level, respectively. In other words, voting will yield a value of b within the interval bounded by b_e and b_u . It is now useful to consider voter preferences over values of b within this range separately for three categories of workers: (i) workers who are unemployed at a benefit level b_e , (ii) workers who become unemployed for a value of b between b_e and b_u , and (iii) workers who are employed at a benefit level b_u .

Workers in category (i), who are already unemployed at the low benefit level b_e , see their net incomes rise as b is raised from b_e to b_u . These workers, therefore, will always vote for the higher of two values of b within the interval between b_e and b_u . Next, let us consider workers who cease to be employed at a critical benefit level, denoted $b_c(a)$, between b_e and b_u . The critical benefit level, $b_c(a)$, clearly increases with the quality level a . The net incomes of individuals in this group fall with the benefit level b between b_e and $b_c(a)$, while their net incomes rise with b for values of b between $b_c(a)$ and b_u . For these individuals, net income thus is lowest at a benefit level $b_c(a)$, when the individual is indifferent between working and not working. At the same time, net income is highest either at a benefit level b_e , for the relatively high quality workers, or at a level b_u for the relatively low quality workers in this category. Finally, individuals in category (iii), who are employed even at the high benefit level b_u , see their net incomes fall as b rises from b_e to b_u . In summary, all individuals achieve the highest net income at a value of b equal to either b_e or b_u . In particular, workers of quality lower (higher) than a certain level obtain the highest net income at a benefit level b_u (b_e).

As is usual, the outcome of the vote will be determined by the median voter. The voting outcome will be b_e , if at this benefit level the median voter obtains higher net income than at a benefit level b_u , and vice versa. In principle, the median voter can be in any of the three categories of agents. For example, the median voter can be in category (iii), in which case he will vote for a positive level of unemployment benefits, b_e , even though he himself will be employed at this benefit level. If the median voter is in category (ii), then it is possible that he in fact obtains equal net incomes at benefit levels b_e and b_u . The median voter, specifically, can be indifferent between working at a benefit level b_e and not working at a benefit level b_u . In this instance, the benefit levels b_e and b_u are both possible voting outcomes. Note that in this instance only the median voter is indifferent between benefit levels b_e and b_u . Workers of higher (lower) quality than the median voter will strictly prefer the benefit level b_e (b_u).

5. *The effect of immigration on transfers*

In this section, we consider the impact of immigration on the income transfer scheme. This immigration is assumed to be independent of the income transfer system. Some international migration, indeed, may be motivated by, for example, a flight from oppression rather than by differences in international net income levels. Let us assume that immigrants have the same rights and duties as original residents. In particular, they are eligible for unemployment benefits and they are required to pay income taxes.⁸

As an aside, it is first interesting to consider that the benefit level is set by a government interested in maximizing aggregate income, Y , rather than the outcome of voting by self-interested voters. In this instance, we know from (7) and (10) that $a_c = \mu/2$ and thus $b = \mu^2/2$. Let us assume that foreign workers with quality level a^* migrate to the home country. If a^* is less than a_c , then the immigrant workers will be unemployed in the home country, and vice versa. If the immigrants do not work, then the optimal transfer level, b , the critical quality level, a_c , and also output, Y , are not affected by the immigration. To finance additional transfers, however, the income tax rate, τ , has to rise. As a result, the net-of-tax incomes of all original home residents fall. If the immigrants' quality, a^* , exceeds a_c , then the immigrant workers will be employed in the home country. Unlike in section 2, immigrant workers now pay income taxes. The effect of immigration on the income of original home residents in (3), therefore, has to be replaced by,

$$\frac{dY_{-m}}{da^*} = (a^* - \mu + \tau a^*)\mu f'(a^*) \quad (13)$$

From (13), we see that immigrants of quality a^* exceeding $\mu/(1 + \tau)$ increase the aggregate income of original home residents. As before, not all potential immigrant workers who can find employment in the home country increase Y_{-m} . In particular, immigrants of quality a^* between $\mu/2$ and $\mu/(1 + \tau)$ will work in the home country, but from (13) we see that they reduce the aggregate income of original home residents. The immigration of foreign workers of quality a^* exceeding a_c

generally leads to a change in the income transfer scheme that maximizes aggregate income, Y . Such immigration, in particular, leads to a higher (lower) benefit level and a lower (higher) labor participation rate of the original population, if a^* is more (less) than μ .

Now let us consider how the income transfer system is affected by immigration when the benefit level is determined by popular vote. At the same time, we consider whether immigration will in fact be favored by the median voter. At a given pre-immigration benefit level, there generally are three separate channels by which immigration affects the net incomes of original home country workers. First, if the immigrants become benefit recipients, then the income tax rate has to rise to finance these additional benefit payments. Second, if the immigrants accept employment in the home country, then they can affect the productivities of existing employees by their impact on mean worker quality. Third, a higher employment generally changes total income and thus the income tax rate consistent with financing the existing transfer system. Generally, immigration also leads to an adjustment in the benefit level selected by the median voter. This benefit level adjustment, however, only has a second order effect on the median voter's net income. We can, therefore, ignore the adjustment in the benefit level, if we wish to assess whether the median voter favors immigration.

To start, let us consider the immigration of workers of quality a^* less than a_c . At the pre-immigration benefit level, these individuals will receive benefits in the home country. The type of immigration clearly does not affect the productivities of employed workers. To pay for the additional income transfers, the income tax rate, however, has to increase. Consequently, the immigration of prospective benefit recipients reduces the net incomes of all original home country residents. Such immigration, therefore, will be opposed by the median voter.

Next, let us consider the immigration of foreign workers of quality a^* exceeding a_c . At the original benefit level, these individuals choose to work in the home country. The immigrants increase (decrease) the productivity of already employed workers if a^* exceeds (is less than) μ .⁹ At the same time, total output increase (decreases) and, consequently, the income tax rate falls (rises)

if a^* exceeds (is less than) $\mu/2$.¹⁰ If the median voter is unemployed, then $a_c > \mu/2$ from (12). The income tax rate thus falls, and the median voter will favor the immigration. If instead the median voter is employed, however, then $a_c < \mu/2$ from (11). The entry of prospective employees of quality a^* , with $a^* > \mu$ benefits an employed median voter, as it (i) increases pre-tax income, and (ii) reduces the income tax rate. The entry of workers with $a_c < a^* < \mu/2$, to the contrary, harms an employed median voter, as it (i) reduces pre-tax income, and increases the income tax rate. For a borderline quality level a^* , between $\mu/2$ and μ , the median voter's net income will not be affected, as the reductions in the pre-tax income level and in the tax rate are exactly offsetting. An employed median voter only favors the immigration of future employees of a quality exceeding this borderline quality level.

In the previous section, we saw that the median voter possibly is indifferent between working at a benefit level, b_e , and not working at a benefit level, b_u . Small migration flows potentially eliminate this indifference, and lead the median voter to strictly prefer one benefit level to the other. To see this, let us consider the immigration of low quality foreign workers who will be unemployed in the home country regardless of whether the median voter is employed or unemployed. The immigration of such foreigners leads to higher total benefit payments at either benefit level b_e or b_u . Note that at a benefit level b_u , the increase in total benefit payments relative to aggregate income, Y , is relatively large. This is true because at b_u the benefit level is large relative to the entire income tax base. It can be seen that at b_u the immigration of potential benefit recipients leads to a relatively large reduction in the net income of the median voter. This assertion is proven in the Appendix. The immigration of potential benefit recipients, therefore, leads the median voter to strictly prefer the benefit level b_e , at which the median voter works. Conversely, the emigration of benefit recipients leads the median voter to prefer the benefit level b_u . Migration flows that lead the median voter to prefer b_e to b_u , and vice versa, lead to continuous changes in the net income of the median voter. As already noted, the net incomes of other voters change discretely. In particular, the net incomes of people of lower (higher) quality than the median voter

jump up (down) when the median voter switches preference from a benefit level b_e to a benefit level b_u .

To conclude this section, let us consider which foreign workers in fact have the incentive to emigrate to the home country, if only the home country operates an income transfer system. All foreigners have an incentive to emigrate if $\mu(1 - \tau) > \mu^*$. In this instance, foreign workers of any quality will achieve higher net incomes at home after emigrating, regardless of whether they will work in the home country. If instead $\mu(1 - \tau) < \mu^*$, then only foreigners with $a^* < b(1 - \tau)/\mu^*$ (if any) benefit from emigration. In this instance, all immigrants into the home country will be unemployed.¹¹

6. *Transfer policy in anticipation of migration*

So far, we have considered how the income transfer system is adjusted in response to exogenous migration flows. In this section, we recognize that the income transfer system itself influences migration flows. In particular, we consider how the anticipation of potential migration flows influences the determination of the income transfer system. To this end, let us assume that the world consists of two symmetric countries that both operate an income transfer scheme. Following Brown and Oates (1987), we will assume that only the poor, i.e. those who choose not to work in their own country, are internationally mobile.¹² Their migration is motivated by the difference in the net transfer level, denoted n , given by $n_u - n_u^*$. Let us assume that the unemployed are heterogeneous in their moving costs. As a result, a share $s(n)$ of the foreign unemployed will migrate to the home country, if $n > 0$, and vice versa. We will assume $s(0) = 0$, with $ds/dn > 0$. If $n > 0$, then the aggregate income of home residents is less than home output by the expense of providing foreign immigrants with income transfers. In particular, with $n > 0$ the aggregate income accruing to original home residents, Y_m , is given by,

$$Y_m = Y - s(n) n_u F(a_c^*) \tag{14}$$

In (14), $F(a_c^*)$ is the volume of foreign unemployed, while Y is domestic output as in (8).

The exact impact of potential immigration on the income transfer system depends on how the benefit level is determined. Generally, however, an additional cost of increasing benefit levels with migration will be larger income transfers to foreign benefit recipients. This cost of higher benefits ultimately reduces the benefit level compared to the case of no immigration considered in sections (2) and (3). To illustrate this, let us consider the benchmark case where the benefit level is set so as to maximize the aggregate income to original home residents in (14). With $n \geq 0$, an increase in a_c and thus in the benefit level, b , affects Y_{-m} as follows,

$$\frac{dY_{-m}}{da_c} = \frac{dY}{da_c} - \frac{ds}{dn} \frac{dn}{da_c} n_u F(a_c^*) \quad (15)$$

An optimum requires that dY_{-m}/da_c in (15) is zero. We now wish to show that such an optimum requires $dn/da_c > 0$ in (15) starting from $n_u = n_u^*$. To see this, note that without migration we have $dn_u/da_c > 0$ in (11) for $a_c \leq \mu/2$. With migration, the relationship between n and a_c further reflects the following two effects: (i) immigration into the home country, which increases the number of domestic unemployed, leads to a higher domestic tax rate τ , which reduces the net benefit level n_u , (ii) emigration from the foreign country reduces the number of foreign unemployed, and thus leads to a lower foreign income tax rate τ^* , increasing n_u^* (for a given foreign benefit level b^*). Both of these effects tend to reduce the size of dn/da_c . For there to be any migration following an increase in b , however, we need to have $dn/da_c > 0$. It now follows from (15) that optimally $dY/da_c > 0$. The prospect of immigration of foreign unemployed, thus, has reduced the optimal domestic benefit level, b , and in this instance also national output, Y . If the reduction in the domestic benefit level is slight, the net income levels of the (un)employed are higher (lower) than in a world without migration.

The prospect of migration similarly leads to lower benefit levels if the benefit level is determined by popular vote. In particular, the benefit level will be reduced below b_e or below b_u ,

depending on whether the median voter is employed or unemployed. If the reduction in benefit levels is slight, then in the first instance the net incomes of all original domestic residents decline, relative to the no migration case. In this instance, the median voter clearly opposes migration. In the second instance, the net income levels of the employed and unemployed will increase and decrease, respectively. The unemployed median voter will correspondingly disfavor free migration.

Several authors, including Oates (1968), Musgrave (1969), and Brown and Oates (1987), have argued that income redistribution is best carried out by the highest level of government in a federal system because of the potential mobility of benefit recipients among the lower level jurisdictions. In the present model, a redistributive scheme at an international level is not ambiguously better than independent national schemes, as the mobility of welfare recipients can in fact increase the net income of employed individuals if the median voter is unemployed. Note, however, that in the present model the median voter always loses from the potential mobility of the unemployed. The median voter, therefore, will unambiguously be in favor of transferring the power to operate an unemployment compensation scheme to an international authority.

7. *Conclusion*

This paper starts from the assumption that a worker's productivity depends on his own quality as well as on the quality of other workers around him. In this setting, migration immediately affects the productivities of workers left behind in the source country and of workers in the recipient country. The model displays what can be called increasing returns to average quality: the output of a group of workers increases more than linearly with average worker quality. The migration of particular workers may or may not increase world output. Free international migration, however, generally reduces world output. In this paper, the model has been applied to migration between countries. The model, however, is also applicable to transfers of individuals between institutions such as companies, universities, or even sports teams.

A main feature of the model is that a system of internal transfers to low quality workers so

as to remove them from the labor force can increase total output. More strongly, retiring low quality workers from the labor force potentially increases the net incomes of benefit recipients and non-recipients alike. The model thus rationalizes the wide-spread systems of income transfers in the developed countries on efficiency grounds. The fact that migration has important externalities also implies that countries generally wish to restrict the exit and entry of workers. Most countries in the world, indeed, have restrictive immigration policies.

Transfer systems generally have the dual role of effecting efficient exits from the labor market and of redistributing income. The political process generally will take both aspects of transfer systems into account. The distribution of the voting population determines whether the transfer system only benefits the unemployed, at the expense of the employed, or whether in fact it benefits both classes of workers. Interestingly, small changes in the composition of the population can have large effects on the outcome of the voting process. In particular, small immigration of benefit recipients can lead the median voter to prefer a materially different transfer system with lower benefit and income tax levels. Such a discrete change in the benefit level leads to upward or downward jumps in the net income levels of all but the median voter.

Appendix

This appendix provides a proof of the assertion that immigration of foreign benefit recipients leads the home country's median voter to prefer a benefit level b_e to a level b_u if before he was indifferent. To see this, note that the net income levels n_e and n_u can be written as $a\mu(1 - \tau_e)$ and $b_u(1 - \tau_u)$, respectively. The changes in net income levels are given by,

$$\frac{dn_e}{da^*} = -a\mu_e \frac{d\tau_e}{da^*} f^*(a^*)$$

$$\frac{dn_u}{da^*} = -b_u \frac{d\tau_u}{da^*} f^*(a^*)$$

Using (9) and the expressions for n_e and n_u , respectively, we see that the above derivatives are equal to,

$$\frac{dn_e}{da^*} = - \frac{b_e}{b_e F(a_{c,e}) + \mu_e^2 (S - F(a_{c,e}))} n_e f^*(a^*) \quad (\text{A1})$$

$$\frac{dn_u}{da^*} = - \frac{b_u}{b_u F(a_{c,u}) + \mu_u^2 (S - F(a_{c,u}))} n_u f^*(a^*) \quad (\text{A2})$$

Note that dn_e/da^* in (A1) exceeds dn_u/da^* in (A2) as $n_e = n_u$ and as,

$$\frac{b_u}{b_u F(a_{c,u}) + \mu_u^2 (S - F(a_{c,u}))} > \frac{b_e}{b_e F(a_{c,e}) + \mu_e^2 (S - F(a_{c,e}))}$$

This inequality reflects that the benefit level b_u is relatively large compared to the entire income tax base.

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Endnotes

1. See Razin and Sadka (1992), Table 9.
2. Ethier (1986) has previously distinguished between low skill and high skill labor in a model of migration.
3. The mean by definition attaches equal weights to the qualities of all workers. One can, however, easily think of activities where the productivities of a group's members depend chiefly on the group's most able members or rather on its least able members. An army's overall success, for instance, may depend primarily on the brilliance of its general. The productivity of a group of workers along a conveyor belt in a car assembly plant, on the other hand, may be determined by the slowest worker.
4. Rivera-Batiz (1982) has previously shown that emigration lowers the welfare of non-migrants if the average amount of capital owned and removed from the country by the migrants differs from the aggregate capital-labor ratio. In addition, the welfare of non-migrants may be affected by remittances, as examined by Djajić (1986).
5. Note that home's imposition of its optimal immigration restriction implies that fewer foreigners are allowed to migrate to the home country than is necessary to maximize world income, as $\mu > (\mu + \mu^*)/2$.
6. Note that there are in fact many ways of dividing the world population into two groups such that mean worker qualities are equal internationally. These equilibria are not stable in the sense that starting from an equilibrium workers that are transferred always face an incentive to retrace their steps. Also note that in the absence of a specification of transportation costs it is impossible to establish the order in which individual workers migrate.

7. The optimal stratification of the work force into two or more nations or groups in the presence of increasing returns to average labor quality is considered in Huizinga (1994). Berglas and Pines (1981) instead examine the optimal stratification of a heterogeneous population by income or tastes in the theory of clubs where agents affect each others' welfares through congestion rather than through labor productivity externalities.
8. Generally, they also are allowed to vote. Note that whether immigrants have voting rights only makes a difference if it influences which of the two benefit levels b_e and b_u is preferred by the median voter. These two benefit levels themselves generally change with the composition of the population, but preferences between the two by those surrounding the median voter are invariant to small immigration flows, unless the median voter is already close to being indifferent before immigration takes place.
9. To be precise, pre-tax income, $a\mu$, is affected by the immigration of prospective employed workers for a given benefit level as follow,

$$\frac{d(a\mu)}{da^*} = a \left(\frac{a^* - \mu}{1 - F(a_c)} \right) f^*(a^*)$$

10. To be precise, using (9) and applying (10) we see that the tax rate, τ , is affected by immigration of prospective employed workers for a given benefit level as follows,

$$\frac{d\tau}{da^*} = \frac{-\tau}{bF(a_c) + Y} (2a^* - \mu)\mu f^*(a^*)$$

11. As before, migration in this setting can have a positive or a negative impact on world output. If the transfer system in the home country is chosen so as to maximize output Y , then equation (5), as before, indicates the effect of migration on world output.
12. See Blank (1988) for evidence on the mobility of welfare recipients in the U.S. in response to interstate differences in welfare benefits.