Migration, Foreign Aid and the Welfare State*

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Abstract

In this paper we highlight aspects related to the links between international migration, foreign aid and the welfare state. We model migration as a costly movement from an aid-recipient developing country with low income and no welfare state, towards a rich donor, developed country with a well-developed welfare state. Within this model, we find, among other things, that the best response of the developed donor country is to increase aid as the co-financing rate by the recipient country increases. When the immigration cost decreases, e.g., due to greater economic integration between the two countries, it is beneficial for the donor country to increase aid and the recipient country to increase the co financing rate.

Key Words: Migration, Foreign aid, Welfare state

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H23 Redistributive Effects

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1. Introduction

A recent UN World Economic and Social Survey (2004) reports a remarkable increase of international migration during the last quarter of the 20th century and the beginning of the 21st. International immigrants rose from 82 million in 1970 to 100 million in 1980, and to 154 in 1990. By the year 2000, approximately 175 million people were living outside the country of their birth. All this, despite the efforts of many host countries to restrict immigration especially that of the low skilled labor. In a recent European Summit it is reported that from 1992 to 2001 immigration rates in the EU were the highest in the world. In this Summit, Wildasin (2004) reports that more than one million people per-year have been arriving to the EU from points of origin beyond its geographic boundaries, amounting to a cumulative inflow of over 13 million immigrants over that period. Countries, traditionally hosts of immigrants, eg., Germany, experienced a resurgence of immigration, while others, traditionally emigration countries, e.g., Spain and Ireland experienced a strong immigration turnaround. On the other hand, at a recent enlargement of the EU (i.e., 1.5.2004) the original 15 union members adopted various restrictions on free labor movements between them and the accession countries for a transitional time period. EU countries are concerned that due to the large differences in workers income, mass migration will occur and this could create problems in their labor markets and endanger their social welfare state.

Governments in advanced societies impose income and other taxes to finance the provision of public goods and inputs and make transfers in money and or in kind to their citizens. Thus, governments with their welfare states transfer incomes from the more to their less affluent citizens, amongst which are the immigrants. In particular, regarding fiscal transfers to this latter group, Wildasin (2004) notes, among other things, that in Germany, Sweden and Denmark where immigrants account for approximately 10 percent of the total population, they are recipients of over 30 percent of total cash welfare expenditures. In addition, Sinn (2004, p. 6) analyzing recent immigration flows into Germany states that: “Migration of workers has been a direct migration into the welfare state because the migrants have less than average productivity, earn less than average wages and are therefore beneficiaries of the

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1 The CES-ifö and BMW Foundation Herbet Quandt Munich Economic Summit on “Social Union, Migration and the Constitution: Integration at Risk”, June 2004.
2 With the exception of two small countries, Cyprus and Malta.
redistributive activities of the welfare state. They pay taxes and contributions but receive more public resources from the state than they pay for. According to a study by the Ifo Institute, in 1997 the average migrant, who had been in the country for less than ten years, received a gift of about € 2,400.”.3

Considering the above it can be argued that unrestrained influxes of immigrants and in particular of low-skilled workers, in host countries may exert strong pressures on the social welfare programs designed to protect low-income groups.

2. Literature Review
Standard neoclassical results of the international migration literature state that permanent migration is welfare beneficial to the natives of a host country and welfare deteriorating to the non-emigrants of a source country, while marginal international labor flows has no welfare effects in either type of countries.4 These results are shown to hold irrespectively of the number of goods or factors, and of whether commodity prices are endogenously determined or exogenously fixed (e.g., Wong, 1985).5

Recent developments in the literature of international migration within models which include income taxes and transfers reveal that immigration of workers, who are subject to the same fiscal treatment as natives and are net fiscal beneficiaries, reduces the welfare of natives (e.g., Wildasin, 1994; Michael, 2003).6 On the other hand, Razin and Sadka (2004), in an infinite-horizon, overlapping generations’ economy,

3 Other studies, however, report on strong potential fiscal benefits of immigrants to the host countries. For example, the UN World Economic and Social Survey (2004) on international migration reports that for low-fertility advanced economies such as Germany, immigration at a constant inflow of 0.25 percent of the initial resident population it is expected to reduce the fiscal burden of future-born natives by approximately 30 percent.
4 Migration is permanent in the sense that immigrants do not remit any part of their income earnings back to the source country. Also permanent immigrants are allowed direct access to the host countries public welfare state. Other types of international migration considered in the international trade literature are temporary and cross-border migration. Kondoh (1999) examines the welfare implications of these types of migration patterns on host country welfare.
5 In the above and other studies of the relevant literature, the welfare beneficial effects of migration for the host country rely on the assumption of perfectly competitive product and factor markets. Chao and Yu (2002) conclude that in an economy with imperfectly competitive commodity markets, immigration of unskilled workers can be welfare deteriorating while that of skilled workers can be welfare improving.
6 See Sandmo and Wildasin (1999), among others, for the welfare implications of immigration and tax policies when immigrants are subject to fiscal treatment different than that of native workers.
show that this net welfare loss due to immigration of the low-skilled labour could change to net gain to the natives.7

Razin, Sadka and Swagel (2002), using data for 11 European countries find positive and statistically significant correlation of rising social transfers to medium and high education immigrants, and negative, but not statistically significant, correlation of social transfers to low education immigrants. Most developed countries, however, are more willing to accept immigration of high skilled workers who, among other things, are net fiscal contributors (e.g., Carrington and Detragiache, 1998; Bauer and Kunze, 2004).

Djajic (2007) examined the welfare effects of migration from the source country’s perspective. He uses a model with three types of households, the rich, the emigrating poor and their non-emigrating relatives, and shows that the degree of sensitivity of migration to targeted aid is the determining factor of the impact of aid on the welfare of non-emigrants.

The purpose of this paper is to highlight aspects related to the links among foreign aid, international migration and the welfare state. To achieve this we model migration as a costly labor movement from an aid-recipient developing country with low income, poor infrastructure, and a non-existing welfare state, towards a rich donor developed country with a well-developed welfare state. The developed country imposes income taxes to finance domestic income transfers and aid to the developing country.8 For the purposes of our analysis, the level of such taxes is viewed as a proxy for the size of the donor labor-importing country’s welfare state. Aid to the developing country, along with appropriating matching funds and other local fixed funds, are used by the latter country to finance the purchases of an imported public input. Thus, in our analysis, along with foreign aid, the recipient country voluntarily contributes, i.e., chooses the aid co-financing rate, to the financing of the public input.9 Two alternative assumptions are made regarding the choice of aid by the

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7 Storesletten (2000) using a calibrated general equilibrium overlapping generations model for the US demonstrates that reforms of immigration policies alone can alleviate the fiscal burden due to the aging of the native born baby boom generation. One such policy would be to admit annually 1.6 million 40-44 years old high skilled immigrants.

8 Xenogiani (2006) reports that: “... the main link between aid and migration lies in the role of aid in employment creation and its effect of reducing migration pressure, (p. 15)... one could suggest the provision of aid from rich countries to poor ones in order to fight the causes of migration (e.g., poverty, unemployment)...(p.29)”.

9 In reality, e.g., aid in the context of EU regional policy, co-financing on the part of the recipient countries is mandatory for aid to be allotted to them and it is set by the donor. In models of
international migration where international transfers to the source country are used as a migration deterrent mechanism (e.g., Faini and Venturini, 1993; Myers and Papageorgiou, 2000), aid is lump-lump distributed to local residents in order to improve their welfare. For example, EU implements the co-financing policy considered here, within its regional policy where countries that get aid are required to finance a certain percentage of the cost of the project.

10 The issue of an altruistic vs. a self-interested donor country is raised, among others and in a different context, by Lahiri and Raymondos-Møller (1997).

11 The assumption that capital is internationally immobile is made for simplicity. The qualitative results of the paper, however, remain the same since capital is less than perfectly mobile. For an analysis of the welfare effects of immigration in the case where capital is perfectly internationally mobile see among others Michael (2003).

12 This asymmetric treatment of the two countries in world commodity and factor (labor) markets is adopted since in the present model the issue is international migration rather than international trade. Practically, however, the model could resemble a case of an “old”, pre-accession, EU donor country (e.g., Germany, France) and of a “new”, post-accession, one (e.g., Poland, Slovakia), where both may be considered price takers in international goods markets but are affected by their bilateral migration flows.

13 Schiff (1994) notes that financial costs of migration, especially when combined with imperfect capital markets, can exert serious constraints on international mobility of workers since they make it difficult for poor immigrants without collateral to acquire loans/funds to cover migration expenses, e.g., transportation expenditures and living expenses until they settle in the host country, or payments to intermediaries in the case of illegal migration. He reports, for example, that in the case of Pakistan donor country. First, we consider the case of an *altruistic donor*, which chooses an amount of aid that maximizes the joint, its own and the recipient country’s, level of welfare. Second, we consider the case of a *self-interested* donor, which chooses the amount of aid so as to maximize its own level of welfare. We find, among other things, that the best response of the developed donor country is to increase aid as the co-financing rate from the recipient country increases. When the immigration cost decreases, it is welfare improving for the donor country to increase aid and the recipient country to increase the co-financing rate.

3. The Model

We develop a two-country, Home and Foreign, general equilibrium model of international migration, foreign aid and of public inputs. For the purposes of our analysis we let Home be a developed aid-donating labor-importing, host-country, while Foreign is a developing aid-receiving labor-exporting, source-country.

Other factors of production, such as capital and land, for simplicity, are assumed to be internationally immobile, and thus their national supplies are equal to their fixed endowments in each country. International trade in goods is free and the two countries are small in world commodity markets. As a result, labor flows between them do not affect world prices of goods. However, the two countries are large in labor markets and labor mobility between them it is not costless.
We assume that each country comprises two groups of identical within each class individuals. *Capitalists* who possess one unit of labor and other factors of production, and *workers* who only possess one unit of labor. This assumption implies that wages are lower than the average income. We further assume that migration between the two countries is from the group of workers and is permanent in the sense that immigrants do not remit any of their income earnings back to the source country.\(^{14}\) We proceed to develop the two-country model of international migration, foreign aid and public inputs. Star variables refer to Foreign.

Let \( N = L + H \) be Home’s total initial population, where \((L)\) and \((H)\) respectively denote the initial number of workers and capitalists in the country. Similarly, \( N^* = L^* + H^* \) denotes Foreign’s total population. Because of the assumptions of the model \( dL = -dL^* \) and \( dH = dH^* = 0 \). Let \( R(L) \) denote Home’s maximum value of gross domestic product (GDP), given constant world commodity prices and fixed endowments of all other factors. These variables are omitted from the GDP function since they do not affect the analysis. The \( R(L) \) function is assumed strictly concave in \( L \) (i.e., \( R_{LL} < 0 \)).\(^{15}\) Its partial derivative with respect to \( L \) (i.e., \( R_L \)) is the marginal revenue product of labor, which in equilibrium equals the country’s rate of return to the factor.

We denote by \( e^j(\mu^j), j = L, H \) the minimum expenditure required for a representative worker \((L)\) or a capitalist \((H)\) to achieve a level of utility \( \mu^j \) at constant commodity prices. Its derivative \( e^j_\mu \) denotes the reciprocal of the marginal utility of income. Home’s public sector (the government) levies income taxes at a rate \((\rho)\). A portion of this tax revenue is used to finance aid of the amount \((T)\) to Foreign, and the remaining portion is equally distributed to the country’s residents as transfer payments.\(^{16}\)

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\(^{14}\) Omitting remittances from our model is a simplifying assumption which, however, is consistent with part of the relevant migration literature (e.g., Wong, 1995). While for some poor countries remittances are at relatively low levels (the UN, 2004), clearly they are a key factor of the aid-migration nexus, far exceeding the amounts of foreign aid, e.g., ODA, by developed countries to the developing world (e.g., the UN, 2004; OECD, 2006).

\(^{15}\) In a standard two-good two-factor Heckscher-Ohlin model it is known that \( R_{LL} = 0 \).

\(^{16}\) It is assumed that all the residents of the country have the same access to the services provided by the government such as health, education etc.
The country’s income-expenditure identity requires that total spending by its residents must equal net income from production minus the transfer payment to Foreign. That is,

\[ Le^H (u^H) + He^H (u^H) = R(L) - T. \]  

(1)

The income-expenditure identity of a Home’s representative worker requires that his expenditure equals net income from labor services plus net transfer payments received from the government in a lump-sum fashion. \(^{17}\) That is,

\[ e^H (u^H) = (1 - \rho)R_L(L) + \frac{\rho R(L) - T}{N}. \]  

(2)

In Foreign, production of goods by the private sector, aside of the use of primary factors (eg., labor, capital, land), also makes use of a public input \((z)\). \(^{18}\) For the purposes of our analysis it is assumed that the quantity \((z^*)\) of the public input is imported by the country’s public sector, purchased in international markets at a constant price \(p_z\). \(^{19}\) Then, the government provides \(z\), at no cost, to the private sector producers for the production of the traded goods. Thus, we define \(R^* (L', z^*)\) to be Foreign’s GDP function at variable supplies of labor and public input, given the fixed endowments of all other primary factors and the constant commodity prices. The latter variables, for the reasons previously noted, are omitted from the GDP function. By the properties of the GDP function \(R^* = \partial z / \partial z^*\) denotes the marginal revenue product of the public input, and is positive and diminishing (i.e., \(R^*_{z z} < 0\)). It is further assumed that labor and the public input are complements in production, that is,

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17 For simplicity, it is assumed that all income is taxable. The results of the paper, however, remain the same if we assume that a fixed part of the income is tax deductible. It is assumed that immigrants are identical to local workers in the host country. Thus, immigrant labour income is taxable at the same rate as that of natives, and as previously noted, immigrants have equal access to public sector services.

18 For simplicity, it is assumed the Home, donor country, does not use a public input in the production of goods. The essence of the results of the paper, however, remain the same if we assume that it uses public input in its production process but the level of the public input is fixed and it does not change with changes in aid, tax rate or in immigration.

19 There exists a broad international trade literature on local production of public inputs along with the production of private goods (e.g., Abe, 1990). Here, and without much loss of generality we depart from this standard analytical framework in order to highlight more clearly the results of the paper.
an increase in the level of the public input $z^*$ increases the marginal revenue product of labor (i.e., $R_{Lz}^* > 0$).

Imports $z^*$ of the public input by Foreign’s government are purchased at a fixed world price. Part of these imports are financed by Foreign through own funds at a fixed amount $F$. The remaining of these imports is financed through foreign aid received from Home, and by appropriating matching funds at a rate $\gamma > 0$ by Foreign’s government to co-finance the purchases of the imported public inputs (i.e., $\gamma T$). For simplicity we assume that both the fixed funds ($F$) and matching funds are raised through non-distortionary taxes solely imposed on the country’s other (i.e., internationally immobile) factors of production, while no taxes of any type are levied on the class of workers. Assuming that Foreign’s government maintains a balanced budget, the public sector’s budget constraint is given by:

$$p_z z^* = F + (1 + \gamma)T. \quad (3)$$

The income-expenditure identity for Foreign requires that total spending by that country’s residents must equal income from production minus the taxes required to finance part of the cost of the imported public input, i.e., $\gamma T + F$. That is,

$$L^e (u^L^e) + H^* e^H^* (u^H^*) = R^* (L^*, z^*) - \gamma T - F. \quad (4)$$

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20 Michael and Hatzipanayotou (2001) examine the welfare effects of migration when revenue from indirect taxes is used to finance the provision of public goods.

21 Alternatively, we can model aid as a matching grant. That is, the recipient country chooses the amount of investment $F^*$ and the donor country choose the co financing rate $\gamma$. In this case the amount of aid is $\gamma F^*$. The qualitative results are the same in both cases.

22 In justifying this assumption we argue that it is the poor unskilled workers, possessing only labor and no capital, those who migrate while more affluent skilled workers or capitalists do not (e.g., Epstein et al., 1999). Since these workers may be amongst the poorer economic groups of the source country, their income may be below or may equal the source country’s minimum taxable income. Among others, Docquier and Marfouk (2004), note of cases where immigration is higher among individuals with higher rather than lower skills, and thus are of higher income earning capacity in the host countries. Our analysis and results do not change if we were to assume that wages are taxed in the recipient country, and then wage tax revenues are equally distributed among all individuals in the country. That is, each worker receives a lump-sum transfer from the government equal to what he pays in taxes. Then the government uses taxes on the internationally immobile, factors of production to finance the public input.
Recall that no taxes of any type are levied by the Foreign’s public sector on the class of workers neither do they receive any transfer from the government. Thus, the income-expenditure identity of a representative worker requires that his spending equals his wage, which at equilibrium, equals his marginal revenue product. Thus,

\[ e^{L'}(L') = R^*_L(L', z^*). \]  

(5)

As previously noted, migration is associated with the class of workers, it is permanent and the labor markets equilibrium requires the equalization of the net income of the factor in the two countries. It is assumed, however, that migration is not costless. That is, immigrants incur fixed monetary and other costs (\( c \)) in moving from one country to the other.  

Thus, labor market equilibrium is achieved when:

\[ R^*_L(L', z^*) = (1 - \rho) R^*_L(L) + \frac{\rho R(L) - T}{N} - c. \]  

(6)

The left-hand side of equation (6) is the marginal revenue product of labor in Foreign, the labor-exporting country. The right-hand side term is the income, net of immigration costs received by an immigrant worker in Home, the labor-importing country.

Equations (1), (2) and (4)-(6) comprise a system of five equations in terms of levels of individual welfare (i.e., \( u^j, u^{L'}, j = L, H \)), and level of employment (i.e., \( L(L') \)) in the two countries. The policy instruments in our analysis are, for Home, the level of foreign aid \( T \), and for Foreign the matching rate \( \gamma \) of co-financing the purchases of the imported public input \( z^* \). The costs of migration \( c \) and the income tax rate constitute exogenous parameters to the model.

The social welfare function is defined as the weighted sum of utilities of all initial persons in the country, with weights equal to the reciprocal of the marginal utility of income of each individual. Thus, changes in social welfare or changes in the welfare of natives (i.e., initial population) are denoted in Home.

\[ 23 \] The immigration cost can be monetary but it can include other costs associated with immigration such as cost of moving, settlement, adjustments cost etc.
by \( dW = \text{Le}_u \text{du}^t + \text{He}_u \text{du}^u \), and in Foreign by \( dW^* = L^* \text{e}_u \text{du}^t + H^* \text{e}_u \text{du}^u \).

Differentiating equations (1), (4) and (6) and using equations (2), (3) and (5) we obtain:

\[
dW = -\Lambda_t dL -dT, \\

\begin{align*}
dW^* &= \frac{T}{p_z}(R^*_z - p_z)d\gamma + \left[\frac{R^*_z + \gamma(R^*_z - p_z)}{p_z}\right]dT, \\

\Delta dL &= \frac{T}{p_z}R^*_L d\gamma + \left[\frac{p_z + (1 + \gamma)NR^*_z}{p_z N}\right]dT - \lambda_t d\rho + dc,
\end{align*}
\]

where \( \Lambda_L = (\rho(R - NR_L) - T)/N \), \( \Delta = [\Phi - (\Lambda_L/N)] \), \( \Phi = (1 - \rho)R_{LL} + R^*_L (< 0) \) and \( \lambda_L = (R/N) - R_L \), which is positive since average income is higher than the wage rate. Moreover, \( \Lambda_L \) is positive since it denotes the net transfer payments per worker in Home, who by assumption is considered a net fiscal beneficiary. That is, a worker receives \( (\rho R - T)/N \) transfer payments that exceed the amount of income taxes \( \rho R_L \) that he pays. By the properties of the GDP function and the above assumption regarding \( \Lambda_L \), \( \Delta \) is negative.

Equation (7) captures the standard direct worsening effect of foreign aid on the donor country’s (Home) welfare. Also, an increase in the local labor force, due to immigration, exerts a negative impact on Home’s welfare since it is assumed that workers are net fiscal beneficiaries (i.e., \( \Lambda_L \) is positive). Equation (8) indicates that if the marginal revenue product of the public input (i.e., \( R^*_z \)) is greater than its fixed price (i.e., \( p_z \)),\(^{24}\) then an increase in the rate \( (\gamma) \) or in the amount of aid \( (T) \), which both raise total funds available for public input spending, raises welfare in Foreign, the aid receiving country. Finally, equation (9) captures the effects on Home’s labor supply, due to migration, from changes in the policy variables, the size of Home’s welfare state, and the cost of migration. It indicates that Home’s labor supply falls either with an increase in the costs of migration \((c)\) and/or with an increase in Foreign’s matching funds rate \((\gamma)\). Intuitively, an increase in the rate \( (\gamma) \) raises

\[^{24}\text{We say that if } R^*_z > (<) p_z, \text{ then there is under-(over) provision of the public input.}\]
purchases of $z^*$ which in turn raises the marginal revenue product of labor, and thus the equilibrium wage rate, in Foreign. This increase in Foreign’s wage rate reduces the number of emigrants from Foreign or causes return migration from Home to Foreign. In either case, the higher ($\gamma$) reduces Home’s labor supply. An increase in the amount of aid entails a negative impact on Home’s labor supply. On the one hand, higher aid to Foreign exerts a negative impact on the donor country’s labor supply since it lowers domestic workers net income earnings by decreasing the net income transfers. On the other hand, as in the case of a higher matching rate ($\gamma$), an increase in the amount of aid reduces Home’s labor supply since it increases wages in Foreign, given that labor and the public input are complements in production. Lastly, the third term in equation (9) captures the impact of changes in the donor’s income tax rate on the domestic labor supply. Since the wage rate is lower than the average income (i.e., $\lambda_\delta > 0$), this term is positive. Thus, an expansion of the host country’s welfare state, through a higher income tax rate, induces new immigration which results to an increase in the domestic labor supply.

4. Aid, International Migration and Welfare

In this section, we derive the effects on each country’s welfare from changes in the policy instruments or the exogenous variable. Substituting equation (9) into (7) and using equation (8), changes in Home and Foreign’s welfare due to changes in the variables $T$, $c$, $\rho$ and $\gamma$, accounting for migration induced changes in labor supplies, are given as follows:

$$\Delta dW = A_\gamma dT + A_\rho d\rho + A_c dc,$$

$$dW^* = B_\gamma dT + B_c dc,$$

where,

$$A_\gamma = -\Delta - (p_z N)^{-1} \Lambda_\delta [p_z + (1+\gamma) NR^*_L], \quad A_\rho = -p_z^{-1} T \Lambda_\delta R^*_L,$$

$$A_c = N^{-1} \Lambda_\delta (R - NR_L), \quad A_c = -\Lambda_\delta, \quad B_\gamma = p_z^{-1} [R^*_z + \gamma (R^*_z - p_z)], \quad B_\gamma = p_z^{-1} (R^*_z - p_z) T,$$

and $B_c = B_\rho = 0$.

Equation (10) depicts the effects of changes in the policy instruments $T, \gamma$, in the size of the welfare state, $\rho$, and in the migration cost parameter $c$ on Home’s
welfare. The term $\Delta^{-1} A_T$ indicates that more aid to Foreign exerts a direct negative effect, and an indirect, labor supply, effect on Home’s welfare. As we have seen, labor supply in Home falls as a result of aid, and thus aid may result to the so-called “transfer paradox” whereby it may improve Home’s, the donor country, welfare if the indirect labor supply effects dominates the direct negative effect of aid. The term $\Delta^{-1} A_T$ indicates that an increase in the matching rate of aid ($\gamma$), increases employment in the Foreign since labor and the public input are complements in production, reduces immigration in Home and thus increases its welfare, since immigrants are net fiscal beneficiaries. An expansion in Home’s welfare state, indicated by an increase in $\rho$, captured by the term $\Delta^{-1} A_\rho$, entails a negative impact on domestic welfare. An expansion of Home’s welfare state leads to immigration into the country. Since by assumption workers are fiscal beneficiaries, this induced increase in domestic labor supply affects negatively Home’s welfare. Finally, a decrease in the cost of immigration unambiguously decreases Home’s, the labor-importing country’s, welfare since it causes inflow of net fiscal beneficiary workers. Equation (11) captures the effects of changes in $T, \gamma$ and $c$ on Foreign’s welfare. Specifically, if there is under provision of the public input, then more aid or a higher matching rate ($\gamma$) raises Foreign’s welfare.

4.1. Optimal policies for the Donor,

In this subsection we assume that Home, the donor country, cares about the welfare of Foreign, assigning a weight $0 < \mu \leq 1$ to that country’s welfare changes. Thus, $\mu$ captures the degree of Home’s altruism, and a value of $\mu = 1$ denotes the case of a “fully altruistic” donor. Thus Home chooses the amount of aid ($T$) so as to maximize the joint, i.e., its own and the recipient Foreign’s welfare. From equations (10) and (11), after some calculations we obtain:

$$N \rho_z \Delta \left( \frac{dW}{dT} + \mu \frac{dW^*}{dT} \right) = \Omega = N \Phi \left[ \mu \gamma (R_{T^*}^z - p_{z^*}) + \mu R_{T^*}^z - p_{z^*} \right]$$

$$+ (\rho \Lambda_{T^*} + \bar{T}) (1 + \gamma) (N R_{T^*}^z + \mu R_{T^*}^z - \gamma \mu p_{z^*}),$$

Equation (11) captures the effects of changes in $T, \gamma$ and $c$ on Foreign’s welfare. Specifically, if there is under provision of the public input, then more aid or a higher matching rate ($\gamma$) raises Foreign’s welfare.

25 Note that combining equations (9) and (10) we can write $A_T = -\Delta (1 + \Lambda_L (dL / dT))$. 

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where \( \bar{T} = T / N \) and \( \Omega_T = A_T + \mu B_T \). Setting \( \Omega_T = 0 \), the optimal level of aid \( (T_\Omega) \) maximizing the two countries joint welfare is given by

\[
T_\Omega = \left[ \rho \lambda_z - N \Phi \left[ \frac{\mu \gamma (R_z^* - p_z) + \mu R_z^* - p_z}{(1 + \gamma) \left( NR_{z^*} + \mu R_z^* \right) - \gamma \mu p_z} \right] \right] N. \tag{13}
\]

The denominator of the right hand side term of equation (13) is always positive if the marginal revenue product of the public input is equal or greater than its unit cost (i.e., \( R_z^* \geq p_z \)) (sufficient but not necessary condition).\(^{26}\) The numerator of the same term, however, may be positive, zero or negative, depending among other things, on the values of Home’s degree of altruism \( (\mu) \) and on the specific value of rate \( (\gamma) \) chosen by Foreign.

### 4.2. The Nash equilibrium

We now examine the choice of the instruments by the two countries, assuming that they act non-cooperatively (Nash). Home decides on the amount of aid \( (T) \) and Foreign, the recipient labor-exporting country, chooses the matching rate \( (\gamma) \) to foreign aid. For this, the first order conditions, or the reaction functions, are given by setting equation (12) equal to zero (i.e., \( \Omega_T = 0 \)) and by the following:

\[
\Delta (dW^*/d\gamma) = B_\gamma = 0. \tag{14}
\]

The solution of these two reaction functions simultaneously determine the Nash equilibrium values of \( (T) \) and \( (\gamma) \). In particular, from equation (14) we have that the Nash equilibrium value of \( (\gamma) \) require that \( R_z^* = p_z \). That is, the Nash equilibrium value of \( (\gamma) \) leads to the provision of \( z^* \) up to the point where its marginal revenue

\(^{26}\) Note that the recipient country never chooses \( \gamma \) in a way that the public input is over-provided (i.e., \( R_z^* < p_z \)). If it does so, then by reducing \( \gamma \) and thus the amount spend for public input, welfare increases and it will continue to increase until \( R_z^* = p_z \).
product is equal to its fixed world price. Setting $\Omega_r = 0$, and using equation (14), we obtain Home’s, the donor country’s, Nash equilibrium value of $(T)$ as follows:

$$T_{\Omega} = \rho \lambda_L - \frac{N \Phi (\mu R_L^* - p_z)}{(1 + \gamma^0) N R_L^* + \mu R_L^*} N ,$$

(15)

where $\gamma^0$ is the optimal co-financing rate.

If Home is a fully-altruistic donor, i.e., $\mu = 1$, then the optimal amount of aid which maximizes the countries joint welfare is unambiguously positive and it is given by $T_{\Omega} = \rho N \lambda_L$. Intuitively, when $R_L^* = p_z$, $\mu = 1$ and the donor country gives aid $T$, the welfare of the recipient country increases by $T$ and the donor’s decreases by $T$, which cancel each other. There is, however, an additional indirect effect via the increase in employment in the recipient country and thus a decrease in immigration in the donor country. Since immigrants are net fiscal beneficiaries, the reduction in immigration in the donor country increases its welfare by $\rho N \lambda_L$. The optimum amount of aid equals the gain in its welfare due to the reduction in the immigration.27

If Home is not fully altruistic, i.e., $0 < \mu < 1$, while $\gamma = \gamma^0$, then, ceteris paribus, the amount of aid maximizing the countries joint welfare is smaller than that in the fully altruistic case.

In the case where Home, is a completely “self-interested” country, i.e., $\mu = 0$, equation (15) gives Home’s, the donor country’s, Nash equilibrium value of $(T)$ as follows:

$$T^0 = \rho \lambda_L + \frac{\Phi p_z}{(1 + \gamma^0) R_L^*} N .$$

(16)

Equation (16) indicates that the Nash equilibrium value of $(T^0)$ can be positive or zero.28 However, given everything else, the likelihood for it to be positive increases if (i) the degree of complementarity between labor and the public input in Foreign’s

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27 In this case substituting $T_{\Omega}$ into the migration equilibrium condition, equation (6), it reduces to $R_L^* = R_L - c$.

28 The two right-hand side terms of equation (16) are of opposite sign. The amount of aid, however, can only be non-negative.
production (i.e., $R_{z'}^o$) is high, and (ii) the difference between the average income and the marginal revenue product of labor in Home, i.e., $\lambda_z$ is large. Intuitively, when $\lambda_z$ is large then a decrease in immigration due to aid has larger positive effect on the donors welfare. Similarly, when the degree of complementarity is high, aid that increases the public input increases a lot the domestic employment and thus it has a large negative effect on immigration into the donor. Observing equations (15) and (16) it is easily verifiable, when $\mu = 1$, and since $R_{z'}^o = p_z$, then $(T_o - T') > 0$. That is, the amount of aid chosen in the fully altruistic case is greater than the one chosen in the self–interested case.

Consider the case where Foreign choose ($\gamma$) sub-optimally, e.g., $\gamma' < \gamma^0$ so that $R_{z'}^o > p_z$, while assume that Home, behaves as a fully-altruistic country. Then, from equation (13) it is easily observable that the numerator of the second term is positive, which implies that the amount of aid is higher compared to the case where the recipient chooses optimally its co financing rate. Thus, when the public input is sub-optimally provided in the recipient country, then there is an additional positive effect on the welfare of the recipient country, since it finances the public input with aid and the marginal revenue product of the public input is greater than its marginal cost, i.e., $R_{z'}^o > p_z$.

**Proposition 1:** Consider two small open economies linked through international migration, and foreign aid which finances, along with matching funds by the recipient country, the purchases of a public input by the latter country. Then,

- Assume that both countries behave non-cooperatively. If the donor country acts fully self-interested, then the Nash equilibrium values of $\gamma$ requires $R_{z'}^o = p_z$ and the Nash equilibrium amount of aid is positive or zero.
- Assume that both countries behave non-cooperatively. If the donor country acts fully altruistically, then the optimal amount of aid equals the gains to the donor’s welfare due to the reduction in immigration. If the degree of altruism is less than full, then the optimal amount of aid is smaller than the aforementioned level.
When the donor acts fully altruistically, the optimal amount of aid to the recipient is greater when the latter country chooses sub-optimally rather than optimally its co-financing rate.

4.3. Aid, co-financing and the immigration cost.

Having obtained the Nash equilibrium values of the policy instruments \( T \) and \( \gamma \), we examine how changes in the immigration cost and the size of the welfare state affect the above Nash equilibrium values when the donor country is completely self-interested, i.e., \( \mu = 0 \). Differentiating the best response or the reaction functions \( \Omega_T = A_T = 0 \) and \( B_T = 0 \), we obtain:

\[
A_{\gamma T} dT + A_{\gamma^2} d\gamma = -A_{\gamma T} d\gamma - A_{\gamma^2} d\rho, \\
B_{\gamma T} dT + B_{\gamma^2} d\gamma = -B_{\gamma T} d\gamma - B_{\gamma^2} d\rho.
\]

(17)

(18)

The expressions and signs of the coefficients in the above equations are given in the Appendix.

First, equations (17) and (18) can give the slope of each country’s best response function. Specifically for Home and Foreign, respectively, we have:

\[
\left( \frac{dT}{d\gamma} \right)_{A_T = 0} = \frac{-A_{\gamma T}}{A_{\gamma^2}}, \quad \left( \frac{dT}{d\gamma} \right)_{B_T = 0} = \frac{-B_{\gamma T}}{B_{\gamma^2}}.
\]

(19)

Both expressions are of positive sign, i.e., both best response functions have positive slope, given the signs of the right-hand side terms as stated in the Appendix. That is, when Foreign raises its co-financing rate \( \gamma \) the best response for Home is to increase the amount of foreign aid. Likewise, the best response for Foreign, when Home raises the amount of aid, is to increase its co-financing rate \( \gamma \). Moreover, invoking the stability condition of equations (A.3) of the Appendix, requiring that \( D > 0 \), then \(-\left( A_{\gamma T} / A_{\gamma^2} \right) > -\left( B_{\gamma T} / B_{\gamma^2} \right)\).

Second, using equations (A.4) of the Appendix, the effect of an increase in the migration cost \( c \) on the Nash equilibrium values of policy parameters \( T \) and \( \gamma \) is given as follows:
Equations (20) and (21) indicate that a decrease in the immigration cost unambiguously increases the Nash equilibrium amount of aid by Home, and Foreign’s co-funding rate.\(^{29}\)

Insert Figure 1

This can also be seen with the help of Fig. 1. Both reactions functions have positive slope and the initial Nash equilibrium is at \(\Gamma^0\). Using equation (17) we get that \(\left.\frac{dT}{dc}\right|_{\gamma=0} = -(A_{Tc}/A_{TT})\) which is positive. Thus a decrease in the immigration cost moves downwards the \(A_r = 0\) line. Similarly, using equation (18) we get that \(\left.\frac{d\gamma}{dc}\right|_{T=0} = -(B_{\gamma c}/B_{\gamma\gamma})\) which is also positive. Thus, a decrease in the immigration cost moves to the left the \(B_r = 0\) locus. The new Nash equilibrium is at point \(\Gamma^1\), which is characterized by higher values of both foreign aid \(T^1\) and the co-financing rate \(\gamma^1\).

Intuitively, when the immigration cost decreases, immigration in the host country increases. For a given tax rate, the larger number of workers causes the net transfer per worker to decrease. For the net transfer per worker to remain constant, (i.e., condition \(A_r=0\) to be satisfied) foreign aid has to decrease (i.e., to make more funds available for workers). This moves downwards the \(A_r = 0\) locus in figure 1. In Foreign, the emigration reduces the domestic labor supply which causes the marginal revenue product of the public input to decrease. To keep the marginal revenue product

\(^{29}\) An explanation for the positive sign of the term \(\Lambda_L + \rho NR_{LL}\) is provided by equation (A.1) in the Appendix.
of the public input at the initial level (i.e., condition $B_\gamma=0$ to be satisfied), its level must fall, which is achieved with the reduction in the co-financing rate. This moves to the left the locus $B_\gamma = 0$ in Fig. 1. Given the reactions functions of each country, that is in Home as $\gamma$ increases the amount of aid increases and in Foreign as $T$ increases $\gamma$ increases, in order to achieve a stable equilibrium, foreign aid has to increase which in turn causes $\gamma$ to increase and so on. The Nash equilibrium is achieved at point $\Gamma$ with larger values of foreign aid and of the co-financing rate.

Because of the immigration induced welfare losses, Home has an incentive to provide more aid to Foreign in order to reduce immigration. Thus, if for some reason (e.g., due to greater economic integration), immigration cost is reduced, causing immigration, then it is beneficial for the Home, the donor, to provide more aid that in turn reduces immigration. The reduction in the immigration cost, which causes the increase in aid by the donor, creates an incentive for the recipient country to increase the co-financing rate $\gamma$ since this increase; increases even further the amount of aid.

4.4. Aid, co-financing and the size of the welfare state
We now examine how, given the cost of immigration (ie., $dc = 0$), changes in the size of the host country’s welfare state ($\rho$) affect the Nash values of ($T^o$) and ($\gamma^o$) when the donor is completely self-interested (i.e., $\mu = 0$). Using equations (A.4) of the Appendix, the effect of an increase in the size of Home’s welfare state ($\rho$) on the Nash values of the policy instruments ($T$) and ($\gamma$) is given as follows:

\[
\left(\frac{T}{p_z}\right)^{-1} \Delta^2 D \left(\frac{dT^o}{d\rho}\right) = -\Delta \Psi \left(\frac{T}{p_z}\right) R^*_z \gamma + \left[ \Psi \left(\frac{T}{p_z}\right) + \rho \delta N^2 (\lambda(A_L + \rho NR_{LL}) - N A_L R_{LL}) \right] R^*_L z \gamma .
\]

(22)

\[
N^{-1} (\Delta \rho)^2 D \left(\frac{dy^o}{d\rho}\right) = (1 + \gamma)NR^*_z \gamma - \beta \left[ \rho \lambda (1 + \gamma) \left(\frac{T}{p_z}\right) R_{LL} R^*_z \gamma + \Delta \right] R^*_z \gamma ,
\]

(23)

30 Myers and Papageorgiou (2000) in a model with illegal immigration have shown that when illegal immigrants have access to the public sector welfare state, then as the border control becomes more expensive some migration is permitted and foreign aid may be used to reduce migration pressure.
where, \( \Psi = \Delta R_{L^L} - p_z^{-1}(1+\gamma)R_{L^L}^* (R_{L^L} + R_{L^L}^*) > 0 \), \( \delta = (1+\gamma)\tilde{\lambda}R_{L^L}^* > 0 \), and \( \beta = p_z + N(1+\gamma)R_{L^L}^* > 0 \).

Both expressions of equations (22) and (23) have ambiguous signs. The first term on the right hand side of both equations is negative while the second term is positive. That is, an increase in the size of the welfare state has an ambiguous effect on the Nash equilibrium level of foreign aid and the co-financing rate.

Insert Figure 2

The effect of an increase in the size of the welfare state on the Nash equilibrium level of foreign aid and the co-financing rate is shown with the help of Fig. 2. The initial Nash equilibrium is at \( \Gamma^0 \). Using equation (17) we get that \( \left( \frac{dT}{d\rho} \right)_{\rho_T=0} = -\left( \frac{A_T}{A_{TT}} \right) \) which is positive. Thus the increase in the welfare state moves the \( A_T = 0 \) locus upwards. Similarly, using equation (18) we get that \( \left( \frac{d\gamma}{d\rho} \right)_{\rho_T=0} = -\left( \frac{B_T}{B_{TT}} \right) \) which is negative. Thus, the increase in the welfare state moves to the left the \( B_T = 0 \) locus. Such shifts in the two loci can lead to a new Nash equilibrium either to the left or up and right of the initial equilibrium \( \Gamma^0 \). As a result, the emerging new Nash equilibrium values of \( (T,\gamma) \) may be either bigger or smaller than their corresponding values at the initial equilibrium \( \Gamma^0 \). The final effect depends on the slopes and on the size of the movements of the reaction curves. One such possible outcome is a new Nash equilibrium as depicted by point \( \Gamma^1 \), whereby the new equilibrium values of aid \( (T^1) \) and of the co-financing rate \( (\gamma^1) \) are respectively higher and smaller to their initial values at \( \Gamma^0 \).

Intuitively, when the welfare state increases, this causes two opposing effects on the net transfers to workers. When the welfare state increases, the tax revenues increase, which in turn raise the net transfers to workers (direct positive effect). The indirect negative effect is caused from the induced inflow of immigrants, which decreases the net transfer per worker. The total effect of an increase in the welfare state on the net transfer is shown to be positive (see equation A2 in the Appendix). For the net transfer per worker to decrease (i.e., condition \( A_T=0 \) to be satisfied) the
host country increases aid to Foreign. This is shown with upward movement of the $A_T = 0$ locus in Fig. 2. In Foreign, emigration reduces the domestic labor supply, which reduces the marginal revenue product of the public input. To increase the marginal revenue product of the public input to the initial level to satisfy the Nash Equilibrium condition (i.e., $R_Z^* = p_Z$), the level of public input has to decrease and this is achieved with the reduction in the co-financing rate. This is shown with leftward movement of the $B_T = 0$ locus in Fig. 2. Given the reactions functions of each country, the total effect of these shifts on the Nash equilibrium values is ambiguous, depending on their slopes and on the size of their movements.

The previous results are summarized in the following proposition.

**Proposition 2:** Consider two small open economies linked through international migration, and foreign aid which finances, along with matching funds by the recipient country, the purchases of a public input by the latter country. Then, at Nash equilibrium:

- A decrease in the cost of immigration unambiguously increases both the Nash equilibrium amount of aid by the donor and the co-financing rate by the recipient country,
- An increase in the size of the donor country’s welfare state has an ambiguous effect on the Nash equilibrium amount of aid by the donor and the co-financing rate by the recipient country.

**5. Concluding Remarks**

It is well known that there are large differences in wages and government income transfers through the welfare state, between developed and developing countries. Globalization and recent technological developments have made people in the developing countries more aware of these disparities and have reduced the cost of migration. Consequently, large numbers of people from developing countries are willing to migrate to the rich world. The host countries, however, are reluctant to accept large numbers of low-skilled immigrants. They are afraid that large number of immigrants will affect negatively their local labor markets and endanger their social welfare states since the low skilled immigrant are expected to be net fiscal beneficiaries.
This paper develops a framework that accounts for the above features. That is, we build a two-country model where migration takes place from a developing-source country with no welfare state to a developed-host country with a comprehensive welfare state of income taxes and transfers from its more to its less affluent residents. Labor mobility between the two countries is not costless due to the existence of migration costs. The developed country gives aid to the developing country. This aid, along with local co-financing, by the developing country is used for the provision of a public input that positively affects the marginal revenue product of labor. We first consider the case of an altruistic donor which chooses the amount of aid so that it maximizes the joint, its own and the recipient country’s, level of welfare. Second, we consider the case of a self-interested donor, which chooses aid so as to maximize its own level of welfare.

We demonstrate, among other things, that, when the donor country acts fully altruistically and the recipient country chooses optimally the co-financing rate, then the optimal amount of aid equals the gains to the donor’s welfare due to the reduction in immigration. If the degree of altruism is less than full, then the optimal amount of aid is smaller than the aforementioned level. When the donor acts fully altruistically, the optimal amount of aid to the recipient is greater when the latter country chooses sub-optimally rather than optimally its co-financing rate. If there is a reduction in migration cost, due to globalization or due to greater economic or political integration, then it is beneficial for the donor-host country to increase the Nash equilibrium amount of aid to the recipient-source country, and for the recipient country to increase the co-financing rate. Our analysis thus implies for instance that for the original 15 EU members it is beneficial to increase aid to the new members through the EU regional policy or that for the USA and Canada it is beneficial to give tied economic aid to Mexico for the co-financing of improvements in its infrastructure.31,32.

31 For example, instead of the co financing rate of the EU regional policy to be fixed, as the immigration cost decreases, it will beneficial for both, the old and the new EU countries if the former countries increase aid to the latter and the new countries increase the co-financing rate as the number of new financed projects increases.

32 Another example is that of regional development transfers between two regions of the same country, e.g., former West Germany gives aid to former East Germany to finance the improvement in its infrastructure.
APPENDIX

I. The coefficients in equations (18) and (19) and their signs

(I.a) The coefficients: Using the first order conditions $A_T = 0$ and $B_\gamma = 0$, and when differentiating $A_T = 0$ we assume that the third derivatives of the revenue function are zero, we obtain:

\[ A_{TT} = \Delta^{-1} p z^2 \rho (1 + \gamma) NR_{LL} R_{zz}^* [p_z + N(1 + \gamma) R_{z'}^*] > 0, \]
\[ A_{T\gamma} = \Delta^{-1} (1 + \gamma) NR_{z'}^* [N A_L^2 + T(A_L + \rho NR_{LL})] < 0, \]
\[ A_{Tc} = \Delta^{-1} p_z N(1 + \gamma) R_{z'}^* (A_L + \rho NR_{LL}) < 0, \]
\[ A_{T\rho} = R_{LL} - \frac{\lambda(1 + \gamma) R_{z'}^*}{\Delta p_z} (R_{LL} + R_{z'}^*) < 0, \]
\[ B_{TT} = (T/p_z)^2 (R_{zz}^* - \Delta^{-1} R_{z'}^*) < 0, \]
\[ B_{T\gamma} = (Np_z^2)^{-1} [N(1 + \gamma)(R_{zz}^* - \Delta^{-1} R_{z'}^*) - p_z \Delta^{-1} R_{z'}^*] > 0, \]
\[ B_{Tc} = -(\Delta p_z)^{-1} TR_{z}^* > 0, \quad B_{T\rho} = \Delta^{-1} \lambda(T/p_z) R_{z'}^* < 0. \]

(I.b) The signs of the coefficients:

(i) $A_{TT}$ and $B_{TT}$ are signed based on the welfare maximization problem of each country. Namely, Home chooses $(T)$ and Foreign chooses $(\gamma)$, non-cooperatively, so that social welfare is maximized. Following suitable calculations this implies that for Home $(d^2W/dT^2) = \Delta^{-1} A_{TT}$ must be negative, and for Foreign $(d^2W/d\gamma^2) = B_{TT}$ must be negative. For these results the necessary condition is that $A_{TT} > 0$ and $B_{TT} < 0$, respectively.

(ii) The sign of the expression $A_{T\gamma}$ and of $A_{Tc}$ is determined by the sign of the right-hand side term $(A_L + \rho NR_{LL})$. Based on the assumptions of the model, the latter term is signed as follows:

Let $\Lambda_L = \frac{\rho R - T}{N} - \rho R_L$ be the net fiscal benefit accruing to a representative worker in Home, the host country. Differentiating this expression with respect to $(L)$ captures the migration induced change in this per-capita net fiscal benefit. That is:
\[
\frac{d\Lambda_L}{dL} = \frac{d}{dL}\left(\frac{\rho R - T}{N} - \rho R_L\right) = -(\Lambda_L + \rho NR_L).
\]  
(A.1)

Assuming that \((d\Lambda_L/dL)\) is negative, i.e., the net fiscal benefit of a worker in Home falls as more immigrants enter into the country, it requires \(\Lambda_L + \rho NR_L\) is positive. Based on this, \(A_T\) and \(A_{TC}\) are of negative sign.

Differentiating the expression \((\Lambda_L)\) with respect to \((\rho)\) gives the effect of changes in the size of Home’s welfare state on net transfer payments to a representative worker. After suitable calculations we obtain:

\[
\frac{d\Lambda_L}{d\rho} = N^{-1}\left[(R - NR_L) + \frac{\partial\Lambda_L}{\partial L} \frac{dL}{d\rho}\right] = \Delta^{-1}\Lambda_L \left(R_{LL} + R_{LL}^*\right) > 0.
\]  
(A.2)

(iii) The coefficient \(B_{\gamma T}\) is signed as follows: Equations (18) and (19) in a matrix form are given as:

\[
\begin{bmatrix}
A_T & A_T^* \\
B_T & B_T^*
\end{bmatrix}
\begin{bmatrix}
dT \\
d\gamma
\end{bmatrix} =
\begin{bmatrix}
-A_T^* \\
-B_T^*
\end{bmatrix}
dc +
\begin{bmatrix}
-A_T \\
-B_T
\end{bmatrix}
\begin{bmatrix}
d\rho
\end{bmatrix},
\]  
(A.3)

where the determinant of the matrix of the coefficients of \(dT\) and \(d\gamma\) is

\[D = A_T B_T - A_T^* B_T^*.\]  
Stability requires that \(D\) is positive. Given the signs of \(A_T, A_T^*, B_T, B_T^*,\) the necessary condition for \(D > 0\) is that \(B_{T T} > 0.\)

(iv) Lastly, \(B_{Tc} > 0\) and \(B_{\rho T} < 0\) are based on our assumption that \(R_{LL}^* > 0.\)

II. The effects of changes in \(c\) and \(\rho\) on \((T)\) and \((\gamma)\):

Equations (A.1) yield the following results:

\[
D\left(\frac{dT^*}{dc}\right) = -A_T B_{\gamma T} + A_T^* B_{T T} \]  
and \quad \[D\left(\frac{d\gamma^*}{dc}\right) = -A_T B_{T T} + B_{T T}^* A_T,\]

\[
D\left(\frac{dT^*}{d\rho}\right) = -A_T B_{\rho T} + A_T^* B_{T \rho} \]  
and \quad \[D\left(\frac{d\gamma^*}{d\rho}\right) = -A_T B_{T \rho} + B_{T \rho}^* A_T.\]  
(A.4)
References


Fig. 1. Nash equilibrium and the cost of migration
Fig. 2. Nash equilibrium and the size of the welfare state