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International migratory agreements: the paradox of adverse interest

Abstract

This article seeks to explain the contradiction between the promises of welfare gains derived from the economic models recommending the removal of immigration restrictions and the realities experienced by countries attempting to apply restrictions to immigration flows. A formal model is built in which the strategic reaction of countries considers not only the benefits derived from migration but also the (economic and non-economic) costs that migration can generate in the host country. Strategic reactions drive what may be called the "paradox of adverse interest": the fewer potential gains associated with liberalization of migration, the easier it becomes for nations to reach an unrestrictive agreement. The existence of two asymmetries (between the bargaining power of receiving and sending countries, and between the private nature of most of migration's benefits and the social nature of its main costs) can hinder the agreement when the countries involved exhibit a high wage differential. Results suggest that permissive international agreements on migration are easier to reach in regional contexts, among countries with proximate economic conditions and levels of income.

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1 Introduction

The increase in migratory flows is one of the most visible aspects of the globalization process. According to the United Nations, there were about 258 million international migrants in 2017. In relative terms, this corresponds to over 3.4% of the world population. This percentage does not seem exceptionally high, especially when compared with the proportion of other cross-border transactions, such as trade and investment. However, the social and political relevance of migration goes beyond numbers as migration involves people (with individual rights and agency) and not merely inert production factors.

Economic theory predicts that international migration is associated with an improvement in global efficiency, since it allows people to move from where they are less productive (labor-abundant developing economies) to where they are more productive (labor-scarce developed economies). As a consequence, migration may be considered as a developmental force for the countries involved, and particularly for the migrants themselves (Hatton and Williamson, 1998, 2005; Jaumotte et al., 2016). Only few studies have quantified the global welfare gains that might be drawn from a borderless world. Their results are astonishingly high and significantly higher than those that can be expected from trade or capital liberalization. Obviously, not all sectors of society would benefit from such change, but the overall result is clearly positive.

Given the expected positive effect given by economic theory, it would be natural to expect countries to enthusiastically support the international mobility of labor. However, only the opposite phenomenon has been observed, namely, tougher regulatory restrictions to migration, particularly in the case of unskilled workers (Martin et al., 2006a,b; Ruhs, 2015; Trachtman, 2009; among others). Given this reality, some authors have considered the aforementioned economic estimates to be incomplete and biased, referring to other factors (not necessarily economic in nature) that may attenuate or contradict the gains predicted from the removal of immigration restrictions. As a consequence, while some specialists consider free migration a promise of "trillion-dollar bills on the sidewalk" (Pritchett, 2006; Clemens, 2011), others suggest that such promises are simply fanciful (Borjas, 2015) or else interpret migration as a serious threat to the social order in recipient countries (Collier, 2013).

This article explores the contradiction between the expectations of welfare gains that are derived from labor mobility and the realities when countries trying to apply severe restrictions to immigration flows. We suggest a formal model, empirically illustrated, that may explain why countries reject the adoption of a more liberal migratory regime at the international level. As a starting point, we presume that countries attempt to implement policies that are either in their own interest or, at least, aligned with the interests of those social sectors, which are having the capacity for taking decisions. As a consequence, if countries adopt restrictions to labor mobility, it is sometimes because they take into account certain costs that are not properly considered in the standard models. In order to clarify this in our model, payoff functions have been built in which benefits and costs are considered in both the host and home countries.

When gains and costs are considered in a strategic game, we obtain a result that has been termed the "paradox of adverse interest": the smaller the potential welfare gains associated with migratory liberalization, the easier it becomes for nations to reach an agreement that reduces migration restrictions; on the other hand, the greater the potential gains, the more difficult for the possibility of such an agreement. Evidence from bilateral labor agreements (BLAs) confirms this relation, as the bulk of BLAs have been signed between countries with more or less

same levels of income (Chilton and Posner, 2017; Peters, 2018). The aforementioned paradox is associated with: (i) the effects that wage differentials (and, therefore, income per capita differences) between countries tend to exert on the volume of non-skilled workers willing to move; (ii) the limited technical and institutional capacity that developing countries (particularly, the poorest) have to control and screen the flow of migrants; and (iii) the links between the number of immigrants (including undocumented ones) and the magnitude of the (visible and invisible) costs of migration in the host country.

The article consists of seven sections. In Section 2, the literature on the welfare effects of free migration is briefly presented. Sections 3 and 4 are oriented to discuss the assumptions adopted by this literature, and following an economic policy approach, identify the conflicting interests existing between the different actors involved in the migratory process. In Section 5, a basic model incorporating the strategic incentives of developed and developing countries is defined. Section 6 analyses the resulting game together with the international migration incentives derived from its set of equilibria. Finally, in Section 7, some final opinions are offered in order to understand the limitations of the exercise. Formal proofs and model extensions have been explained in Section "Appendix."

2 Global welfare

Economic theory offers consistent arguments to indicate that the removal of immigration restrictions would be a source for significant welfare gains. Many studies have attempted to gauge how large these benefits might be in the hypothetical case of free movement of people. The earliest works on this subject (such as Hamilton and Whalley, 1984 or Moses and Lettnes, 2004) applied static partial equilibrium models, assuming full labor mobility. The estimated benefits were striking: in the first study, the world GDP could double as a consequence of completely free migration, while in the second, the increase in global efficiency could amount to, in the most conservative scenario, something between 6 and 47% of the world's GDP.

Subsequent studies confirmed the tone of these results. For example, Iregui (2005) used a fully developed static general equilibrium model (AGE) with trade and found that the reduction in world GDP caused by migration barriers amounted to something between 13 and 67%, depending on the scenario considered. Klein and Ventura (2007, 2009) used a growth model that included dynamic effects and concluded that completely free migration would increase world GDP by something between 20 and 120%. Finally, Bradford (2012) applied a one sector AGE model with a continuum of skills and confirmed the effect of free migration on the increase of world GDP (75%) and the reduction of poverty (between 66.9 and 43.3%).

The World Bank (2006) carried out a similar exercise, but assuming an annual growth rate of 3% for the working population in developed countries between 2001 and 2025, and allowing for labor needs to be covered, as required, by immigration. Taking as a baseline assumption the proportion of immigrants in 2001, they estimate the net welfare gains from such an expansion scenario to be close to US$674 million, or 1.19% of the world GDP (0.63% in Purchasing Power Parity terms). These results are very close to those obtained by Walmsley and Winters (2005) and Van der Mensbrugghe and Roland-Holst (2009) through static computable general equilibrium models.

Giovanni et al. (2015) reanalyzed this field by incorporating several novelties to the approach. In particular: (i) they included remittances as a way to transfer some of the increased productivity of migrants back to the residents in the home country; (ii) they considered the effect of migration on market size and product variety, taking into account several insights from the recent literature on firm heterogeneity under monopolistic competition; and (iii) they distinguished the short- and long-run impact of migration. Their results suggest that in the long-run the average Organisation for Economic Co-operation and Development (OECD) country would suffer a welfare loss of 2.38% in their non-migration counterfactual. It is said that the loss could reach values in between 7 and 11% in the case of those countries with the largest share of immigrants in their populations (Australia, Canada, and New Zealand). On the other hand, non-OECD countries would also have suffered a welfare loss (around 2%) in the non-migration counterfactual. In the short-run, however, the loss in the non-migration counterfactual is lower in the average OECD country (0.46%) and higher in the non-OECD ones (3.28%).

In spite of the methodological differences, the conclusions are unequivocal in underlining the substantial potential welfare benefits associated with freer migration. These results are in accordance with the fact that price disparities between different labor markets are significantly greater than those between different goods or capital markets at international level. As Clemens et al. (2008) assert, while price differences between equal goods in different international markets are at around 74%, and at around 15% for identical financial instruments, the gaps in real wages for unskilled workers can exceed 1,000% between the United States and certain developing countries like Haiti or Nigeria.

The fact that migration has a positive effect on aggregate efficiency does not mean that everyone ends up winning. Current immigrant and native workers who are substituted by new immigrants may be negatively affected by an increase in migratory flows. Empirical studies confirm this effect but find the salary decline in host countries to be small, which is conditioned by the workers' skill levels and but only significant for a short term (Card, 1990; Borjas, 2003; Ottaviano and Peri, 2008; Dustmann et al., 2013; Aydemir and Borja, 2007; Mishra, 2005).

To sum up, estimates confirm that with current migration barriers, labor force is not efficiently allocated and, as a consequence, "the gains from liberalizing labor movements across countries are enormous, and much larger than the likely benefits from further liberalization in the traditional areas of goods and capital" (Rodrik, 2002, p. 314).

3 International cooperation on labor migration

Since migration restrictions reduce the welfare benefits associated with labor mobility, and countries should be interested in promoting an international cooperative regime that promotes freer migration policies. However, this is not the case: most receiving countries maintain important restrictions to migration and are reluctant to adopt international agreements in this field, as recent history shows (Pecoud and Guchteneire, 2004). The ILO Convention 97 proposed by the International Labour Organization in 1949 in order to facilitate the movement of surplus labor from Europe to other countries, has received only 49 ratifications; similarly the ILO Convention 143 adopted in 1975 focusing on the elimination of irregular migration has been endorsed by only 23 countries. The International Convention on the Protection of

the Rights of all Migrants Workers and Members of their Families (CMW) adopted by the General Assembly of the United Nations in 1990, has been ratified by only 51 countries, most of which are net senders of migrants. This has turned CMW into the least ratified convention among all the international human rights treaties (Ruhs, 2015). Finally, the recent attempt to define a "global compact for safe, orderly, and regular migration" in Marrakech (2018)[1] has reached an agreement that is far from the expectations initially raised by the New York Declaration (2016)[2]. Many important host countries (such as the United States and some European countries) did not attend the intergovernmental conference and the declaration was too vague, including 23 very general and aspirational objectives not legally binding[3].

At the regional level, there have been more advances in this field. Clearly, the European Union (EU) has built the most ambitious international system on human mobility. EU residents are allowed to move between member States without restriction and absent any allegation by the receiving country, can extend their stay and earn the right to become permanent residents after five years. In addition, several European countries (most of them are part of the EU) signed the Schengen agreement adopting common principles and procedures regarding the admission of immigrant from non-EU countries.

Another example involving a regional initiative is the Trans-Tasman Travel Arrangement (TITA), which constitutes an informal set of rules agreed upon by Australia and New Zealand regarding immigration practices. These rules enable the citizens of these two countries to reside and work in the other country, although their ability to access social services requires the obtaining of the permanent resident status. Finally, the arrangement adopted by the Economic Community of West African States (ECOWAS) was conceived along the same lines, although the implementation of this agreement has remained partial. Despite their differences, these regional agreements share two common features: (i) countries involved in the agreements have same comparable levels of income (an important factor as we will argue later) and (ii) the agreements are embedded in a more comprehensive framework of cultural links, deep cooperation policy, and in some cases, economic and political integration processes.

In fact, most international agreements adopt the form of BLAs. BLAs are based on the idea that the receiving country cannot properly bring either the number or the kind of workers that it needs through unilateral measures and the sending country being in a better position to control and screen the migrant flow. Therefore, for the recipient country, a BLA reduces the costs of vacancy and selection of the appropriate workers to fill the gaps in its labor market. On the other hand, the sending country can be interested in signing a BLA as a way for its unemployed workers to enjoy preferential access to the labor market of the host country, to assure protection for its workers against abuses by employers, to guarantee good transfer condition for remittances, and in some cases, to access other "issue linkages" (concessions in other fields) (Trachtman, 2009; Chilton and Posner, 2017).

According to the detailed account provided by Peters (2018), the number of BLAs has consistently grown since 1945 to reach a total of 779. This process can be divided in three different periods. From 1945 to 1973, BLAs were mainly promoted by European countries, trying to attract unskilled workers from the Mediterranean countries to nurture their economic growth

1 See: https://www.un.org/en/conf/migration/

2 See: https://www.unhcr.org/new-york-declaration-for-refugees-and-migrants.html

3 Please, refer to http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/71/1.

processes and fill labor shortages in their domestic markets. The second period is between 1974 and 1989, when the number of BLAs signed stagnated as a consequence of the economic crisis taking place through it. From 1990 on, the intensification of the globalization process has led to an increase in the number of BLAs. The geographical coverage of the BLAs is also wider including countries from (Eastern) Europe, Latin America, the Persian Gulf, and Southeast and East Asia. In the latter years, a new kind of BLA has been signed with countries that play important roles in migratory corridors. In these cases, the sending country deals with the recruitment of its citizens for migration while blocking the access to the host country border to any migrants arriving from other surrounding countries (i.e., the BLA signed between Spain and Morocco).

4 Political economy of migration

4.1 Differential features of migration: nonpecuniary externalities

Theoretical models used for measuring the gains from migration adopt basically the same analytical framework as those oriented to explaining the welfare gains derived from free trade. However, international migration presents particular characteristics that should be taken into account in the analysis (Greenaway and Nelson, 2006).

First, migration is a *dominant one-way flow* between countries. That is, while trade is based on comparative advantages that, by definition, are distributed (not necessarily in an equal way) between the countries involved in the exchange as international labor migration is mainly a flow in a single direction: from countries with lower levels of productivity (and salaries) to countries in which labor productivity and salaries are higher (Razin et al., 2011; Sykes, 2013). The dominant one-directional flow makes agreements based on reciprocity among host and home countries more difficult.

Second, labor is a *heterogeneous factor*, particularly due to a dissimilarity of skills. Significant externalities are attributed to skilled labor as long as this factor improves productivity and promotes innovative capacity, institutional quality, and tax resources in the economy involved. This is why some authors think that emigration of high-skilled labor may generate negative, uncompensated effects for the home country (and additional benefits to the host) (Schiff, 2006). Other authors have underlined that if returns from the educational effort are higher abroad than in the country of origin, emigration could increase the return on investment in human capital and lead to more people becoming educated in the sending country. This, then, would represent a "brain-drain-induced-brain-gain" (Stark et al., 1997, 1998; Mountford, 1997; Vidal, 1998): the effectiveness of this phenomenon is however far from conclusive (Gibson and McKenzie, 2011; Docquier and Rapoport, 2012). In any case, the benefit that countries obtain from the reception of skilled workers explains why, in most countries, the programs that target high-skilled workers impose fewer restrictions than those oriented to regulate low-skilled migration.

Third, while the induced shift in prices motivated by trade can benefit consumers in both importing and exporting countries, the induced shifts in wages caused by unskilled migration benefit mainly the migrants and their families as well as the employers in the host country. Estimates by the World Bank confirm that close to 70% of the total rent gains generated by migration is captured by migrants (World Bank, 2006). Moreover, migration can produce additional benefits in host countries in terms of contributing human capital, filling jobs that

citizens are no longer willing to take while providing workers to foster economic growth, helping to smooth out the effects of population ageing, and making social security and tax contributions. However, most of these benefits are dispersed and difficult to recognize as having been produced by migration.

Finally, benefits that the host country gains from international migration may additionally be counteracted by the negative nonpecuniary externalities that the process can generate in terms of sustainability, congestion, and the quality of the public services that the recipient country provides (Facchini and Mayda, 2009). This is one of the main factors that explains the reluctance of large sections of the population in recipient countries toward immigration and studies based on survey data confirm that (such as Dolmas and Huffman, 2004; Hanson et al., 2007; Hainmueller and Hiscox, 2010; Callens, 2015; Gallup, 2015; Jacobs and Herman, 2009; among others).

Additionally, there are other types of negative nonpecuniary externalities associated with the effects that immigration has on social cohesion and the level of trust in the host country. There are people who feel that their way of life, culture, language, and/or religion are threatened by the presence of persons coming from other social communities. For these people, immigration is regarded as a challenge to their "social model," particularly when migration is intense and involves people from very different cultures (Collier, 2013). As mutual regard is crucial for social cooperation and the functioning of the overall society, immigration—when not adequately managed—can be transformed into a factor of social disruption and upset.[4] Needless to say that these concepts are hard to measure even though they are crucial in explaining countries' reactions to immigration.

4.2 **Defining the paradox**

Considering the above specificities would suggest that: (i) besides benefits, immigration may also generate (not necessarily economic) costs that need to be accounted for if we want to understand the reaction of host countries (Ruhs, 2015) and (ii) accordingly, imposing restrictions to migratory flows is not a necessarily inefficient or unintelligible response (Sykes, 2013). These two facts explain why establishing an international framework of agreement for migration liberalization is not an easy task (Martin et al., 2006a,b; Betts, 2011; Ghosh, 2013; Alonso, 2015).

In fact, the smaller the potential gains associated with migratory liberalizations, the simpler it becomes for nations to reach such kind of agreement; alternatively, the greater the potential gains, the more difficult for the possibility of reaching an agreement. Again, this is what could be called the "paradox of adverse interest."

The explanation of this paradox rests on two main asymmetries. The first one is the asymmetry of power between sending and receiving countries, the latter being in a much better position to regulate migration. The second is the asymmetric way in which the benefits and costs of the migratory process are distributed in host countries. While the benefits are basically private (mainly, though not only, captured by the migrants), the costs are social (as long as they harm social capital and access to public services). Moreover, while beneficiaries in host countries are

4 This interpretation is in accordance with the idea that non-economic forces play a more important role than economic factors in determining social preferences in relation to migration (Greenaway and Nelson, 2006).

mainly foreigners (and not voters), it is the citizenry (or at least a part of them)[5] with the power to remove governments that feels threatened by potential losses. A combination of these two asymmetries explains: (i) why host countries are not interested in backing an international agreement but prefer to preserve their autonomy in this field and (ii) why many home countries tend to have limited capacity for and low interest in repressing unskilled emigration.[6]

In order to appreciate the effect of this paradox, we consider two extreme hypothetical cases. Let us assume, first, a world made up of two countries with relatively similar factor endowments. In this ideal case, the wage differentials that drive labor migration are small, as would be the gains in well-being associated with migratory liberalization. The international mobility of labor would operate on the margins, filling small shortfalls in each labor market. In this case, a liberalizing action would only meet with (weak) opposition from the workers that compete with migrants, while the remaining productive factors (labor and capital) would favor liberalizations; consumers would be neutral (or weakly favorable) toward the process. Since the number of people in motion would be small, so would the social costs caused by migrants in the host economy. If, additionally, liberalization is reciprocated, the agreement possibilities would be higher and the process could, therefore, result in a cross-flow of migrants. This type of migration is already taking place among countries in the former EU-15 block and in the form of BLAs signed between countries with similar levels of income (will be illustrated later in this section).

Although plausible, the above model is not the most representative of current migration. In most cases, emigration takes place between countries with substantially different levels of productivity. Here the gains derived from the liberalization of the migratory process may be high feeding an intense and cumulative movement of people from the less developed country toward the more developed one. Because of this intensity, the costs of migration in terms of social capital loss and congestion of public services in the host country can be high complicating the process reaching of agreements.

In such a case, the shortage factor (i.e., unskilled labor) in the host country would be actively against liberalization; if there is freedom of movement of capital, this factor might be neutral, as capital may enter countries with lower labor costs (through offshoring); finally, if negative externalities (losses in social capital and access to public services) are considered, consumers turn actively against liberalization. Reciprocity does not facilitate agreement in this case since migration is in the inverse sense that is toward the developing country and seems not to be a viable alternative.

4.3 **Empirical illustration of the paradox**

In order to illustrate the "adverse interest paradox," we will consider empirical evidence on migration policies from four complementary perspectives. In general terms, the migration policy of recipient countries is based on two important decisions: the number and skills of migrant workers to be admitted and the rights to be granted after admission. Both decisions are necessarily related. Rights can generate costs in the recipient society in terms of public services'

5 While the native population of the receiving countries tends to reject large-scale immigration, this sentiment is far from universal and is highly conditioned by the ways in which States manage the process of migration.

6 Sending countries have come to understand the advantages of emigration, both as a safety valve to alleviate social pressure on domestic markets and institutions, and as a source of external financial resources. Therefore, they have few incentives to repress non-skilled emigration (Portes and DeWind, 2007).

provision, social policy funding, or the "diluting" of national identity. However, as long as these rights are part of the social and legal foundations of the political community, the capacity that democratic recipient countries have for restricting rights to migrants living in the country tends to be constrained by liberal institutions (at national and international levels), as well as by prudential policies designed to avoid social fragmentation. Therefore, recipient countries try to manage the balance between the costs and benefits of migration by controlling admissions. The restriction in admissions will be stricter, the higher their expectations of receiving massive migratory inflows (a feature related to the income gaps existing between countries). This is what the adverse interest paradox suggests.

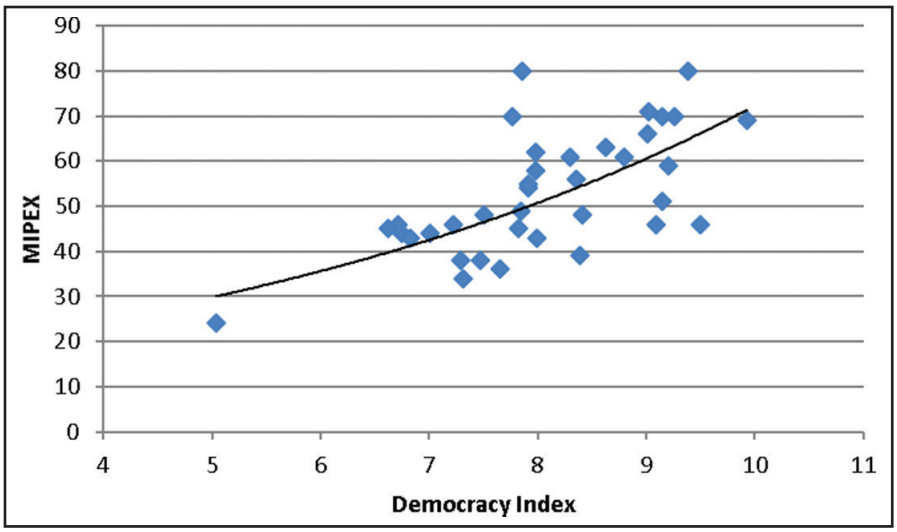
If what this paradox suggests is true, we would expect that, all other factors being equal

(**P1**) the higher the strength of democratic institutions in the host country, the wider the spectrum of rights granted to the admitted migrants;
(**P2**) the wider the rights granted by the host country to migrants, the lower the level of openness of their migratory policy;
(**P3**) the higher the income gap between the sending and receiving countries, the more restrictive the migratory policy that will be applied by the host country.

Even though the indicators available for measuring the corresponding variables may not be sufficiently good, empirical data seem to confirm the aforementioned relationships.

(**P1**) The strength of democratic institutions can be approached by the "democracy index," an index built by the Economic Intelligence Unit based on the assessment of experts on 60 questions related to the countries' political regime; at the same time, the spectrum of migrant rights could be measured through the Migrant Integration Policy Index (MIPEX), an index built by a consortium of think tanks to assess migrant integration policies. Even though data focus on developed countries (mainly OECD), the positive relation between democracy and rights of migrants illustrated in Figure 1 is unequivocal, confirming the limited room for maneuver that democratic countries have in this area.

Figure 1 Relation between democracy in host countries and rights of admitted migrants.



(**P2**) We can also confirm the negative relation existing between the rights granted to migrants after their admission and the openness of the countries' migratory policy. To measure this last variable, we adopt an index built by Ruhs (2015), which takes into account 12 potential restrictive factors in the criteria that host countries can apply through the admission process. Figure 2 illustrates the negative relation between these two variables, which confirms the trade-off between openness and the rights of migrant workers admitted to high-income countries, as Ruhs (2015) suggested.

(**P3**) In order to confirm the third relationship, we built an "income gap" index, taking into account the average weight of the relation between the GDP per capita (PPP) of several receiving countries and the GDP per capita of each country of origin of the stock of migrants. The higher the coefficient, the wider the income gap between receiving and sending countries. As Figure 3 shows, the level of openness is lower in those countries exhibiting a higher income gap in the composition of their migratory inflows. This is what the adverse interest paradox suggests and is also in accordance with the findings of Ruhs (2015), i.e., that programs in high-income countries are less open to labor migration than those in middle-income countries.

Figure 2 Relation between rights of migrants and openness.

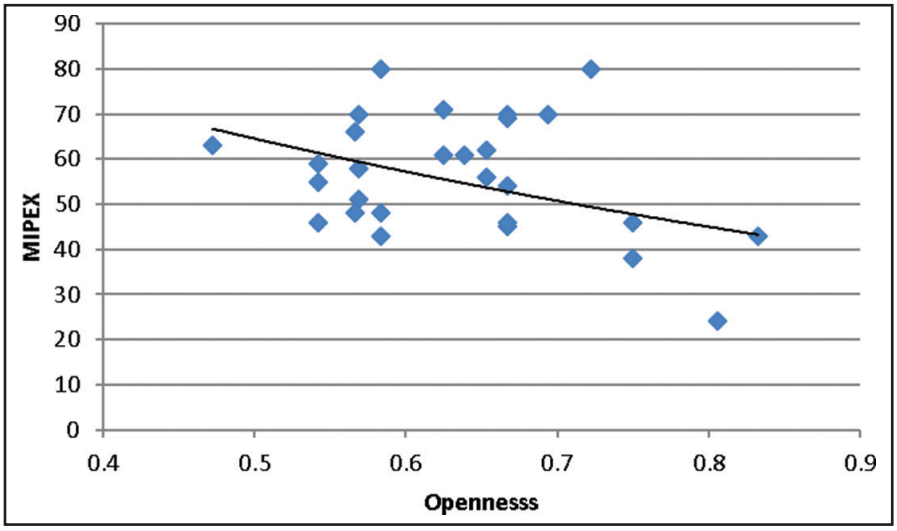
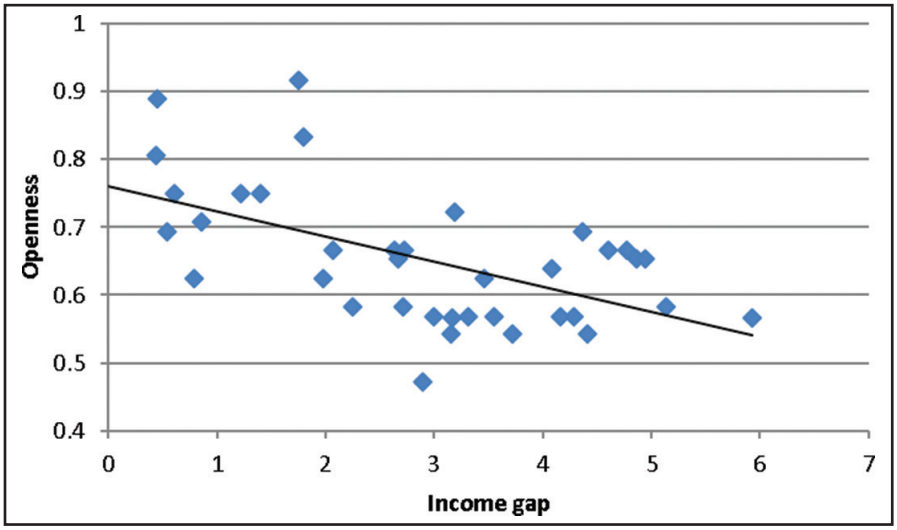


Figure 3 Relationship between openness and the income gap.

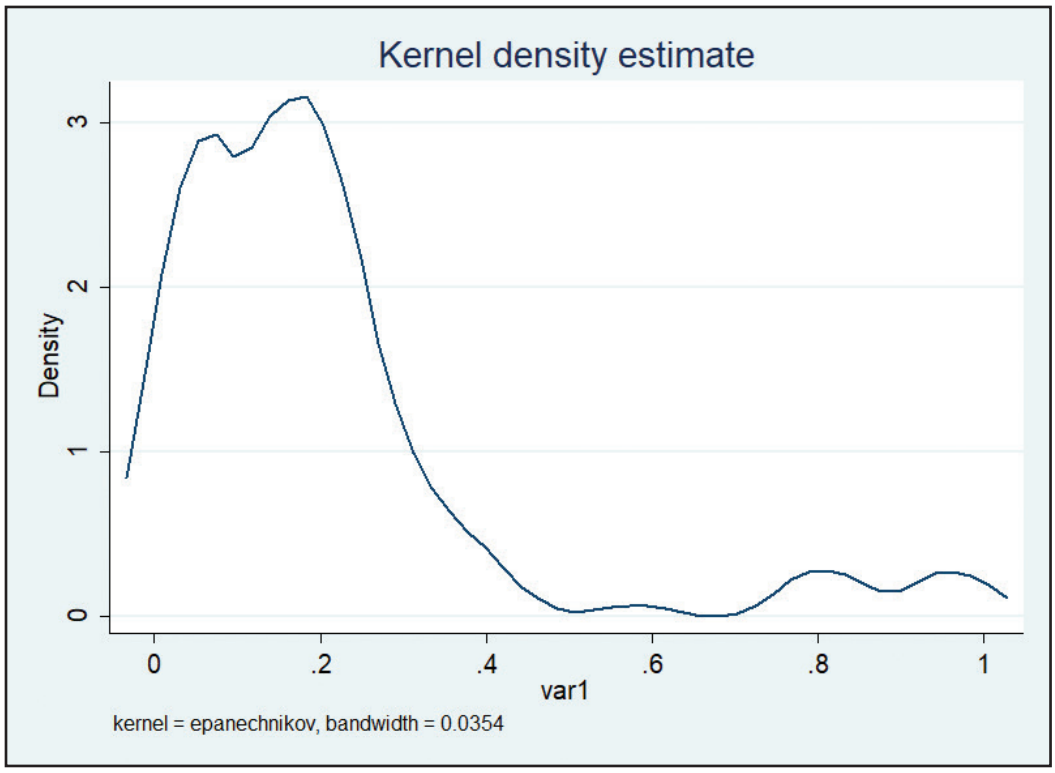


Finally, the implementation of BLAs offers a complementary confirmation of the "adverse interest paradox." The paradox suggests that this kind of agreements would be easier to reach when the difference in income per capita levels between the parties is not substantial. This is what Chilton and Posner (2017) and Peters (2018) confirm in their respective studies when analyzing the BLAs signed since 1945. In order to eliminate the effect of those agreements promoted by European countries linked to "*guest worker programs*" (signed mainly in the 50s and 60s), we consider only the 311 BLAs signed after 1990 (based on Chilton and Posner's (2017) data). We build a normalized index in which the difference in income levels between the partners is expressed in relation to the total difference between the richest and poorest countries at the international level within periods of five years. The kernel distribution function presented in Figure 4 clearly illustrates how most BLAs are located among the lower values of the index, i.e., where the difference in income levels between countries is lower. In fact, two thirds of the agreements have been signed between countries whose income differences are lower than 30% of the international reference range.

5 Theoretical models

After the empirical illustration, we define a simple model that explains what the paradox proclaims. The main assumptions defining the model follow directly from the empirical evidence presented. This will be particularly the case when formalizing the rejection effects inherent to the frictions triggered by migration on the social cohesion model as emphasized by Collier (2013).

Figure 4 Kernel distribution of the normalized income levels difference index.



Note: var1 describes the differences in GDP per capita (in PPP) between two partner countries relative to the differences between the richest and poorest country in the world in the year being considered. The variable has been estimated for each five-year period. The vertical axis describes the number of BLAs per income gap.

5.1 **Payoff functions**

The formal framework of analysis builds on the empirical evidence illustrating the paradox of adverse interest. The basic incentive structure follows from P1, which implies that, as countries develop, they also improve their institutional framework, granting their populations (including migrants) access to the corresponding public services. Thus, the corresponding payoff function should account for the effects derived from migrant integration together with the resulting congestion imposed on the public services guaranteed by the host country. This last effect follows the nonpecuniary externalities caused by the inflow of migrants as described in Section 4.1. As a result, the corresponding term should decrease the willingness to open the host economy as migration flows of any type increases. This negative effect is validated by P2, which illustrates the lower level of openness exhibited by those countries granting wider rights to migrants.

P2 highlights the incentives to limit migration caused by both nonpecuniary externalities and the negative effect on the wages of local unskilled labor. P3 describes the consequences from the income gap on the incentives of the host country to open the economy to migratory flows. In this regard, less developed countries—endowed with higher proportions of unskilled workers (Campbell, 2013)—impose a larger burden on the host economy. A mitigating effect must however follow from the migration of skilled workers in order for countries to increase their level of openness when dealing with similarly developed economies, as the evidence retrieved from the BLAS described in Figure 4 illustrates.

5.1.1 **Basic notation**

We will consider two countries, a developed host economy, whose variables will exhibit a D superscript, and a developing home economy, whose variables will be denoted via U superscript. The proportion of unskilled to skilled workers will be assumed higher in the developing country than in the developed one. It will further be assumed that this trend prevails when considering income differentials across developing countries. The proportion of unskilled workers out of the active population in the developed and developing country will be denoted by γ^D and γ^U, respectively (consequently, the proportion of skilled workers will be denoted by $(1-\gamma^D)$ and $(1-\gamma^U)$, respectively).

We will define two different payoff functions for each country depending on whether or not migratory flows are allowed between countries. Each type of migrant will have two potential effects on the host country, which are described in the following sections.

5.1.2 **Developed country**

Consider first the payoff function defined for the developed country when the economy is open to migratory flows. The incentives of the host developed economy to receive both types of migrants are summarized in the following function:

$$H^D\left(\gamma^U\right)=\epsilon\left(\Phi\left(\left(1-\gamma^D\right),\left(1-\gamma^U\right)\right)\right)-\Delta\left(\frac{\gamma^D+\gamma^U}{\gamma^D+1}\right)-\xi\left(\frac{e^{\left(\delta\gamma^D+\delta\gamma^U+\left(1-\gamma^D\right)+\left(1-\gamma^U\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right) \tag{1}$$

The function consists of the three effects as defined through (P1)–(P3) but normalized so that the equilibrium of the resulting game can be directly determined by the relative

proportions of migrants reaching the host country and the structural parameters accounting for its institutional and technological situation.

(i) The first term, $\epsilon(\Phi((1-\gamma^D), (1-\gamma^U)))$, refers to the non-directly observable positive effects from having a given proportion of skilled labor in a country. The capacity of a country to exploit its available human capital can be defined as a function of its technological development level and the proportion of skilled workers available. In this regard, the value of the variable ϵ can be assumed to reflect the capacity of the host economy to exploit the potential complementarities arising between both native and migrant workers and the resulting cumulative effect from having a larger skilled labor base (Santos-Arteaga et al., 2017).

The function $\Phi((1-\gamma^D), (1-\gamma^U))$ serves as a proxy for the cumulative technological complementarities arising from the inflow of skilled migrants into the host economy. As such, it is defined as an increasing function of the proportion of skilled migrants, $(1-\gamma^U)$,

$$\Phi\left(\left(1-\gamma^D\right), \left(1-\gamma^U\right)\right)=\left[\frac{\left(1-\gamma^D\right)+\left(1-\gamma^U\right)}{1+\left(1-\gamma^U\right)}\right]$$

This function has been introduced to account for the potential increments in productivity arising from a higher inflow of skilled migrants. The most direct use of human capital consists of its potential applications to improve the technological development level of the country and as such it is not directly observable by the population.

When distinguishing between directly and non-directly observable variables, we refer to those immediately observed by the average citizen/voter within the country. That is, technological evolution is hard to observe given the specialized nature of the information revealing this trend. However, the decrease in wages suffered by the less skilled workers, and the delays in public services derived from the congestion costs imposed by migrant workers into a country are directly observable by the local population. The remaining terms defining Equation (1) account for both these effects, respectively.

(ii) The second term, $\Delta\left(\frac{\gamma^D+\gamma^U}{\gamma^D+1}\right)$, represents the directly observable negative effects derived from unskilled migration on the wages of the host country's unskilled workers. The value of the variable Δ within this term weights the importance that decrements in the wages of unskilled workers have for the host economy. Note that, although the unskilled proportion of the population is lower in the host economy than in the developing home one, this does not mean that all skilled workers are assigned labor positions in accordance with their human capital potential—a particularly severe problem referred to as "brain waste" in the south of Europe (García Pires, 2015).

A certain positive compensation could be allowed for when considering the effect of immigration on the host economy. This compensatory mechanism should account for the positive effect that unskilled migrant workers have on the labor market such as covering existing shortages in positions that local unskilled workers are not willing to consider. Despite ameliorating the negative impact that follows from a decrease in wages, the empirical evidence presented implies that its inclusion would not suffice to fully compensate for it.

(iii) The third term, $\xi\left(\frac{e^{\left(\delta\gamma^D+\delta\gamma^U+\left(1-\gamma^D\right)+\left(1-\gamma^U\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right)$, relates to the observable congestion costs suffered by the host population. The variable ξ weights the impact that the congestion caused by the inflow of skilled and unskilled migrants has on the host economy. It will be assumed that due to the differences in living standards, unskilled workers impose larger congestion costs on social services than skilled workers, i.e., $\delta > 1$. In this regard, the normalization of the exponential term has been defined based on a proportion of unskilled migrants equal to one.

Given the fact that congestion costs are suffered by all members of the local population, they have been assumed to evolve exponentially instead of linearly, as was the case when unskilled wages were considered.[7] This has been done to capture the biased negative discrimination that the population of developed countries tends to exhibit toward migrants. The observations acquired by the population (and the resulting opinions formed) will in general differ substantially from the actual data. That is, the effect that locally observed migrants in the waiting rooms of hospitals have on the subsequent delay suffered in the provision of medical services will be exacerbated by those suffering such delay (Hainmueller and Hiscox, 2010). While not necessarily corresponding to the behavior exhibited by the actual data, host governments will consider complaints due to the voting power of their citizens. Moreover, the migrant population may be used as a scapegoat by host governments to justify the results from inefficient policy designs or delays in the provision of public services.

Consider now the payoff function defined for the developed country when the economy is closed to migratory flows:

$$H^D\left(\gamma^D\right)=\epsilon\left(\Phi\left(1-\gamma^D\right)\right)-\Delta\left(\frac{\gamma^D}{\gamma^D+1}\right)-\xi\left(\frac{e^{\left(\delta\gamma^D+\left(1-\gamma^D\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right) \tag{2}$$

with $\Phi(1-\gamma^D) = (1-\gamma^D)$. An important assumption has been imposed to simplify the presentation, implying that the host country can actually block all unskilled migrants from entering the country. We could also allow for a small proportion of unskilled migrants gaining access to the host economy even if the latter decides to close its borders. By doing so, we would be increasing the relative incentives of the host country to open its borders and of the home country to promote the flow of unskilled labor to the developed host, a strategy that we will define as a defect in the theoretical game framework introduced through Section 6.

5.1.3 **Developing country**

The incentive payoff function for the home country of the migrants is given by:

$$H^U\left(\gamma^U\right)=\epsilon'\left(\Phi\left(1-\gamma^U\right)\right)-\Delta'\left(\gamma^U\right)-\xi'\left(\frac{e^{\left(\delta\gamma^U+\left(1-\gamma^U\right)\right)}}{e^{\delta}}\right) \tag{3}$$

with $\Phi(1-\gamma^U) = (1-\gamma^U)$. The assumptions are identical to those used to define the payoff function of the developed country, considering that emigration flows will modify the

7 The formal results presented remain unaffected by this assumption and can be also derived using a linear congestion function.

relative composition of the labor force and the resulting proportions of skilled and unskilled workers.

We should highlight the fact that the same technological development level—as that of the developed host country—is implicit in the definition of $\Phi(1-\gamma^U)$. Given the developing characteristic of the home country, we could assume that the productivity rate and value of its skilled labor force are lower than those of the developed host. Alternatively, given its scarcity, we could also adopt the opposite option, considering skilled labor to be more valuable for the home country than for the host. Both interpretations are plausible, and both would imply modifications in the results obtained. We take the intermediate path and assume that both productivity effects are identical. Clearly, the model can be easily adapted to reflect any of the suggested alternatives.

Finally, note that the ϵ', Δ', and ξ' variables would differ across countries, depending on the interests and objectives of the respective governments. However, we will not be focusing on the effect of these variables in the resulting strategic equilibria, but on the importance of the population flows from differently developed countries. Thus, we will assume that both sets of variables are identical across countries.

5.2 **Population flows**

In order to simplify the presentation and posterior analysis, and even though the model can be adapted to account for populations of different sizes in both countries, we shall assume that the populations of both countries are the same. This assumption increments considerably the expositional simplicity of the results.

Denote by η the proportion of unskilled workers that are allowed to exit the home country and migrate. We will assume that, to a certain extent, the home country can control this value and regulate the amount of unskilled migration that leaving the country. Similarly, denote by η^S the proportion of skilled workers that the developing country allows migrating. Recall that the proportions γ^U and $(1-\gamma^U)$ differ in size, and that the unskilled proportion is larger than the skilled one in the developing country. Thus, when both unskilled and skilled workers migrate to the host developed country, the γ^D and $(1-\gamma^D)$ proportions become:

$$\widehat{\gamma}^D = \frac{\gamma^D + \eta\gamma^U}{1+\eta\gamma^U+\eta^S(1-\gamma^U)}$$

$$(1-\widehat{\gamma}^D) = \frac{(1-\gamma^D)+\eta^S(1-\gamma^U)}{1+\eta\gamma^U+\eta^S(1-\gamma^U)} \tag{4}$$

As illustrated through the next section, the developed host country prefers $\eta^S = 1$ and $\eta = 0$, while the opposite is true for the developing home economy. The resulting incentives of the host country to open the system to international migratory flows will therefore be determined by the values taken by the η^S and η variables either in known or expected terms.

$$H^D\left(\gamma^U,\eta^S,\eta\right) = \epsilon\left[\frac{\left(1-\gamma^D\right)+\eta^S\left(1-\gamma^U\right)}{1+\eta^S\left(1-\gamma^U\right)}\right] - \Delta\left(\frac{\gamma^D+\eta\gamma^U}{\gamma^D+1}\right) - \xi\left(\frac{e^{\left(\delta\gamma^D+\delta\eta\gamma^U+\left(1-\gamma^D\right)+\eta^S\left(1-\gamma^U\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right) \tag{1'}$$

We now define the equivalent of the above population proportion equations for the developing home country.

$$\tilde{\gamma}^U = \frac{\gamma^U - \eta\gamma^U}{1-\eta\gamma^U - \eta^S(1-\gamma^U)}$$

$$(1-\tilde{\gamma}^U) = \frac{(1-\gamma^U) - \eta^S(1-\gamma^U)}{1-\eta\gamma^U - \eta^S(1-\gamma^U)} \tag{5}$$

These proportions have to be implemented in the incentive payoff function of the home country whenever migration takes place between countries:

$$H^U\left(\gamma^U, \eta^S, \eta\right) = \epsilon\left(\Phi\left(1-\hat{\gamma}^U\right)\right) - \Delta\left(\hat{\gamma}^U\right) - \xi\left(\frac{e^{\left(\delta\tilde{\gamma}^U + \left(1-\hat{\gamma}^U\right)\right)}}{e^{\delta}}\right) \tag{6}$$

Clearly, $H^U(\gamma^U, \eta^S, \eta)$ is a decreasing function of the proportion of unskilled workers in the developing country. Thus, there is an incentive for the home developing country to signal the true (or else a higher) value of the η^S variable to the host developed country while trying to hide or misrepresent the value of η.

6 Migration entry game

Given the above description, the equilibrium of the resulting migration entry game will be determined by the chosen values of η^S and η together with the proportions γ^U and $(1-\gamma^U)$ with which developing countries are endowed. While the equilibrium will be defined in terms of these variables, the existence of different potential equilibria and the choice of the corresponding strategies will also depend on the values of the exogenous parameters. These latter values can be assumed to change through time based on the preferences of governments in terms of each element $(\epsilon;\Delta;\xi)$ (productivity; pressure of unskilled wages; and social pressure). The entry game faced by the host developed and home developing countries is described below.

		Host	
		Open	Close
Home	Coop	$H^U\left(\gamma^U, \eta^S, \eta\right);\ H^D\left(\gamma^D, \eta^S, \eta\right)$	$H^U\left(\gamma^U\right);\ H^D\left(\gamma^D\right)$
	Defect	$H^U\left(\gamma^U, \underline{\eta^S}, \overline{\eta}\right);\ H^D\left(\gamma^D, \underline{\eta^S}, \overline{\eta}\right)$	$H^U\left(\gamma^U\right);\ H^D\left(\gamma^D\right)$

Developing countries take $(\epsilon;\Delta;\xi)$ as given from the host developed country, since it will be assumed that they can approximately infer these values from public announcements regarding innovation and social policies—together with the evolution of wages. After considering $(\epsilon;\Delta;\xi)$, developing countries announce the values of η^S and η that they are willing to accept when allowing both skilled and unskilled workers to migrate to the host country.

At the same time, the developed host subjectively determines the incentives—or capacity—of the developing countries to actually enforce these values. In particular, given the

existing differences in education and living standards between countries, and the potential costs faced by the emigrants, the host economy must consider the existence of lower bounds for the proportion of skilled workers, $0<\underline{\eta^S}<\eta^S$, and upper bounds for the proportion of the unskilled workers, $1>\overline{\eta}>\eta$, allowed to emigrate from the developing country. Given these values and those of η^S and η announced by the developing countries, the host country has to calculate the potential payoffs derived from opening the economy to foreign migrants.

We analyze the dependence of the resulting equilibria on the choice of η^S and η made by the developing countries, their relative γ^U and $(1-\gamma^U)$ endowments, and the $\underline{\eta^S}$ and $\overline{\eta}$ values that must be considered by the host country.

6.1 Host payoffs and unskilled migrants

We provide below several formal results following from the way the function $H^D(\gamma^U, \eta^S, \eta)$ has been defined. We also analyze their main consequences for migration flows based on the relative development and income levels of the countries involved in the corresponding strategic environment.

Proposition 1. $H^D(\gamma^D,\eta^S,\eta)>H^D(\gamma^D,\underline{\eta^S},\overline{\eta})$ *for* $d\eta^S=d\eta$.

Proof. See Appendix 1. ▪

An immediate implication from this proposition is that a developing country provides a lower cooperative payoff to the host developed country as the proportion of unskilled workers allowed to emigrate increases. At the same time, the negative effect that follows from increasing the proportion of skilled workers entering the host country is more than compensated by the positive effect derived from an identical decrease in the proportion of unskilled workers allowed to exit the home country.

Proposition 2. $\delta\eta \geq \eta^S$ *suffices for* $H^D(\gamma^U, \eta^S, \eta)$ *to be a decreasing function of the proportion of unskilled workers in the developing country.*

Proof. See Appendix 2. ▪

These propositions have two main implications.

- The first one is that cooperation increases the incentives of the host country to open its economy to migratory flows.
- The second one states that developing countries located farther away from the economic development level of the host will face a higher probability of ending in a closed equilibrium, even if their incentives to cooperate are the same as *or higher than* those of a more developed migrant country.

This latter implication has important consequences for the equilibria of the corresponding entry game. Assume that two developing countries announce the same η and η^S values with $\eta > \eta^S$. In this case, the less developed country will exhibit a higher proportion of unskilled workers and provides a lower payoff to the developed country *in any open equilibrium*. As a result, less developed countries—exhibiting lower income endowments—will be more prone to end up in a closed equilibrium of the resulting games. We develop this result in the following sections.

Finally, it should be emphasized that in order for Proposition 2 to hold, it is not necessary to satisfy $\delta\eta \geq \eta^S$; i.e., the previous implications may remain valid even if the proportions

announced by the developing countries lead to $\delta\eta < \eta^S$, as the numerical simulations presented in Figure 5 will illustrate.

6.2 Equilibrium results: dominant defect strategies

In order to guarantee the existence of an open equilibrium—for a sufficiently large proportion of skilled migrants—we require the technological variable, ϵ, to counterweight the negative effect of the variables accounting for the importance of unskilled wages, Δ, and congestion costs, ξ. Note that these variables may depend on exogenous factors such as the type of parties composing the government and the proximity of elections. Peters (2015) has reviewed the main arguments put forward to explain variations in the immigration policies regulating unskilled workers, which range from prejudice against foreigners and the protectionist attitude of native labor to the fiscal costs derived from the immigrants and their lack of political power.

The above requirement should be initially imposed to obtain a positive value for $H^D(\gamma^D, \eta^S, \eta)$, while opening the economy arises as a potential equilibrium strategy when $H^D(\gamma^D, \eta^S, \eta) > H^D(\gamma^D)$.

Consider the entry game faced by the host developed and the home developing countries and assume that $H^D(\gamma^D)$ is independent of the cooperation or defection strategy chosen by the developing country, i.e., the host economy can effectively block all unrequested migration flows.

Proposition 3. *A necessary and sufficient condition for Open to become a (strictly) dominant strategy whenever* $d\eta^S = d\eta$ *is given by* $H^D(\gamma^D, \underline{\eta^S}, \overline{\eta}) > H^D(\gamma^D)$.

Proof. See Appendix 3. ▪

This result together with the one displayed in Proposition 2 has an immediate implication for our migration setting.

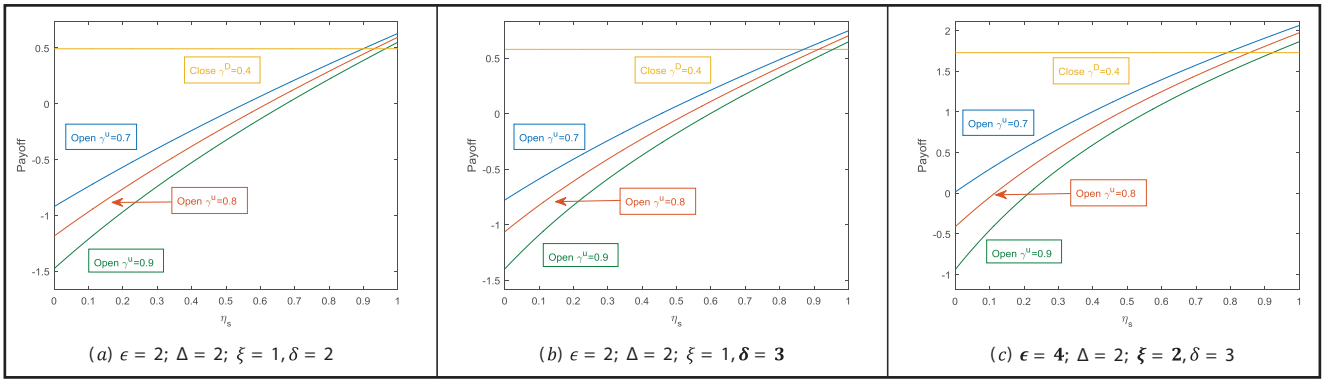
Proposition 4. *Developing countries with a relatively larger skilled population – exhibiting higher income endowments—are more prone to end up in an open equilibrium.*

Finally, a similar proof to that of Proposition 2 can be used to illustrate the following:

Proposition 5. $H^U(\gamma^U, \eta^S, \eta)$ *is a decreasing function of the proportion of unskilled workers in the developing country.*

Note that, as stated in Section 5.2, the incentives of the developing home countries oppose those of the developed host country when selecting the values of the η^S and η variables. Given the assumed independence of $H^D(\gamma^D)$ from the cooperation or defection strategy chosen by the developing countries, it immediately follows that

Figure 5 $H^D(\gamma^D, \eta^S, \eta)$ and $H^D(\gamma^D)$ functions for $\eta^S = 1 - \eta$.



(*a*) $\epsilon = 2$; $\Delta = 2$; $\xi = 1, \delta = 2$ (*b*) $\epsilon = 2$; $\Delta = 2$; $\xi = 1, \boldsymbol{\delta = 3}$ (*c*) $\boldsymbol{\epsilon = 4}$; $\Delta = 2$; $\boldsymbol{\xi = 2}, \delta = 3$

Corollary 1. *Defection constitutes a (weakly) dominant strategy for the developing countries independently of their income.*

Corollary 2. *Consider two developing countries that differ in their income levels. Assume that*

- $H^D(\gamma^D, \eta^S, \eta) > H^D(\gamma^D)$ *for both countries;*
- *Both countries follow their (weakly) dominant strategy and defect by implementing the same* $\overline{\eta}$ *and* $\underline{\eta^S}$ *proportions.*

Subsequently, there exists a set of γ^U *and* $(1-\gamma^U)$ *values such that the pure equilibrium strategies of the host economy consist of*

- *Closing, if the emigrants are from the lower income country;*
- *Opening, if the emigrants are from the higher income country.*

Proof. See Appendix 4. ▪

This latter corollary constitutes an "equilibrium in dominant defect strategies" version of the adverse selection mechanism affecting migrant developing countries. That is, the incentives of the host to open the economy decrease as the income distance between developing countries increases. Thus, poorer countries in greater need of incrementing their emigration flows to the host economy—but delivering lower $H^D(\gamma^D, \underline{\eta^S}, \overline{\eta})$ payoffs—will be more prone to end up in a closed equilibrium than relatively richer countries in lesser need of incrementing their emigration flows.

Figure 5 displays the behavior of the $H^D(\gamma^D, \eta^S, \eta)$ and $H^D(\gamma^D)$ functions for different values of the $(\epsilon;\Delta;\xi,\delta)$ variables and the(γ^D,γ^U) proportions when $\eta^S = 1-\eta$. We have introduced this latter constraint to illustrate the existence of the above equilibria, even when the developed host is restricted to assimilating relatively large proportions of unskilled workers from the developing countries.

The following remarks about the simulations should be considered:

- Figures 5(a) and 5(b) illustrate how small variations in δ determine the shape of $H^D(\gamma^D, \eta^S, \eta)$ and $H^D(\gamma^D)$ together with the corresponding threshold values, which are described in Table 1. We will return to these numerical results in the next section.
- Figures 5(b) and 5(c) describe the capacity of the technological variable, ϵ, to compensate for increments in congestion costs, implying that a sufficiently large technological effect fosters the incentives of the host to consider opening the economy. To further emphasize the essential role played by technology, the human capital from lower income countries

Table 1 η^s thresholds obtained for different $(\epsilon;\Delta;\xi,\delta)$ variables and (γ^D,γ^U) values.

Threshold values	$\gamma^U = 0.7$	$\gamma^U = 0.8$	$\gamma^U = 0.9$
$(\epsilon = 2; \Delta = 2, \xi = 1; \delta = 2)$	0.9	0.931	0.964
$(\epsilon = 2; \Delta = 2, \xi = 1; \delta = 3)$	0.87	0.913	0.955
$(\epsilon = 4; \Delta = 2, \xi = 2; \delta = 3)$	0.79	0.855	0.922

could be assumed to deliver lower values of ϵ than the human capital from a higher income country.
- Similar effects to those described in Figures 5(b) and 5(c) are obtained when the technological variable is used to compensate for increments in the relative importance assigned to unskilled wages Δ.

The following corollary relates the current equilibrium results to the "separating equilibrium" version of the adverse selection mechanism described in the next section, where lower income developing countries follow a cooperative strategy while the higher income ones defect. The subscripts P and R will be used to refer to the lower and higher income developing countries, respectively.

Corollary 3. *Consider two developing countries that differ in their income levels. Assume that:*

- $H_R^D\left(\gamma^D,\eta^S,\eta\right) > H^D\left(\gamma^D\right)$.

Then, there exists a set of $\overline{\eta}$, $\underline{\eta^S}$ *and* γ^U *values such that the pure equilibrium strategies of the developed host country imply that:*

- *it closes its economy to the lower income country, even if the latter cooperates.*
- *it opens its economy to the higher income country, even if the latter defects.*

The proof is similar to that of Corollary 2, while noting that in the current setting:

- *we can have* $H_P^D(\gamma^D,\underline{\eta^S},\eta) < H^D(\gamma^D)$;
- *the continuity of* $H^D(\gamma^D,\eta^S,\eta)$ *guarantees that a set of* $\overline{\eta}$ *and* $\underline{\eta^S}$ *values can be defined such that* $H_R^D(\gamma^D,\underline{\eta^S},\overline{\eta}) > H^D(\gamma^D)$.

6.3 Equilibrium results: separating equilibrium and adverse selection

In order to define the payoffs and strategies of the developing countries, we need to consider their incentives to cooperate or defect. We continue to assume that the host country is able to block the flow of immigrants, an assumption that will be relaxed in Appendix 6, where the validity of the main results presented is extended to scenarios in which the host economy cannot fully contain the flow of unskilled migrants when the developing country defects.

As stated in Corollary 1, defection would constitute a (weakly) dominant strategy for the developing countries, unless some sort of retaliation policy can be implemented by the host economy. That is, defection could be prevented if a direct cost is imposed on the developing countries whenever the proportion of skilled or unskilled migrants entering the host economy differs from either η^S or η.

In this regard, Ortega and Peri (2012) illustrated empirically that the total number of migrants from a developing country into a developed host is basically a function of the per capita income of the host, the cost of migration as determined by geographic and cultural differences between countries, the entry restrictions implemented by the host, and a set of origin-specific factors.

Thus, we will assume that differences between the proportions of unskilled and skilled migrants across developing countries are mainly determined by their relative economic conditions, as follows:

$$\eta - \eta^S = \left(\overline{w}(Y_{host}) - \overline{w}\left(Y_{mig}\right)\right) + (\overline{\gamma} - \gamma) - C^U \tag{7}$$

- The variable $\overline{w}$ accounts for the average unskilled labor wages, determined by the relative income levels of the developing countries, Y_{mig}, and the developed host country, Y_{host}.
- The variable γ reflects the congestion impact of immigrants, with $\overline{\gamma}$ representing its upper threshold. This variable (i.e., the congestion level) is based on the size of the immigrant community in the host country and the capacity of the host labor market to assimilate the inflow of immigrants.
- The variable C^U represents the costs of migration. Assuming similar cultural differences among developing countries, this variable stands for the economic and social opportunity costs incurred when leaving a country, which increase in the income of the country of origin.

Assuming that similar congestion levels are faced by all developing countries would imply that differences in wages and migration costs determine the width of $\eta - \eta^S$, which would increase in the case of lower income developing countries. Note that the wider spread of $\eta - \eta^S$ among lower income developing countries together with Proposition 1 guarantee that the $H^D(\gamma^D, \eta^S, \eta)$ and $H^D(\gamma^D, \underline{\eta}^S, \overline{\eta})$ payoffs received by the host economy are higher when opening to higher income developing countries validating the analysis performed in the previous section.

The following set of assumptions follows naturally from the above description:

- $\eta^S \geq \eta^S_{--}$, with η^S_{--} representing the proportion of skilled workers expected to be received by the host country. That is, there is a difference between the η^S proportion announced by the developing country and the η^S_{--} expected by the host country.
- Whenever the developing countries defect, the developed host implements a retaliation measure proportional to the $\eta^S - \eta^S_{--}$ difference, i.e., $k(\eta^S - \eta^S_{--})$, with $k > 1$. For completeness, it can be assumed that the retaliation effect equals zero whenever $\eta^S \leq \eta^S_{--}$, leading to the scenario described in the previous section.

Even though the analysis focuses on mismatches relative to the value of the $\underline{\eta}^S$ variable, the adverse selection mechanism could be also derived (and/or reinforced) through $\overline{\eta}$, or a combination of both variables. That is, the same type of scenario and results can be obtained in terms of unskilled workers whenever $\eta \leq \eta^{--}$, which would lead to a retaliation measure given by $k(\eta^{--} - \eta)$, with η^{--} representing the proportion of unskilled workers expected to be received by the host country.

We work under the following constraints, which have been imposed to simplify the presentation, though they could be relaxed to demonstrate the main results obtained in a variety of alternative scenarios.

- Throughout the numerical analysis, the restrictions $\eta^S = 1 - \eta$ and $\underline{\eta}^S = 1 - \overline{\eta}$ prevail.
- Both developing countries announce the same η^S and implement identical $\underline{\eta}^S$ when defecting.

- The analysis performed will be deterministic, though a monitoring probability could be defined in terms of the $\eta^S - \underline{\eta}^S_{--}$ difference for the host country when deciding whether or not to verify the potential defection of the developing economies.

Given the strategic scenario described above, the corresponding entry game is given by:

	Open	Close
Coop	$H^U\left(\gamma^U,\eta^S,\eta\right);\ H^D\left(\gamma^D,\eta^S,\eta\right)$	$H^U\left(\gamma^U\right);\ H^D\left(\gamma^D\right)$
Defect	$H^U\left(\gamma^U,\underline{\eta}^S,\overline{\eta}\right)-k\left(\eta^S-\underline{\eta}^S_{--}\right);\ H^D\left(\gamma^D,\underline{\eta}^S,\overline{\eta}\right)$	$H^U\left(\gamma^U\right)-k\left(\eta^S-\underline{\eta}^S_{--}\right);\ H^D\left(\gamma^D\right)$

We are assuming that, even when closing its borders, the host economy is able to monitor—to a certain extent—the containment efforts made by the developing countries, and to implement retaliation measures whenever the observed η^S differs from that, which are announced. Examples justifying such an assumption are provided by the Spanish-Moroccan borders in Ceuta and Melilla (Spijkerboer, 2007; Pallister-Wilkins, 2017) and by the Turkish containment policy sponsored by the EU (European Commission, 2015; Van Heelsum, 2016).

The "separating equilibrium" version of the adverse selection mechanism described in the previous section states that the dominant strategy of the host economy consists of opening to the high-income developing country despite its incentives to defect, while closing to the low income one despite its incentives to cooperate.

The only additional assumption required to guarantee the existence of such an equilibrium is that $\underline{\eta}^S_{--P} < \underline{\eta}^S_{--R}$, with the subscripts *P* and *R* referring to the lower and higher income developing countries, respectively. That is, the host economy is assumed to assign a lower $\underline{\eta}^S_{--}$ value to the lower income developing country.

Proposition 6. *Consider two developing countries that announce the same* η^S *and implement identical* $\underline{\eta}^S$ *if defecting, but that differ in their income levels. Assume that:*

$$H^D_R\left(\gamma^D,\eta^S,\eta\right) > H^D\left(\gamma^D\right).$$

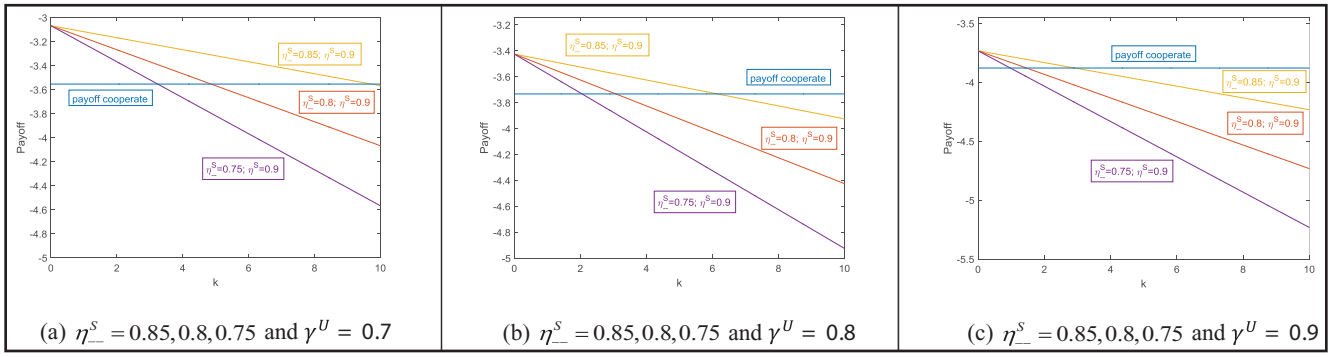
Then, there exists a set of k, $\underline{\eta}^S_{--}$ *,and* γ^U *values such that:*

- *The pure dominant equilibrium strategies of the developed host economy consist of:*
  - *closing its economy to the lower income country, even if it cooperates;*
  - *opening its economy to the higher income country, even if it defects.*
- *The pure dominant equilibrium strategies of the developing countries consist of:*
  - *cooperating if it is a lower income country;*
  - *defecting if it is a higher income country.*

Proof. See Appendix 5. ▪

Figure 6 presents the payoffs received by the developing countries for different values of *k* when they announce $\eta^S = 0.9$ and implement $\underline{\eta}^S = 0.8$ within the numerical framework of Figure 5(c). This latter figure and Table 1 describe how, given these numerical values, the developed host has a dominant strategic incentive to open its economy to a developing country with $\gamma^U = 0.7$ while it closes to a developing country with $\gamma^U = 0.9$.

Figure 6 H^U $(\gamma^U,\ \eta^S,\ \eta)$ and $H^U(\gamma^U,\underline{\eta}^S,\overline{\eta}) - k(\eta^S - \underline{\eta}^S)$ when $\eta^S = 0.9$ and $\underline{\eta}^S = 0.8$. In order to simplify the presentation, we have assumed: $\epsilon = 4$; $\Delta = 2$; $\xi = 2$; $\delta = 3$, for all developing countries.



(a) $\eta^S_{--} = 0.85, 0.8, 0.75$ and $\gamma^U = 0.7$ (b) $\eta^S_{--} = 0.85, 0.8, 0.75$ and $\gamma^U = 0.8$ (c) $\eta^S_{--} = 0.85, 0.8, 0.75$ and $\gamma^U = 0.9$

Consider now the payoffs described in Figures 6(a) and 6(c), which illustrate the incentives of the developing countries to cooperate or defect when $\gamma^U = 0.7$ and $\gamma^U = 0.9$, respectively. Assume, for example, that a value of $k = 2$ is applied by the developed host to both developing countries. In this case, if the host country assigns (correctly) a value of $\eta^S_{--R} = 0.8$ to the high-income developing country, then Figure 6(a) implies that the dominant strategy of the latter should be to defect. At the same time, if the host country assigns a value of $\eta^S_{--P} = 0.8$ to the low-income developing country, Figure 6(c) implies that the dominant incentives of the latter should lead to cooperation. Thus, if the host economy opens, the high-income developing country would defect while the low-income country cooperates.

Given Proposition 6 and the above numerical examples, the discriminating "separating equilibria" of the game are defined as follows:

If migrants are from a lower income developing country: (cooperate, close);
If migrants are from a higher income developing country: (defect, open).

This summarizes our main conclusion regarding the adverse selection equilibrium mechanism of the migration entry game.

7 Final remarks

Standard economic models of migration predict substantial global welfare gains derived from a more open regime of international labor mobility. In accordance with this result, it would be expected that countries will be craving to build an international agreement favorable to more open migratory policies. However, what we observe in the reality is just the opposite: countries are applying tighter restrictions to migrants' access to their territories. Additionally, countries are clearly reluctant to build a multilateral framework for regulating migratory flows, preferring to maintain migration policy under the domain of sovereign States. This contradiction reveals that standard models do not properly reflect the totality of factors—benefits and costs, visible and invisible—that migration sets in motion.

We have developed a formal model that attempts to overcome this limitation. The model is based on payoff functions in which different components of benefits and costs are considered in both host and home countries. The strategic game not only explains why recipient countries are reluctant to advance toward more permissive regimes but also drives us to a paradoxical

result: the higher the potential welfare gains associated with migratory liberalization, the more difficult it is for nations to come to an unrestrictive agreement (and, contrarily, an agreement is more likely when the potential welfare gains are lower). In other words, an agreement is easier to reach when countries are closer in economic (and non-economic) terms.

This result leads to another conclusion in the policy domain. In a world so interconnected, it is difficult for migratory flows to be well-managed exclusively through the decisions of independent nations. Migration is a global phenomenon requiring cooperative solutions at the international level. However, the considerable differences in countries' income levels make this aspiration very difficult to achieve at the global level (such as our model has shown). It would be more realistic to promote agreements at bilateral and regional levels, between countries with closer economic conditions (Trachtman, 2009). Presumably, the international community should advance through the way of a progressive, pragmatic, and gradual liberalization of regulation on migration based on a bottom-up dynamic (rather than a top-down logic). Thus, regional commitments should serve as building blocks (rather than stumbling blocks) for a more effective international governance of migration.

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Appendix 1

Proof of Proposition 1

In order to illustrate that $H^D(\gamma^D,\eta^S,\eta) > H^D(\gamma^D,\underline{\eta^S},\overline{\eta})$ we have to totally differentiate the expression $H^D(\gamma^D,\eta^S,\eta)$ assuming that the proportions $(1-\gamma^U)$ and γ^U remain unchanged, i.e., fixed at $\overline{(1-\gamma^U)}$ and $\overline{\gamma^U}$. Consider the following definition:

$$H^D\left(\gamma^U,\eta^S,\eta\right)=\epsilon\left[\frac{\left(1-\gamma^D\right)+\eta^S\left(1-\gamma^U\right)}{1+\eta^S\left(1-\gamma^U\right)}\right]-\Delta\left(\frac{\gamma^D+\eta\gamma^U}{\gamma^D+1}\right)-\xi\left(\frac{e^{\left(\delta\gamma^D+\delta\eta\gamma^U+\left(1-\gamma^D\right)+\eta^S\left(1-\gamma^U\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right)$$

The total differential of the above expression equals:

$$d(H^D\left(\gamma^U,\eta^S,\eta\right))=$$

$$\epsilon\left[\frac{\left(1-\gamma^U\right)-\left(1-\gamma^U\right)\left(1-\gamma^D\right)}{\left(1+\eta^S\left(1-\gamma^U\right)\right)^2}\right]d\eta^S-\Delta\left(\frac{\gamma^U}{\gamma^D+1}\right)d\eta$$

$$-\xi\left(\frac{e^{\left(\delta\gamma^D+\delta\eta\gamma^U+\left(1-\gamma^D\right)+\eta^S\left(1-\gamma^U\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right)\left(1-\gamma^U\right)d\eta^S$$

$$-\xi\left(\frac{e^{\left(\delta\gamma^D+\delta\eta\gamma^U+\left(1-\gamma^D\right)+\eta^S\left(1-\gamma^U\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right)\delta\gamma^U d\eta$$

The first right-hand side term is clearly positive, indicating the higher payoff received by the host country due to the productivity improvement generated by the additional skilled migrant labor. The second term is negative, reflecting the unskilled wage effect, which implies that as the proportion of unskilled workers decreases, the payoff received by the host country increases. The main terms determining the payoff effect that results from a cooperative strategy of the developing countries are the last two. Indeed, the positive effect derived from decreasing the proportion of unskilled labor, $\delta\gamma^U$, should compensate for the negative congestion effect resulting from the additional skilled workers entering the country, $(1-\gamma^U)$.

Given the fact that $\delta > 1$ and $\gamma^U > (1-\gamma^U)$ in the developing country, we can state that the positive effect following from a decrease in η is stronger than the negative effect derived from an increase in η^S. Thus, it follows that $H^D(\gamma^D,\eta^S,\eta) > H^D(\gamma^D,\underline{\eta^S},\overline{\eta})$ whenever $d\eta^S = d\eta$. ▪

Appendix 2

Proof of Proposition 2

In order to illustrate that $H^D(\gamma^D,\eta^S,\eta)$ is a decreasing function of γ^U, we totally differentiate the expression $H^D(\gamma^D,\eta^S,\eta)$ assuming fixed values for the η and η^S proportions. The resulting total differential of $H^D(\gamma^U,\eta^S,\eta)$ is given by:

$$d(H^D(\gamma^U,\eta^S,\eta)) =$$

$$\epsilon\left[\frac{\eta^S-\eta^S\left(1-\gamma^D\right)}{\left(1+\eta^S\left(1-\gamma^U\right)\right)^2}\right]d\left(1-\gamma^U\right)-\Delta\left(\frac{\eta}{\gamma^D+1}\right)d\gamma^U$$

$$-\xi\left(\frac{e^{\left(\delta\gamma^D+\delta\eta\gamma^U+\left(1-\gamma^D\right)+\eta^S\left(1-\gamma^U\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right)\eta^S d\left(1-\gamma^U\right)$$

$$-\xi\left(\frac{e^{\left(\delta\gamma^D+\delta\eta\gamma^U+\left(1-\gamma^D\right)+\eta^S\left(1-\gamma^U\right)\right)}}{e^{\left(\delta\gamma^D+\delta+\left(1-\gamma^D\right)\right)}}\right)\delta\eta d\gamma^U$$

The intuition is similar to that provided in the proof for Proposition 1. That is, the first right-hand side term is positive, the second one negative, and the last two terms allow us to conclude that the negative effect from increasing the proportion of skilled workers, η^S, should be compensated by the positive effect following from the reduction in the proportion of unskilled workers, $\delta\eta$. It therefore suffices to assume that $\delta\eta \geq \eta^S$ in the developing country to obtain the result required.

Thus, given two developing countries endowed with different levels of income (i.e., with different percentages of skilled labor), the country with the higher income level (i.e., with the lower proportion of unskilled workers) will have a more positive effect on $H^D(\gamma^U,\eta^S,\eta)$ *and* $H^D(\gamma^D,\underline{\eta^S},\overline{\eta})$. ▪

Appendix 3

Proof of Proposition 3

Proof. The result follows directly from the fact that $H^D(\gamma^D,\eta^S,\eta) > H^D(\gamma^D,\underline{\eta^S},\overline{\eta}) > H^D(\gamma^D)$. ▪

Appendix 4

Proof of Corollary 2

Proof. We use the subscripts *P* and *R* to refer to the lower and higher income developing countries, respectively. The result follows directly from the fact that $H_R^D(\gamma^D,\underline{\eta^S},\overline{\eta}) > H_P^D(\gamma^D,\underline{\eta^S},\overline{\eta})$ and the continuity of the payoff functions defined for the developed host country. Note that, given $H_P^D(\gamma^D,\eta^S,\eta) > H^D(\gamma^D)$, the continuity of $H^D(\gamma^U,\eta^S,\eta)$ guarantees that a set of $\overline{\eta}$ and $\underline{\eta^S}$ values can be defined such that $H_P^D(\gamma^D,\underline{\eta^S},\overline{\eta}) = H^D(\gamma^D)$. By Proposition 2, there exists a set of γ^U and $(1-\gamma^U)$ values such that $H_R^D(\gamma^D,\underline{\eta^S},\overline{\eta}) > H^D(\gamma^D) > H_P^D(\gamma^D,\underline{\eta^S},\overline{\eta})$ is satisfied. ▪

Appendix 5

Proof of Proposition 6

Proof. Corollary 3 accounts for the dominant strategies of the developed host country. The continuity of the $H^U(\gamma^U,\eta^S,\eta)$ and $H^U(\gamma^U)$ functions and the fact that the difference $k(\eta^S-\eta^S_{--})$ increases in the proportion of unskilled workers in the developing country, since $\eta^S_{--P}<\eta^S_{--R}$, imply that there exists a sufficiently large k satisfying the equilibrium requirements among developing countries. Note that the same intuition applies when considering differences in the proportion of unskilled workers, $k(\overline{\eta}-\eta)$, with $\eta^{--P}>\eta^{--R}$, or when combining both approaches simultaneously. ▪

Appendix 6

Equilibrium extensions: ineffective immigration containment

Assume that $H^D(\gamma^D)$ and, therefore, $H^U(\gamma^U)$, depend on the strategy chosen by the developing country. That is, assume that when the developing country defects, the host economy cannot effectively contain all unskilled migration, leading to $H^U(\gamma^U,\overline{\eta})>H^U(\gamma^U)$. As a result, we have the following game:

	Open	Close
Coop	$H^U\left(\gamma^U,\eta^S,\eta\right);\ H^D\left(\gamma^D,\eta^S,\eta\right)$	$H^U\left(\gamma^U\right);\ H^D\left(\gamma^D\right)$
Defect	$H^U\left(\gamma^U,\underline{\eta^S},\overline{\eta}\right);\ H^D\left(\gamma^D,\underline{\eta^S},\overline{\eta}\right)$	$H^U\left(\gamma^U,\overline{\eta}\right);\ H^D\left(\gamma^D,\overline{\eta}\right)$

Proposition 2 implies that defection is a strictly dominant strategy among developing countries, while the counterpart of Proposition 3 follows directly from Proposition 1.

Proposition A.1. *A necessary condition for Open to become a (strictly) dominant strategy whenever* $d\eta^S = d\eta$ *is given by* $H^D(\gamma^D,\underline{\eta^S},\overline{\eta})>H^D(\gamma^D,\overline{\eta})$. *Sufficiency requires also that* $H^D(\gamma^D,\eta^S,\eta)>H^D(\gamma^D)$.

Thus, if the host country cannot effectively contain the flow of unskilled immigrants when deciding to close its borders, the developing countries have an incentive to promote the migration of unskilled labor to the developed host so as to decrease the pressure on their labor markets. The analysis performed in Section 6.4 remains valid within the current framework including Proposition 4, which states that the incentives of the host to open its economy are higher when dealing with developing countries with higher levels of income.

Finally, note that it has been assumed that the $H^U(\gamma^U,\underline{\eta^S},\overline{\eta})$ and $H^U(\gamma^U,\overline{\eta})$ functions are based on the same value of $\overline{\eta}$. However, it seems plausible to assume that it is harder for immigrants to enter the host country when it is closed to migration flows, which would modify the payoffs and incentives of the developing countries depending on the assumed strength of such a restriction. It should be emphasized that the results described in Section 6.5 can still be obtained, though it would be necessary to account for a more complex environment whose inclusion does not alter the adverse selection mechanism described throughout the paper.