CESifo Economic Studies, 2016, 572–593
doi: 10.1093/cesifo/ifv024
Advance Access Publication Date: 28 November 2015
Original article

Illegal Immigration, Foreign Aid, and the Transit Countries

Slobodan Djajić* and Michael S. Michael†

*Department of Economics, The Graduate Institute, CH-1202 Geneva, Switzerland. e-mail: slobodandjajic@yahoo.com and †Department of Economics, University of Cyprus, Nicosia, Cyprus. e-mail: m.s.michael@ucy.ac.cy

Abstract

This article examines the problem facing an advanced, final-destination country as it seeks cooperation from its less-well-off neighbors to impede unauthorized, third-country migrants from transiting their territories. With that aim, it transfers aid to the transit countries in support of their border-control efforts. Aid recipients, however, may have an incentive to divert resources to border security objectives other than immigration control. We characterize the donor's optimal allocation of aid between the transit countries and the optimal use of aid by the latter in the Nash equilibrium. These values of the policy instruments are subsequently compared with those in an equilibrium where the transit countries (i) compete for a share of aid, (ii) collude to maximize joint welfare, and (iii) follow the donor who moves first. (JEL codes: F22).

Key words: foreign aid, immigration control, transit countries

1. Introduction

For many of the advanced countries, illegal immigration is becoming an increasingly prominent item on their policy agendas. As a result of their continuous efforts to enhance immigration controls (IC), direct entry through their airports without proper documentation has become practically impossible.[1] This has induced a growing number of illegal immigrants (and human-smuggling organizations that assist them) to choose land routes through transit countries as the most cost-effective way of reaching the final destination. The Council of Europe (2008) reports that estimates on the number of undocumented migrants passing through Libya, Tunisia, Morocco, and Mauritania on their way to the EU are on the order

1 This is primarily due to the (i) tightening of both security and IC at the airports over the last couple of decades, (ii) increased sophistication in the production and inspection of travel documents, (iii) tightening of visa requirements to prevent those who are likely to violate their visas from gaining entry, and (iv) very effective carrier sanctions that have partly shifted the burden of immigration control on to the airlines.

of at least 100,000 per year. This includes not only Sub-Saharan Africans, but also migrants from Asia (China, Pakistan, India, and Bangladesh, in particular), who fly into the major West African airports with proper documentation and then use land routes to reach the Mediterranean before the final, undocumented leg of the journey to the EU (Giavitto, 2012). Similar patterns of migration are seen in North America. The Mexican National Institute of Migration reports that more than 400,000 people cross into Mexico illegally from Guatemala every year, with some 150,000 of them eventually headed to the United States (Gorney, 2008). In light of this trend, the final-destination countries are becoming increasingly aware of the fact that their ability to control illegal immigration depends extensively on cooperation with their immediate neighbors. Such cooperation is beginning to take shape, including in the form of aid transfers from the final-destination to the transit countries. The focus of the present study is on the problem of choosing the optimal allocation of aid to the transit countries in an effort to help them build capacities to address the problem of transit migration.

Illegal border crossing into the advanced countries is of basically two types: (i) direct migration of neighboring-country citizens and (ii) indirect migration of third-country nationals who transit through the territories of the neighboring countries. These two distinct flows are perceived to require different policy responses. The problem of direct entry without inspection (EWI) of a neighboring-country's citizens has been addressed by final-destination countries with a wide range of initiatives. These include repatriation agreements, measures to allow neighboring-country citizens greater access to temporary migration programs, to tourist, student, and other non-immigrant visas, but also steps towards deeper economic integration that will eventually reduce the wage gaps that are currently fueling undocumented inflows. Extension of NAFTA to Mexico or the EU expansion and association agreements over the last two decades are examples of such steps.

Dealing with undocumented border crossing of 'third-country nationals' by relying on deeper economic integration with the countries of origin is likely to be much less effective than in the case of direct migration from the neighboring countries. Moreover, it is perceived by the final-destination countries as impractical and it may not even be feasible. They are therefore addressing this problem by enhancing their border enforcement capabilities and strengthening cooperation on illegal immigration with the transit countries.

There are a number of dimensions along which such cooperation is taking place. Considering the example of cooperation between the EU and the transit countries on the southern shores of the Mediterranean, the 2001 Tunis Declaration called for joint management of migration in the region by the EU and North African nations. Consultations between North- and South-Mediterranean countries on Malta in February 2003 and in Alexandria, Egypt in June 2003, called for further efforts to improve the quality and intensity of cooperation on the issue of irregular migration across the Mediterranean (Roman, 2006). By now, extensive cooperation has developed in the form of repatriation agreements and projects that enhance border controls in transit countries, involving technical and financial assistance as well as training of personnel.[2] At the bilateral level, cooperation

2 For an extensive discussion of EU efforts to address the problem of transit migration through various initiatives involving transit countries over the last two decades, see Düvell (2010). These initiatives typically offer transit countries various concessions on trade, aid, visa regulations, etc., while exerting pressure on them to clamp down on transit migration by tightening their border-control measures as well as their internal enforcement policies. With respect to the latter, Morocco and

between Spain and Morocco, as well as between Italy and Libya, has also been extensive. Spanish and Moroccan police jointly patrol along Morocco's coastline to deter and prevent undocumented immigrants from leaving Morocco and reaching the borders of Spain. In exchange, Spain provided Morocco with a substantial amount of financial aid and technical assistance to enhance its border-control capabilities (Giavitto, 2012). Cooperation between Italy and Libya to combat human smuggling has also been significant prior to the destruction of the Libyan state in 2011. It facilitated repatriation of undocumented transit migrants and included agreements providing Libya with training programs and financial assistance. While such measures cannot be expected to prevent every transit migrant from reaching the borders of a final-destination country, they certainly act as a deterrent by raising the cost of migration without authorization and increasing the probability that the migration attempt will be unsuccessful.

Another example is the case of Australia. In an effort to prevent people smuggling from South-East Asia into Australia, it has expanded its cooperation with the key transit countries, Malaysia and Indonesia, along several dimension: (i) intelligence sharing and building investigative capabilities, (ii) cooperation in developing legal structures that make it possible for transit countries to prosecute people smugglers, (iii) help with training and equipment to increase the capacity of transit countries to intercept migrant boats, (iv) agreements to facilitate return of migrants to transit and source countries, and (v) help Indonesia to care for asylum seekers so they would have less incentive to try and reach Australia.[3]

In the very extensive theoretical literature on illegal immigration,[4] surprisingly few studies examine the problem of reducing undocumented flows through international cooperation. Gaytan-Fregoso and Lahiri (2000) take the first step towards exploring the possibility of using foreign aid as an instrument of illegal-immigration control, by studying the implications of an unconditional foreign aid transfer from the host country to a representative household of the source country. They find that such a policy may have a perverse effect of raising (rather than reducing) the flow of illegal immigrants. Similar results are obtained by Bandyopadhyay et al. (2012) in the context of a somewhat richer model of international trade and illegal immigration. Djajić (2006) also looks into the possibility of reducing illegal immigration by transferring aid from the host to the source country, with

Tunisia introduced new laws in 2003 and 2004, respectively, to further regulate entry and stay of foreigners, criminalize human trafficking, and create new institutions dealing with migration and border surveillance (Giavitto, 2012).

3 According to the Australian Government (2012, p. 115), in the fiscal year 2011–2012, the Department of Immigration and Citizenship (DIAC) has allocated 'approximately $70 million for international engagement and capacity building activities related to people smuggling and border control: $47 million to support regional cooperation and build the capacity of source and transit countries, $10 million for management and care of irregular migrants in Indonesia, $7 million for initiatives to address the situation of displaced persons in, and promote sustainable returns to, source and transit countries, and $7 million for returns and reintegration assistance packages'.

4 See, for example, Ethier (1986), Bond and Chen (1987), Djajić (1987, 1997, 2014), Bandyopadhyay and Bandyopadhyay (1998), Epstein et al. (1999), Hillman and Weiss (1999), Yoshida (2000), Hazari and Sgro (2006), Woodland and Yoshida (2006), Friebel and Guriev (2006), Tamura (2010, 2013), Facchini and Testa (2011, 2015), Auriol and Mesnard (2013), Djajić and Vinogradova (2013, 2014, 2015), and Casarico et al. (2015).

aid being conditional on the members of the recipient households remaining at home.[5] Kahana and Lecker (2005) go a step further to develop a model where the host country distributes aid to the source countries on the basis of the number of source-country migrants apprehended by the local authorities as they attempt to leave. None of these studies, however, examines the problem of providing aid to the authorities of the transit countries in support of their border-control efforts that are designed to deter and prevent 'third-country nationals' from reaching the frontiers of the donor.

Djajić and Michael (2014) attempt to fill this gap in the literature by considering a problem where a final-destination country (such as the USA) seeks cooperation from a single transit country (Mexico). From a given immigration-control budget, it must decide how much to allocate for the control of its own borders and how much to provide to the transit country in support of its efforts to prevent undocumented third-country nationals from passing through its territory. The present study offers new policy conclusions in relation to the problem of transit migration by examining a more complex problem of a final-destination country that has two transit countries along its frontiers. Its objective is to minimize illegal immigration from distant, third countries, by providing aid to the two transit countries in an effort to increase their border-monitoring capacities and ability to prevent transit migrants from ever reaching its own frontiers. What complicates the problem is that transit countries differ not only in terms of their geography (which renders one or the other relatively more attractive as a country of transit from the perspective of the migrants), but also in terms of their attitudes towards immigration control, as well as in terms of their individual needs to divert aid for the purpose of meeting other border-control objectives (OBCO).

After spelling out the details of the problem under investigation and the objectives of the three players in our model of aid allocation, we characterize the Nash equilibrium. We subsequently compare it with the one that emerges in a two-stage game where the two transit countries compete for aid by committing to spend a certain fraction of it strictly on immigration control, taking into account the objective of the donor. We also examine the possibility of the transit countries colluding to maximize their joint welfare for any given amount of total aid disbursed by the donor. Finally, we consider a two-stage game where the donor moves first in deciding on the allocation of aid, with the recipients subsequently choosing how to use it. In each case, the focus of the analysis is on the donor's optimal allocation of aid between the two transit countries, the optimal use of aid by the latter, and the implications for the effectiveness of aid in reducing the flow of transit migrants reaching the borders of the donor country. We find that the optimal allocation of aid and its effectiveness depends not only on the geographic and technological factors, but also on the needs and preferences of the transit countries as well as on the institutional structures that determine the relationships among the players and the sequence of their actions. In terms of the effectiveness of aid allocation in preventing transit migrants from reaching the borders of the donor, we find that the policy regime in which transit countries compete for aid is superior to the Nash equilibrium and the collusion equilibrium. By contrast, a comparison between the competition-for-aid regime and the regime where the donor decides first on aid allocation and then the two transit countries decide on how to use it, does not yield unambiguous results.

5 See also Myers and Papageorgiou (2000) who study the implications of illegal immigration for redistributive policies and inequality in the host country which attempts to control immigration by offering aid to the residents of the source country.

2. The problem for the donor country

Consider an advanced, final-destination country, D, experiencing inflows of illegal immigrants from third countries, who pass through the territories of its two significantly poorer neighboring countries, T and T^*. In the case of the EU, Morocco and Tunisia are two such transit countries along its south-western frontier or we can think of Turkey and Ukraine in the east. Let us suppose that D has decided to allocate F units of foreign aid to T and T^* in support of their efforts to reduce the flow of third-country migrants.[6] In the absence of aid, T and T^* are assumed to lack resources for the purpose of controlling illegal immigration.[7] The problem for the authorities of D is to optimally divide the F units of aid between the two transit countries with the objective of maximizing the number of illegal immigrants prevented from reaching its own borders. Aid is assumed to be provided in the form of surveillance equipment, training of personnel, vehicles, and other material support to build on the recipient's capacity to detect and apprehend transit migrants. This detection and apprehension capacity serves not only to stop some of the transit migrants from reaching the border of D, but it also helps deter potential migrants from leaving their country of origin.

The two transit countries may differ from each other in a number of ways that have bearing on the flow of transit migrants through their territories. First, they are geographically different. One may be closer than the other to the principal source countries of illegal immigration or one may have a more 'hostile' terrain than the other from the perspective of undocumented migrants. Hostility can manifest itself in different forms: in terms of topography (mountain ranges, deserts, large bodies of water, and other natural barriers to migration), in terms of criminal activity that often targets transit migrants, or even in terms of availability of employment opportunities for transit migrants who sometimes rely on them in the context of their strategy for financing migration costs (see Djajić, 2012). Second, the two transit countries may have different preferences with respect to their tolerance of transit migration and different needs and priorities. This will influence their choice between using the aid to strengthen IC or using it to meet OBCO, such as interdiction of drug trafficking activities, merchandize smuggling, arms trafficking, hostage taking, and other transnational criminal and possibly terrorist activities.

These differences influence the effectiveness across the two transit countries of the foreign aid provided by the final-destination country in meeting its goal of reducing the flow

6 Not much would change with respect to the questions addressed in this article if we assume, instead, that F is endogenously determined to maximize D's benefits of expenditures on the control of illegal immigration, with some of the funds allocated for assistance to the transit countries and the rest for its own border surveillance. It would merely bring into focus another tradeoff facing the donor country: that between the benefits of spending at home on immigration control rather than at the level of the transit countries. This tradeoff is examined in some detail by Djajić and Michael (2014).

7 This assumption is not as strong as it might appear at first sight. Even the USA did not have any resources allocated for the control of its borders *between* official border crossings before 1924. It was only after the passage of the 18th Amendment to the US Constitution in 1920 (prohibiting the importation, transport, manufacture, or sale of alcoholic beverages) and the Immigration Acts of 1921 and 1924 (imposing numerical limitations on immigration), that the US Border Patrol was officially established. Border surveillance in many of the developing countries today is not very different from what it was in the USA before 1924.

of undocumented immigrants reaching its own borders. Moreover, studies on the impact of enforcement along the US–Mexico border (Hanson and Spilimbergo, 2005; Gathmann, 2008) suggest that an increase in enforcement along one segment of the border results in diversion of migration flows to other corridors as migrants and human smugglers seek to exploit the weakest links in the chain of border controls. In a three-country setting, this suggests that an increase in expenditure on immigration control by one transit country tends to divert migration flows through the other, increasing the productivity of border-control efforts of the latter. We thus assume that expenditures on IC by the two transit countries are complementary in the Edgeworth sense: Higher spending by one transit country increases the marginal impact of higher expenditure of the other on the total number, N, of migrants 'deterred' and 'prevented' from reaching the borders of D.

To facilitate the analysis later in the article, it is convenient to use a specific functional form for this relationship. A simple way of capturing the complementarity of IC spending across transit countries as well as the aforementioned differences between T and T^* in terms of the effectiveness of their IC expenditures, is by assuming that

$$N = [\beta E^{\varepsilon} + (1-\beta)E^{*\varepsilon}]^{\frac{\tau}{\varepsilon}} \tag{1}$$

where E and E^* are the levels of effective spending on IC by T and T^*, respectively, $\tau < 1$ is the degree of homogeneity of the function and $\varepsilon \in (0,1)$. Without any loss of generality, we shall assume that $1 > \beta > 1/2$, implying that if $E = E^*$, the marginal productivity of E in deterring and preventing migrants from reaching the borders of D is higher than that of E^*. This amounts to assuming that the geographic differences between the two transit countries, alluded to earlier, make T the principal transit country from the point of view of D.

Effective spending on IC by T is defined as

$$E = \alpha\gamma\mu F \tag{2}$$

where μ is the fraction of F transferred to T, α is the share of the received aid that is used by T strictly for immigration control and γ is a shift parameter that reflects the effectiveness of this spending in preventing migrants from reaching the frontiers of D. One can think of γ as being dependent, for example, on the technology of IC measures that are suitable for T's geographic conditions, command and control structure of its enforcement agency, or even the degree of corruption in the country. Similarly, effective spending on immigration control by T^* is defined by

$$E^* = \alpha^*\gamma^*(1-\mu)F \tag{3}$$

where $(1-\mu)$ is the fraction of F received by T^*, α^* is the share of aid that it uses for the purpose of IC, and γ^* is a shift parameter that reflects the effectiveness of IC spending in deterring and preventing undocumented immigrants from passing through T^* to reach the borders of D.

Note that the marginal productivity of a change in E in terms of its effect on N is given by

$$\frac{dN}{dE} = \Lambda^D \beta E^{\varepsilon-1} > 0 \tag{4}$$

where $\Lambda^D = \tau[\beta E^{\varepsilon} + (1-\beta)E^{*\varepsilon}]^{\frac{1}{\varepsilon}-1} > 0$. Similarly, the marginal productivity of IC spending by T^* is given by

$$\frac{dN}{dE^*} = \Lambda^D(1-\beta)E^{*\varepsilon-1} > 0 \tag{5}$$

with the elasticities of N with respect to both E and E^* being smaller than unity in absolute value.[8]

3. The problem for the transit countries

The donor country, D, provides T with μF units of aid and T^* with $(1-\mu)F$ units. Each of the transit countries must decide what share (α for T and α^* for T^*) of their aid transfer to use strictly for immigration control (IC) rather than for the purpose of meeting other border control objectives (OBCO). The welfare gain for T associated with the aid transfer is defined as

$$V = \lambda\varphi(\alpha\mu F) + u((1-\alpha)\mu F) \tag{6}$$

where $\varphi(.)$ measures the benefits enjoyed by T, as a result of spending the share α of its aid on IC. The function $u(.)$ measures the benefits from using the remaining aid to meet OBCO. The constant λ is the weight attached by country T to the benefits it enjoys by using resources for IC as opposed to OBCO, the latter having a weight normalized to unity. The value of λ thus reflects the degree to which T perceives its interests as being harmed by the presence of transit migrants on its territory relative to the degree of harm it sees being inflicted on it by various other types of illegal transnational activities. Thus if merchandize smuggling across its borders should for some reason become a more pressing problem, this would be reflected in a drop in the value of λ in Equation (6). Similarly, if cross-border terrorist activity is suddenly perceived to be a more serious threat to T's national interests, as in the case of the attack on an Algerian oil installation in 2014, it would also entail a drop in the value of λ. In consequence, trained personnel and equipment provided by the donor would be perceived as being more useful in focussing on OBCO rather than IC. By contrast, if transit migrants are being increasingly viewed as a threat to stability and maintenance of law and order in T, this would imply a larger λ. The functions $u(.)$ and $\varphi(.)$ are assumed to be increasing and concave: $u'(.) > 0$, $\varphi'(.) > 0$ and $u''(.) < 0$, $\varphi''(.) < 0$, with the degree of concavity of $u(.)$ measured by $\eta \equiv -[\partial u'(.)/\partial(1-\alpha)\mu F][(1-\alpha)\mu F/u'(.)] > 0$, and that of $\varphi(.)$ measured by $\zeta \equiv -[\partial\varphi'(.)/\partial\alpha\mu F][\alpha\mu F/\varphi'(.)] > 0$. To rule out corner solutions, we also impose the Inada conditions.

The objective of T^* is to maximize

$$V^* = \lambda^*\varphi^*(\alpha^*(1-\mu)F) + u^*((1-\alpha^*)(1-\mu)F) \tag{7}$$

where $u^*(.)$ and $\varphi^*(.)$ are the corresponding functions for T^* and the constant λ^* is the weight attached by T^* to the benefits of using resources for IC as compared with OBCO.

8 Equation (4) can be written in the form of an elasticity to show that $\frac{\partial N}{\partial E}\frac{E}{N} = \frac{\tau\beta E^{\varepsilon}}{[\beta E^{\varepsilon}+(1-\beta)E^{*\varepsilon}]} < 1$. Similarly, $\frac{\partial N}{\partial E^*}\frac{E^*}{N} = \frac{\tau(1-\beta)E^{*\varepsilon}}{[\beta E^{\varepsilon}+(1-\beta)E^{*\varepsilon}]} < 1$.

The properties of $u^*(.)$ and $\varphi^*(.)$ are the same as those of $u(.)$ and $\varphi(.)$, although we allow the exact shapes of the functions to be different. In particular, the degree of concavity of $u^*(.)$, defined by $\eta^* \equiv -[\partial u^{*\prime}(.)/\partial(1-\alpha^*)(1-\mu)F][(1-\alpha^*)(1-\mu)F/u^{*\prime}(.)] > 0$ may differ from η and the degree of concavity of $\varphi^*(.)$, that is, $\zeta^* \equiv -[\partial\varphi^{*\prime}(.)/\partial\alpha^*(1-\mu)F][\alpha^*(1-\mu)F/\varphi^{*\prime}(.)] > 0$ may differ from ζ.

4. Nash equilibrium

Let us take the Nash equilibrium, with all three agents moving simultaneously, as our benchmark policy-setting framework. The donor country chooses μ to maximize its welfare V^D, which is defined as $V^D = \lambda^D N$, where λ^D, assumed constant (without any loss of generality in the present context), is the welfare weight attached by D to the number of illegal immigrants, N, deterred and prevented from reaching its borders. Substituting Equations (2) and (3) into (1), differentiating the latter with respect to μ and setting it equal to zero, we obtain the reaction function of country D:

$$V^D_\mu = \lambda^D\left(\frac{\partial N}{\partial E}\frac{\partial E}{\partial \mu}+\frac{\partial N}{\partial E^*}\frac{\partial E^*}{\partial \mu}\right) = \Lambda\left[\frac{\beta E^\varepsilon}{\mu}-\frac{(1-\beta)E^{*\varepsilon}}{(1-\mu)}\right] = 0 \tag{8}$$

where $\Lambda \equiv \lambda^D\tau[\beta E^\varepsilon + (1-\beta)E^{*\varepsilon}]^{\frac{\tau}{\varepsilon}-1} > 0$. Equation (8) implies that the value of μ that maximizes the welfare of D is given by

$$\mu = 1/\left[\left(\frac{(1-\beta)}{\beta}\right)^{\frac{1}{1-\varepsilon}}\left(\frac{\alpha\gamma}{\alpha^*\gamma^*}\right)^{\frac{\varepsilon}{\varepsilon-1}}+1\right] \tag{9}$$

and the second-order condition is satisfied.[9] Note in addition, that

$$\frac{\partial\mu}{\partial\alpha} = -\frac{\mu^2}{\alpha}\left(\frac{(1-\beta)}{\beta}\right)^{\frac{1}{1-\varepsilon}}\left(\frac{\varepsilon}{\varepsilon-1}\right)\left(\frac{\alpha\gamma}{\alpha^*\gamma^*}\right)^{\frac{\varepsilon}{\varepsilon-1}} > 0 \tag{10}$$

while

$$\frac{\partial\mu}{\partial\alpha^*} = \frac{\mu^2}{\alpha^*}\left(\frac{(1-\beta)}{\beta}\right)^{\frac{1}{1-\varepsilon}}\left(\frac{\varepsilon}{\varepsilon-1}\right)\left(\frac{\alpha\gamma}{\alpha^*\gamma^*}\right)^{\frac{\varepsilon}{\varepsilon-1}} < 0 \tag{11}$$

with the elasticities of μ with respect to both α and α^* being smaller than unity in absolute value.[10]

9 That is, $V^D_{\mu\mu} = \frac{\partial^2 V^D}{\partial\mu^2} = \Lambda(\varepsilon-1)\left\{\frac{\beta E^\varepsilon}{\mu^2}+\frac{(1-\beta)E^{*\varepsilon}}{(1-\mu)^2}\right\} < 0$.

10 The elasticities of μ with respect to α and α^* are given by

$$\frac{\partial\mu}{\partial\alpha}\frac{\alpha}{\mu} = \frac{-\left(\frac{(1-\beta)}{\beta}\right)^{\frac{1}{1-\varepsilon}}\left(\frac{\varepsilon}{\varepsilon-1}\right)\left(\frac{\alpha\gamma}{\alpha^*\gamma^*}\right)^{\frac{\varepsilon}{\varepsilon-1}}}{\left(\frac{(1-\beta)}{\beta}\right)^{\frac{1}{1-\varepsilon}}\left(\frac{\alpha\gamma}{\alpha^*\gamma^*}\right)^{\frac{\varepsilon}{\varepsilon-1}}+1},$$

and

$$\frac{\partial\mu}{\partial\alpha^*}\frac{\alpha^*}{\mu} = \frac{\left(\frac{(1-\beta)}{\beta}\right)^{\frac{1}{1-\varepsilon}}\left(\frac{\varepsilon}{\varepsilon-1}\right)\left(\frac{\alpha\gamma}{\alpha^*\gamma^*}\right)^{\frac{\varepsilon}{\varepsilon-1}}}{\left(\frac{(1-\beta)}{\beta}\right)^{\frac{1}{1-\varepsilon}}\left(\frac{\alpha\gamma}{\alpha^*\gamma^*}\right)^{\frac{\varepsilon}{\varepsilon-1}}+1},$$

respectively, which are smaller than unity in absolute value.

Equation (8) shows that at the Nash equilibrium, country D chooses μ such that the marginal unit of aid given to either transit country has the same effect on the number of illegal immigrants prevented from reaching its borders. Moreover, from the optimality condition (9), we immediately have the following proposition:

Proposition 1 *When the donor allocates a fixed amount of aid to maximize V^D, it will give relatively more aid to country T, the higher the values of β, α, and γ, and the lower the values of α^* and γ^*.*

We recall that for any given amount of aid received by a transit country, its productivity may be higher from the perspective of the donor, either because it allocates a larger share of aid for IC, or because the geographic and technological factors that we referred to earlier make the efficiency of spending on IC higher in T. From Proposition 1, it is clear that if geographic conditions are identical in both transit countries (that is, $\beta = 1/2$), D will give more aid to the country where the effective spending on IC is larger. However, if the IC technology and use of aid by the two recipients is the same (that is, $\gamma = \gamma^*$ and $\alpha = \alpha*$), D will give more aid to T. This is because, having assumed that $\beta > 1/2$, the geographic conditions render spending on IC in T relatively more potent than in T^* in terms of its impact on N.

The problem for country T is to decide on the share of aid it uses for (or 'spends' on) IC, so as to maximize welfare. Setting the derivative of its welfare function (6) with respect to α equal to zero yields the reaction function:

$$V_\alpha = (\partial V/\partial\alpha) = \mu F[-u'(.) + \lambda\varphi'(.)] = 0 \tag{12}$$

Equation (12) shows that at the Nash equilibrium, α is chosen such that the welfare gains from spending a unit of aid on IC is identical to that of spending it instead on OBCO.

Similarly, the objective of T^* is to choose α^* to maximize its own welfare. Setting the derivative of Equation (7) with respect to α^* equal to zero, we obtain its reaction function:

$$V^*_{\alpha^*} = (\partial V^*/\partial\alpha^*) = (1-\mu)F[-u^{*\prime}(.) + \lambda^*\varphi^{*\prime}(.)] = 0 \tag{13}$$

The interpretation of Equation (13) is analogous to that of Equation (12).[11]

The simultaneous solution of the reaction functions (8), (12), and (13) yields the Nash-equilibrium values of μ, α, and α^*.

5. Comparative statics

To examine how these Nash-equilibrium values of the choice variables μ, α, and α^* are affected by changes in the parameters of the model, such as the effectiveness of IC spending in T and T^* (that is, γ and γ^*), or the welfare weights attached to IC by T and T^* (that is, λ and λ^*), or the total amount of aid, F, allocated by the donor, we differentiate the reaction functions (8), (12), and (13), to obtain the following system:

11 The second-order conditions for welfare maximization in T and T^* are satisfied since $V_{\alpha\alpha} = (\partial^2 V/\partial\alpha^2) = \mu^2F^2[u''(.) + \lambda\varphi''(.)] < 0$ and $V^*_{\alpha^*\alpha^*} = (\partial^2 V^*/\partial\alpha^{*2}) = (1-\mu)^2F^2[u^{*\prime\prime}(.) + \lambda^*\varphi^{*\prime\prime}(.)] < 0$, respectively.

$$\begin{bmatrix} V^D_{\mu\mu} & V^D_{\mu\alpha} & V^D_{\mu\alpha^*} \\ V_{\alpha\mu} & V_{\alpha\alpha} & V_{\alpha\alpha^*} \\ V^*_{\alpha^*\mu} & V^*_{\alpha^*\alpha} & V^*_{\alpha^*\alpha^*} \end{bmatrix} \begin{bmatrix} d\mu \\ d\alpha \\ d\alpha^* \end{bmatrix} = \begin{bmatrix} -V^D_{\mu\gamma} \\ -V_{\alpha\gamma} \\ -V^*_{\alpha^*\gamma} \end{bmatrix} d\gamma + \begin{bmatrix} -V^D_{\mu\lambda} \\ -V_{\alpha\lambda} \\ -V^*_{\alpha^*\lambda} \end{bmatrix} d\lambda + \begin{bmatrix} -V^D_{\mu F} \\ -V_{\alpha F} \\ -V^*_{\alpha^* F} \end{bmatrix} dF \tag{14}$$

The system of Equations (14) is analyzed in the following subsections. Readers who are not interested in following details of the comparative statics analysis can skip immediately to a summary of our findings presented in the form of Propositions 2 and 3 at the end of Subsections 5.2 and 5.3.

In what follows, we omit the analysis of changes in γ^* and λ^* since the effects are symmetric to those stemming from changes in γ and λ. Also note that $V_{\alpha\alpha^*} = V^*_{\alpha^*\alpha} = V_{\alpha\gamma} = V^*_{\alpha^*\gamma} = V^D_{\mu\lambda} = V^*_{\alpha^*\lambda} = 0$ and that $V^D_{\mu F} = 0$ at the Nash equilibrium.

5.1 Change in the effectiveness of spending on IC

Let us first examine how an increase in γ, the effectiveness of spending on immigration control in T, affects the Nash equilibrium. Using the system of Equations (11), we have

$$\frac{d\mu}{d\gamma} = \frac{-V^D_{\mu\gamma} V_{\alpha\alpha} V^*_{\alpha^*\alpha^*}}{\Delta} > 0 \tag{15}$$

$$\frac{d\alpha}{d\gamma} = \frac{V^*_{\alpha^*\alpha^*} V_{\alpha\mu} V^D_{\mu\gamma}}{\Delta} \tag{16}$$

$$\frac{d\alpha^*}{d\gamma} = \frac{V_{\alpha\alpha} V^*_{\alpha^*\mu} V^D_{\mu\gamma}}{\Delta} \tag{17}$$

where Δ is the determinant of the coefficient matrix of Equation (14) and is negative, assuming stability of the Nash equilibrium. Note that $V^D_{\mu\gamma} = \Lambda\varepsilon\beta E^{\varepsilon}/\gamma\mu > 0, V_{\alpha\mu} = Fu'(.)[\eta - \zeta]$, and $V^*_{\alpha^*\mu} = Fu^{*\prime}(.)[\zeta^* - \eta^*]$ and recall that $\eta \equiv -[\partial u'(.)/\partial(1-\alpha)\mu F][(1-\alpha)\mu F/u'(.)] > 0$, is our measure of the degree of concavity of the function $u(.)$ and $\zeta \equiv -[\partial\varphi'(.)/\partial\alpha\mu F][\alpha\mu F/\varphi'(.)] > 0$, measures the degree of concavity of the function $\varphi(.)$. Similarly for T^*, $\eta^* \equiv -[\partial u^{*\prime}(.)/\partial(1-\alpha^*)(1-\mu)F][(1-\alpha^*)(1-\mu)F/u^{*\prime}(.)] > 0$ and $\zeta^* \equiv -[\partial\varphi^{*\prime}(.)/\partial\alpha^*(1-\mu)F][\alpha^*(1-\mu)F/\varphi^{*\prime}(.)] > 0$.

Equation (15) shows that in response to an increase in γ, a measure of efficiency of IC spending in country T, the donor raises the proportion of aid it gives to T. The implied changes in α and α^* in Equations (16) and (17) depend, however, on the relative degrees of concavity of the functions relating expenditures on IC and OBCO to the benefits of such spending in the respective transit country. If, for example, $\eta - \zeta > 0$ in country T, its benefits of increased spending on OBCO diminish more quickly than do benefits of increased spending on IC. That is to say, its resource needs for meeting OBCO are more quickly satiated with an increase in spending when compared with its needs for IC. This would be the case if T does not face very serious terrorist threats or problems of weapons and drug trafficking or merchandize smuggling, so that transnational criminal activities of these types can be controlled effectively with a relatively small amount of resources diverted to OBCO. Since T receives more aid as a result of the increase in γ, it then finds it optimal to spend a larger fraction of aid on IC. Accordingly, $d\alpha/d\gamma > 0$ in Equation (16). If it is also the case

that $\eta^* > \zeta^*$ in T^*, an increase in γ reduces α^*. This is because T^* receives less aid in the new equilibrium and thus finds it optimal to reduce the ratio of spending on IC to that on OBCO, given that the marginal benefit of spending on OBCO is relatively more sensitive to a change in expenditure. In that case $d\alpha^*/d\gamma < 0$ in Equation (17). Alternatively, if $\eta^* < \zeta^*$, $d\alpha^*/d\gamma > 0$ and if $\eta < \zeta$, $d\alpha/d\gamma < 0$.

In a broader context, an interesting implication of these findings is that the final-destination country has a greater incentive to invest in developing more efficient IC technologies that are geared to the transit country where $\eta > \zeta$, rather than the one where $\eta < \zeta$. The reallocation of aid triggered by the improvement in the efficiency of IC spending in that country would then have an impact on α and α^* that favors a higher total level of effective spending on IC by the two transit countries combined. This would further the donor's objective of impeding and deterring undocumented third-country migrants from reaching its borders.

5.2 Change in λ

We consider here the impact of an increase in λ, the weight attached by country T to its IC objective. In particular, we wish to examine how it affects the distribution of aid between T and T^* and the share of aid that each of the two recipient countries allocates for IC. Using the system of Equations (14) we obtain

$$\frac{d\mu}{d\lambda} = \frac{V^*_{\alpha^*\alpha^*} V^D_{\mu\alpha} V_{\alpha\lambda}}{\Delta} > 0 \tag{18}$$

$$\frac{d\alpha}{d\lambda} = \frac{-V_{\alpha\lambda}\left[V^D_{\mu\mu} V^*_{\alpha^*\alpha^*} - V^D_{\mu\alpha^*} V^*_{\alpha^*\mu}\right]}{\Delta} > 0 \tag{19}$$

$$\frac{d\alpha^*}{d\lambda} = \frac{-V^*_{\alpha^*\mu} V^D_{\mu\alpha} V_{\alpha\lambda}}{\Delta} \tag{20}$$

where $V_{\alpha\lambda} = \mu F\varphi'(.) > 0$, $V^D_{\mu\alpha} = \Lambda\varepsilon\beta E^{\varepsilon}/\mu\alpha > 0$, $V^D_{\mu\alpha^*} = -\Lambda\varepsilon(1-\beta)E^{*\varepsilon}/(1-\mu)\alpha^* < 0$, and $V^*_{\alpha^*\mu} = Fu^{*\prime}(.)[\zeta^* - \eta^*]$. Equation (18) reveals that an increase in the weight attached by T to the priority of spending funds on IC, increases its own share of aid provided by the donor and reduces that of T^*. As we have seen in the previous subsection, a reduction in the flow of aid received by T^* entails, in turn, a decrease in α^* if $\eta^* > \zeta^*$ and an increase in α^* if $\eta^* < \zeta^*$. In the former case, the marginal benefit of spending on OBCO in T^* is relatively more sensitive to a change in expenditures, so the burden of a cut in aid falls disproportionately on IC spending. In the latter case it is less sensitive, calling for a disproportionate cut in spending on OBCO. This is confirmed by Equation (20).

For country T, an increase in λ has a positive effect on α. This is not only due to its greater interest in spending funds on IC, but also due to an indirect effect stemming from the interaction between the donor and T^*. As the donor cuts its aid to T^*, we have seen in Equation (20) that the latter responds to the cut by adjusting its α^*. Assuming that the interaction between the donor and T^* is stable, in the sense that $V^D_{\mu\mu} V^*_{\alpha^*\alpha^*} - V^D_{\mu\alpha^*} V^*_{\alpha^*\mu} > 0$, Equation (19) shows that $d\alpha/d\lambda$ is unambiguously positive.[12]

12 Note that the necessary and sufficient condition for $V^D_{\mu\mu} V^*_{\alpha^*\alpha^*} - V^D_{\mu\alpha^*} V^*_{\alpha^*\mu} > 0$ is that $\varepsilon\eta^* < \zeta^*$. The assumption that $V^D_{\mu\mu} V^*_{\alpha^*\alpha^*} - V^D_{\mu\alpha^*} V^*_{\alpha^*\mu} > 0$ is required for stability of the bilateral relationship

Proposition 2 *Assume that the donor country allocates a fixed amount of aid between two transit countries to support them in preventing transit migrants from reaching its borders.*

- *An increase in the effectiveness of immigration-control expenditures in T, (a) increases the fraction of total aid received by T and (b) increases the share of spending on immigration control in T (T*) if and only if* $\eta > \zeta$ ($\zeta^* > \eta^*$).
- *An increase in the weight attached by T to its immigration-control objective (a) increases its share of aid from the donor and (b) increases the share of spending on immigration control in both transit countries if* $\zeta^* > \eta^*$.
- *In both cases a greater number of undocumented migrants is deterred and prevented from reaching the borders of the donor.*

5.3 Reduction in the overall amount of aid

Suppose that due to budgetary problems stemming from the current economic crisis, the donor country decides to reduce the total amount of aid, *F*, that it distributes to the transit countries. We take this change in policy to be exogenously given. How should the cut in aid be shared between the two recipients? How will the two recipients react in terms of allocating the aid between spending on IC and meeting OBCO? To avoid going through tedious analysis in the main body of the article, we provide the solutions in the Appendix. Our findings can be summarized in the following proposition:

Proposition 3 *Assume that the donor decides to reduce the total amount of aid it transfers to the two recipient countries.*

- *If* $\eta > \zeta$ *and* $\eta^* < \zeta^*$, *then T gets a smaller share of aid and it also reduces the fraction of aid it spends on IC. T* gets a larger share of aid and it increases the fraction of aid it spends on IC.*
- *If* $\eta < \zeta$ *and* $\eta^* > \zeta^*$, *then T gets a larger share of aid and it increases the fraction of aid it spends on IC. T* gets a smaller share of aid and it reduces the fraction of aid it spends on IC.*
- *If* $\eta > \zeta$ *and* $\eta^* > \zeta^*$ ($\eta < \zeta$ *and* $\eta^* < \zeta^*$) *then each transit country lowers (increases) the fraction of aid it spends on IC. Which of the two enjoys an increase in its share of aid depends on which one responds to the cut in aid by shifting the burden of aid reduction more heavily on the side of meeting OBCO.*

6. Competition for aid

The Nash equilibrium solution analyzed in the previous section is based on the assumption that each of the recipient countries chooses its optimal α while taking μ as given. A transit country may in fact try to obtain a larger fraction of aid, at the expense of the other recipient, by setting α in a way that takes account of the fact that its decision has an impact on the fraction μ of total aid that it receives from the donor. If both recipients behave in this fashion, we have a model of competition for aid.[13]

between D and *T**. Otherwise the interaction between the two countries through changes in μ and α^*, holding α constant, gives rise to a corner solution with μ ending up at either 0 or 1.

13 Lahiri and Raimondos-Moller (1997) develop and analyze a model in which two developing countries compete for trade-liberalization aid by cutting their tariffs. Hadjiyiannis et al. (2013) develop a

Assume now that we have a two-stage subgame-perfect Nash equilibrium. In the first stage, the recipient countries decide on the proportion of aid that each of them will use strictly for IC. That is to say, they make decisions with respect to α and α^*. In the present context, one can think of the aid flows to T and T^* as being continuous and contingent on the recipient remaining committed to its decision. In the second stage, D decides how to split the aid package between the two recipients.[14]

We solve the problem by starting from the choice of μ by the donor in the second stage and then proceed backwards to the first stage where the two recipients take into account the reaction of the donor country in choosing the values of α and α^*.

Stage two: The reaction function of D is given by Equation (8), which after differentiation gives

$$V^D_{\mu\mu}d\mu + V^D_{\mu\alpha}d\alpha + V^D_{\mu\alpha^*}d\alpha^* = 0 \tag{21}$$

Equation (21) relates the change in D's optimal distribution of aid to the changes in the shares of aid used strictly for IC by T and T^*. From Equation (21) we obtain the effect of the change in the share of aid spent on immigration control by each country on the distribution of aid between them:

$$\frac{\partial\mu}{\partial\alpha} = -\frac{V^D_{\mu\alpha}}{V^D_{\mu\mu}} > 0 \text{ and } \frac{\partial\mu}{\partial\alpha^*} = -\frac{V^D_{\mu\alpha^*}}{V^D_{\mu\mu}} < 0 \tag{22}$$

reflecting the fact that D reacts to an increase in a transit country's allocation of aid for the purpose of IC by providing it with more aid.

Stage one: As both recipients know that their decisions on α and α^* affect the donor's allocation of aid between them, their optimal policy takes into account the donor's response. Welfare maximization by the two recipients in this setting yields the following conditions.

$$V_\alpha + V_\mu\frac{\partial\mu}{\partial\alpha} = 0 \tag{23}$$

$$V^*_{\alpha^*} + V^*_\mu\frac{\partial\mu}{\partial\alpha^*} = 0 \tag{24}$$

where $V_\mu = (\partial V/\partial\mu) = (1-\alpha)Fu'(.) + \lambda\alpha F\varphi'(.) > 0$, and $V^*_\mu = (\partial V^*/\partial\mu) = -(1-\alpha^*)Fu^{*\prime}(.) - \lambda\alpha^* F\varphi^{*\prime}(.) < 0$. The second term in Equations (23) and (24) corresponds to the competition-for-aid effect. Since $(\partial\mu/\partial\alpha) > 0$ and $(\partial\mu/\partial\alpha^*) < 0$, this effect is positive in both equations. We therefore conclude that the values of α and α^* that maximize the welfare of both recipients in the competition-for-aid case are higher than those that emerge in the Nash equilibrium. The intuition is quite clear: each recipient uses more aid for IC in order to induce the donor to provide it with a larger share of aid.

competition for aid model with trans-boundary pollution where the two recipient countries compete for environmental aid to build infrastructure necessary for pollution abatement.

14 The donor country is assumed to know the technology of enforcement available to the transit countries. This enables it to determine the values of α and α^* chosen by T and T^* by simply observing the flow of migrants reaching its borders through each of its neighbors.

Proposition 4 *Suppose that the donor has a fixed amount of aid to divide between two recipient countries in a way that maximizes the number of migrants deterred and prevented from reaching its borders. In comparison with the Nash equilibrium, competition for aid results in a larger fraction of aid being allocated by each recipient for the purpose of IC. The number of migrants deterred and prevented from reaching the borders of D is correspondingly higher in the competition-for-aid scenario than it is in the Nash equilibrium.*

7. Collusion

Consider again a two-stage game where the recipient countries move first, but in contrast with the competition-for-aid scenario, let us assume that they collude. This case might be particularly relevant when the transit countries have very strong ties with each other and a history of close cooperation on issues in the domain of their external relations. Here they are dealing with a donor country which requires their cooperation. An analytic framework where the two transit countries maximize their joint welfare may then be the most appropriate. This implies maximization of $V + V^*$ in deciding on the share of aid they devote to IC. Note that when all countries make their decisions simultaneously, collusion does not affect the optimal choice of α and α^*. This is because $V_{\alpha^*} = 0$ and $V^*_{\alpha} = 0$.[15]

We are thus considering a two-stage game where the recipients first set the values of α and α^*, and then the donor decides how to divide the aid between them. If the recipients collude, with each of them choosing the share of aid earmarked for IC such as to maximize their joint welfare, the following conditions must be satisfied:

$$V_{\alpha} + (V_{\mu} + V^*_{\mu})\frac{\partial \mu}{\partial \alpha} = 0 \tag{25}$$

$$V^*_{\alpha^*} + (V^*_{\mu} + V_{\mu})\frac{\partial \mu}{\partial \alpha^*} = 0 \tag{26}$$

Since $V^*_{\mu}\frac{\partial \mu}{\partial \alpha} < 0$ and $V_{\mu}\frac{\partial \mu}{\partial \alpha^*} < 0$, it immediately follows on the basis of a comparison of Equations (25) and (26) with (23) and (24), that collusion reduces the proportion of aid used for IC by the transit countries below the levels which are optimal in a two-stage game of competition for aid. The intuition is simply that in the competition-for-aid model, each recipient raises α in an effort to get more aid at the expense of the other recipient. When the transit countries collude instead of competing, there is no such motive. Each recipient cares not only for its own welfare, but also for that of its partner.

Let us now compare the Nash equilibrium solution with the outcome of a two-stage game with collusion. Using the first-order conditions of the Nash equilibrium, that is, $u'(.) = \lambda\varphi'(.)$ and $u^{*\prime}(.) = \lambda^*\varphi^{*\prime}(.)$, it can be shown that $(V^*_{\mu} + V_{\mu}) = [u'(.) - u^{*\prime}(.)]F$. This implies that in comparison with the Nash equilibrium, collusion in a two-stage game results in one country using a higher proportion of aid for IC and the other a lower proportion, depending on the sign of $u'(.) - u^{*\prime}(.)$. If, for example, $u'(.) - u^{*\prime}(.) > 0$, then collusion in a two-stage game results in country T choosing a higher value of α and T^* a lower α^* in comparison with Nash. This is because at the Nash equilibrium, any given increase in aid to

15 For the same reason collusion would not affect the optimal choice of α and α^* in a two-stage game where the donor moves first. A game in which the donor moves first is examined in Section 8 below.

both countries generates a larger welfare gain for T than it does for T^*, given that $u'(.) - u^{*\prime}(.) > 0$ (as well as $\lambda\varphi'(.) > \lambda^*\varphi^{*\prime}(.)$ in light of Equations (12) and (13)). When the recipients collude to maximize joint welfare, it is then optimal for T to choose a higher α and T^* a lower α^*, so as to induce the donor to give more aid to T. In sum, in a two-stage game with collusion, the donor provides a larger amount of aid to the transit country that needs it relatively more, and the share of aid allocated by that country for IC is higher and of the other recipient lower than it is in the Nash equilibrium.

Proposition 5 *Suppose that the final-destination country allocates a fixed amount of aid to the two transit countries with the aim of maximizing the number of undocumented, third-country migrants deterred and prevented from reaching its borders.*

- *Assume that we have a two-stage game. In comparison with the case where the two recipient countries compete for aid, collusion between them results in a lower share of aid being spent on IC in both countries and a larger number of illegal immigrants reaching the borders of the donor.*
- *A comparison of the Nash equilibrium with the one in a two-stage game with collusion between the two transit countries reveals that in the latter case one recipient spends a higher and the other a lower share of aid on IC. The recipient with the greater (smaller) marginal utility of foreign aid is the one that spends a relatively higher (lower) share of aid on IC and it receives more (less) aid in a two-stage game with collusion than it does in the Nash equilibrium.*

8. Two-stage game: donor decides first

Considering how advanced countries set their aid-allocation policies, it may be most suitable to think of a two-stage game where the donor moves first, rather than the Nash solution of our benchmark model. Let us therefore assume that the donor country first makes the decision on how to allocate aid among the two recipients and then in the second stage the recipients decide on how to allocate their aid between IC and OBCO. As we have done in Section 6, we solve the problem backwards by starting first from the second stage in which the recipient countries choose α and α^*. We subsequently proceed to the first stage where the donor country chooses the allocation of aid between T and T^*, taking into account the reaction of each recipient to its choice.

Stage two: The reaction function of T is given by Equation (12), which after differentiation yields

$$V_{\alpha\alpha}d\alpha + V_{\alpha\mu}d\mu = 0 \text{ or } \frac{\partial\alpha}{\partial\mu} = -\frac{V_{\alpha\mu}}{V_{\alpha\alpha}} \tag{27}$$

Similarly, after differentiation of T^*'s reaction function, which is given by Equation (13), we obtain

$$V_{\alpha^*\alpha^*}{}^{*}d\alpha^* + V^*_{\alpha^*\mu}d\mu = 0 \text{ or } \frac{\partial\alpha^*}{\partial\mu} = -\frac{V^*{}_{\alpha^*\mu}}{V_{\alpha^*\alpha^*}} \tag{28}$$

Since $V_{\alpha\alpha}$ and $V^*_{\alpha^*\alpha^*}$ are negative, the response of T and T^* to a change in μ depends, respectively, on the signs of $V_{\alpha\mu}$ and $V^*_{\alpha^*\mu}$. These expressions are defined just after Equation (17) and their signs are ambiguous.

Stage one: The donor knows that its decision on the allocation of aid between the two recipients affects their choice of α and α^*. Thus, when deciding on the allocation of aid, it takes their reactions into account. Welfare maximization of the donor in this two-stage game implies the following condition.

$$V_{\mu}^{D} + V_{\alpha}^{D}\frac{\partial \alpha}{\partial \mu} + V_{\alpha^*}^{D}\frac{\partial \alpha^*}{\partial \mu} = 0 \tag{29}$$

where $V_{\alpha}^{D} = \lambda^{D}\Lambda^{D}E^{\varepsilon-1}\beta\gamma\mu F > 0$ and $V_{\alpha^*}^{D} = \lambda^{D}\Lambda^{D}E^{*\varepsilon-1}(1-\beta)\gamma^*(1-\mu)F > 0$. Equation (29) shows that when $\eta > \zeta$ and $\eta^* < \zeta^*$, which implies, respectively, that $V_{\alpha\mu} > 0$ and $V_{\alpha^*\mu}^{*} > 0$, then D's optimal choice of μ in this two-stage game is greater than the one in the Nash equilibrium. That is, in comparison with the Nash equilibrium solution, the donor gives more aid to T and less to T^*. The intuition is simple. When $\eta > \zeta$, the benefits to country T of higher spending on OBCO diminish more quickly than do the benefits of higher spending on IC. Thus, when T receives more aid, it is optimal to spend a larger fraction of aid on IC. By contrast, when $\eta^* < \zeta^*$ in T^*, the benefits of an increase in spending on IC diminish more quickly than the benefits of an increase in spending on OBCO. Accordingly, when T^* receives more aid, it is optimal to spend a smaller fraction of it on IC. Given this behavior of the two recipient countries, it is optimal for the donor to give more aid to T and less to T^*, when compared with the allocation in the Nash equilibrium. In consequence, both T and T^* use a larger fraction of aid for the purpose of IC relative to Nash. Alternatively, if $\eta < \zeta$ and $\eta^* > \zeta^*$, we have the opposite scenario and so the donor gives a larger fraction of aid to T^* and less to T, when compared with Nash. If, however, $\eta > \zeta$ and $\eta^* > \zeta^*$ or $\eta < \zeta$ and $\eta^* < \zeta^*$ then the donor's optimal choice of μ could be greater or smaller than the one of the Nash equilibrium.

Proposition 6 *Assume that the Donor has a fixed amount of aid to allocate between the two recipients in order to maximize its welfare. The Donor decides first on the allocation of aid between the two recipients and then the recipients decide on how to split the aid between IC and OBCO. Comparing the optimal allocation of aid in this two-stage game with that in the Nash equilibrium,*

- *if $\eta > \zeta$ and $\eta^* < \zeta^*$, the donor gives a larger fraction of aid to T and both α and α^* are higher;*
- *if $\eta < \zeta$ and $\eta^* > \zeta^*$, the donor gives a larger fraction of aid to T* and both α and α^* are higher;*
- *if $\eta > \zeta$ and $\eta^* > \zeta^*$ or $\eta < \zeta$ and $\eta^* < \zeta^*$, the results are ambiguous.*

9. Ranking alternative policy games

Our analysis of the previous sections raises the question of which policy regime is the most favorable one from the perspective of D, given its aid budget and the objective of maximizing the number of transit migrants prevented from reaching its borders. As a way of summarizing our findings on this issue, we relate in Table 1 the equilibrium values of various policy instruments and the number of illegal immigrants prevented from reaching the borders of D under alternative regimes, using the Nash equilibrium as our benchmark.

The analysis of Section 6 shows that when T and T^* compete for aid, then both spend more on IC than they do in the Nash equilibrium. This implies that a larger number of transit migrants are prevented from reaching the borders of D. When T and T^* collude, as in

Table 1. Equilibrium values of policy instruments and the number of transit migrants deterred and prevented from reaching the borders of D as compared with Nash

Solution concept	Equilibrium μ relative to Nash	Equilibrium α relative to Nash	Equilibrium α^* relative to Nash	Equilibrium N relative to Nash
Competition for aid	Ambiguous	+	+	+
Collusion				$\beta = 0.5$
				– – – – – – –
If $u'(.) > u^{*\prime}(.)$	+	+	–	+ if $\gamma > \gamma^*$
				– if $\gamma < \gamma^*$
				– – – – – – –
If $u'(.) < u^{*\prime}(.)$	–	–	+	– if $\gamma > \gamma^*$
				+ if $\gamma < \gamma^*$
Donor Decides First				
If $\eta > \zeta$ and $\eta^* < \zeta^*$	+	+	+	+
If $\eta < \zeta$ and $\eta^* > \zeta^*$	–	+	+	+
If $\eta > \zeta$ and $\eta^* > \zeta^*$	Ambiguous	Ambiguous	Ambiguous	
If $\eta < \zeta$ and $\eta^* < \zeta^*$	Ambiguous	Ambiguous	Ambiguous	

Section 7, then the results are ambiguous and depend on the marginal utility of aid in the two transit countries at the Nash equilibrium. As an example, take the case in which T values aid more than T^* does (that is, $u'(.) > u^{*\prime}(.)$). Then μ and α are higher and α^* lower with collusion than they are at the Nash equilibrium. If, in addition, $\beta = 0.5$, which is the case when the two transit countries are geographically identical from the perspective of transit migrants, then N is higher (lower) relative to Nash if $\gamma > (<)\gamma^*$ (that is, if spending on IC is more (less) effective in T than it is in T^*). Alternatively, if $u'(.) < u^{*\prime}(.)$, then μ and α are lower and α^* higher relative to their Nash equilibrium values. Thus if $\beta = 0.5$, then N is higher (lower) in comparison with Nash if $\gamma < (>)\gamma^*$.

Consider now the policy regime where the donor decides first on aid allocation and then the two transit countries decide on how to use the aid. Comparing this policy regime with the Nash equilibrium, we find that if $\eta > \zeta$ and $\eta^* < \zeta^*$ or $\eta < \zeta$ and $\eta^* > \zeta^*$, then both transit countries spend more on IC, implying that more transit migrants are prevented from reaching the borders of D. If, however, $\eta > \zeta$ and $\eta^* > \zeta^*$ or $\eta < \zeta$ and $\eta^* < \zeta^*$, then the results are ambiguous.

Comparing the Nash equilibrium regime with the regimes where we have competition for aid or collusion, it is clear that, from the perspective of D, the most favorable regime is that of competition for aid. With competition for aid, any given aid budget allocated by D results in a smaller number of transit migrants reaching its borders, both in comparison with the Nash equilibrium and an equilibrium in which the two countries collude. A comparison of the competition for aid regime with the one where the donor decides first on the aid allocation and then the transit countries decide on how to use the aid, does not yield unambiguous results. As suggested by the entries in Table 1, the outcome depends on the magnitudes of the model's parameters.

Our analysis can be readily extended to a larger number of transit countries. Regardless of the number, it is optimal for the donor to allocate its aid budget such that, as in Section 4, the marginal unit of aid going to each recipient has the same effect on the number of migrants deterred and prevented from reaching its borders. In the two-stage game with

competition for aid, our principal finding also remains valid if we consider the more general case with n transit countries. That is, in comparison with the Nash solution, each recipient spends a larger fraction of aid on IC and more migrants are deterred and prevented from reaching the borders of D. Similarly, in the context of a two-stage game with collusion, it is still true that an increase in the fraction of aid spent on IC by one recipient country increases its share of aid at the expense of other recipients. Since each recipient is assumed to care about the welfare of other recipients, it takes this into account in deciding on the fraction of aid it uses for IC. Consequently, relative to the competition for aid equilibrium, each recipient spends a lower share of aid on IC and thus fewer immigrants are prevented from reaching the borders of D. Comparing the Nash solution with that of a two-stage game with collusion among n transit countries reveals, as in the two-transit-country case of Section 7, that some transit countries spend a higher and others a lower share of aid on IC, depending on the relationship among the marginal utilities of aid enjoyed by each of the individual transit countries. Finally, extending to n transit countries the analysis of the case where the donor decides first on the allocation of aid and then the recipients decide on how to divide the aid between IC and OBCO, the results run parallel to those presented on Section 8. That is, in comparison with the Nash equilibrium, the relationship between η and ζ across recipient countries determines which ones enjoy a bigger share of the donor's aid budget. Those recipients with a relatively large η and a relatively small ζ fare better in the two-stage game where the donor decides first.

10. Conclusions

This article examines the problem facing an advanced, final-destination country as it tries to minimize the number of undocumented third-country nationals reaching its borders by providing training, equipment, vehicles, and other forms of support to the transit countries with the view of helping them improve their capacities to deter and prevent unauthorized transit migration. As aid is fungible, the recipients have an incentive to divert some of the aid in order to meet OBCO. We characterize the donor's optimal allocation of aid between the transit countries and the optimal use of aid by the latter in the Nash equilibrium. The donor is found to divide a fixed total amount of aid between the two recipients such that the marginal productivity of each additional unit of aid has the same effect in deterring and preventing undocumented aliens from reaching its borders. This marginal productivity depends, in turn, on the geographic and technological factors specific to each transit country, as well as on their needs to meet OBCO and the weights they attach to the goal of immigration control (IC).

An increase in the effectiveness of IC expenditures in one transit country is found to increase the fraction of total aid it receives and to increase (lower) the share of aid it uses for IC if its benefits of additional spending on OBCO diminish more (less) quickly than the marginal benefits of spending on IC. In the transit country that receives less aid, there is a reduction (increase) in the share of aid spent on IC if its marginal benefits of spending funds to meet OBCO are more (less) sensitive to changes in expenditures than the marginal benefits of spending on IC.

Greater weight attached by a transit country to its IC objective results in an increase in its share of total aid distributed by the donor. Moreover, it entails an increase in the fraction of aid that both recipients spend on IC if the benefits of additional spending on IC by

the other transit country diminish more quickly than the marginal benefits of spending funds to meet OBCO. We also examine the problem facing the donor country which is obliged, for budgetary reasons, to reduce the total amount of aid allocated to the two transit countries. Which of the two gets a larger share of the now smaller aid package depends on which transit country is more inclined to shift the burden of the aid reduction more heavily on the side of meeting OBCO.

The values of the policy instruments in the Nash equilibrium, which we take to be the benchmark, are also compared with those that emerge in a two-stage game where the transit countries compete for a share of aid as well as when they collude to maximize joint welfare. Competition for aid results in a larger fraction of aid being allocated by each recipient for the purpose of IC when compared with Nash, while collusion results in a larger (smaller) share of aid being spent on IC by the transit country with a higher (lower) marginal utility of aid. The recipient country with a higher (lower) marginal utility of aid also receives more (less) aid in a two-stage game with collusion than it does in the Nash equilibrium. In terms of maximizing the number of transit migrants deterred and prevented from reaching the borders of the donor, we find that the policy regime in which transit countries compete for aid is superior to the Nash equilibrium and the collusion equilibrium.

We also consider a two-stage game in which the donor decides first on how to split the aid between the two recipients, with the transit countries subsequently choosing how to make the best use of aid. In comparison with the Nash equilibrium, we show that the donor gives more aid to the transit country whose needs and preferences imply a greater propensity to use additional aid for the purpose of immigration control. This results in a larger number of transit migrants being deterred and prevented from reaching the borders of the donor country.

As a final note, it is obvious that our article cannot address all the relevant questions on the problem of multi-country cooperation in the domain of transit migration. As the first theoretical contribution on this topic, its purpose is to treat one particular dimension of this problem and to increase awareness of it, rather than provide an exhaustive treatment. What we demonstrate quite clearly is that the effectiveness of any given amount of aid allocated to transit countries for the purpose of combating undocumented transit migration depends not only on geographic and technological factors, but also on the needs of the transit countries and their preferences as well as on institutional structures that determine the nature of the strategic relationships among the players and the sequence of their actions.

Acknowledgements

This article was initiated when Djajić was visiting the Department of Economics of the University of Cyprus. I wish to thank the Department for its hospitality and support. We would also like to thank an anonymous referee and the editor of this Journal for helpful comments and suggestions.

References

Auriol, E. and A. Mesnard (2013), *Sale of Visas: A Smuggler's Final Song?* Mimeo, Toulouse School of Economics, Toulouse, France.

Australian Government (2012), *Report of the Experts on Asylum Seekers*, Australian Government, Camberra, Australia.

Bandyopadhyay, S. and S. C. Bandyopadhyay (1998), "Illegal Immigration: A Supply Side Analysis", *Journal of Development Economics* 57, 343–360.

Bandyopadhyay, S., D. Chambers and J. Munemo (2012), "Foreign Aid, Illegal Immigration, and Host Country Welfare", Working Paper 2012-007A, Federal Reserve Bank of St. Louis.

Bond, E. W. and T. J. Chen (1987), "The Welfare Effects of Illegal Immigration", *Journal of International Economics* 28, 315–328.

Casarico, A., G. Facchini and T. Frattini (2015), "Illegal Immigration: Policy Perspectives and Challenges", *CESifo Economic Studies* 61, 673–700.

Council of Europe (2008), "Immigration from Sub-Saharan Africa", Doc. 11526, Committee on Migration, Refugees and Population, Parliamentary Assembly, http://assembly.coe.int/Main.asp?link=/Documents/WorkingDocs/Doc08/EDOC11526.htm

Djajić, S. (1987), "Illegal Aliens, Unemployment and Immigration Policy", *Journal of Development Economics* 25, 235–249.

Djajić, S. (1997), "Illegal Immigration and Resource Allocation", *International Economic Review* 38, 97–117.

Djajić, S. (2006), "Foreign Aid, International Migration and Welfare", in S. Lahiri, ed., *Theory and Practice of Foreign Aid*, North Holland, Amsterdam.

Djajić, S. (2012), "Transit Migration", Unpublished manuscript, Graduate Institute, Geneva.

Djajić, S. (2014), "Asylum Seeking and Irregular Migration", *International Review of Law and Economics* 39, 83–95.

Djajić, S. and M. S. Michael (2014), "Controlling Illegal Immigration: On the Scope for Cooperation with a Transit Country", *Review of International Economics* 22, 808–824.

Djajić, S. and A. Vinogradova (2013), "Undocumented Migrants in Debt", *Labour Economics* 21, 15–24.

Djajić, S. and A. Vnogradova (2014), "Liquidity-Constarined Migrants", *Journal of International Economics* 93, 210–224.

Djajić, S. and A. Vnogradova (2015), "Overstaying Guest Workers and the Incentives for Return", *CESifo Economic Studies* 61, 764–796.

Düvell, F. (2010), "Transit Migration: A Blurred and Politicized Concept", *Population, Space and Place* 18, 415–427, doi:10.1002/psp.

Epstein, G. S., A. L. Hillman and A. Weiss (1999), "Creating Illegal Immigrants", *Journal of Population Economics* 12, 3–21.

Ethier, W. J. (1986), "Illegal Immigration: The Host Country Problem", *American Economic Review* 76, 56–71.

Facchini, G. and C. Testa (2011), "The Rhetoric of Closed Borders: Quotas, Lax Enforcement and Illegal Immigration", CEPR WP 8245, London, UK.

Facchini, G. and C. Testa (2015), "The Political Economy of Migration Enforcement: Domestic Versus Border Control", *CESifo Economic Studies* 61, 701–721.

Friebel, G. and S. Guriev (2006), "Smuggling Humans: A Theory of Debt-Financed Migration", *Journal of the European Economic Association* 4, 1085–1111.

Gaytan-Fregoso, H. and S. Lahiri (2000), "Foreign Aid and Illegal Immigration", *Journal of Development Economics* 63: 515–527.

Gathmann, C. (2008), "Effects of Enforcement on Illegal Markets: Evidence from Migrant Smuggling along the Southwestern Border", *Journal of Public Economics* 92, 1926–1941.

Giavitto, L. (2012), "Effectiveness of European Policies with Regard to Transit Migration", Unpublished manuscript, Graduate Institute, Geneva.

Gorney, C. (2008), "Mexico's Other Border", *National Geographic* 213, 60–79.

Hanson, G. H. and A. Spilimbergo (1999), "Illegal Immigration, Border Enforcement, and Relative Wages: Evidence from Apprehensions at the U.S.-Mexico Border", *American Economic Review* 89, 1337–1357.

Hillman, A. L. and A. Weiss (1999), "A Theory of Permissible Illegal Immigration", *European Journal of Political Economy* 15, 585–604.

Hadjiyiannis, C., P. Hatzipanayotou and M. S. Michael (2013), "Competition for Environmental Aid and Aid Fungibility", *Journal of Environmental Economics and Management* 65, 1–11.
Kahana, N. and T. Lecker (2005), "Competition as a Track for Preventing Illegal Immigration", *Economics of Governance* 6, 33–39.
Lahiri, S. and P. Raimondos-Moller (1997), "Competition for Aid and Trade Policy", *Journal of International Economics* 43, 369–385.
Myers, G. M. and Y. Y. Papageorgiou (2000), "Immigration Control and the Welfare State", *Journal of Public Economics* 75, 183–207.
Roman, H. (2006), "Transit Migration in Egypt", CARIM-RR 2006/01, European University Institute, Florence.
Tamura, Y. (2010), "Migrant Smuggling", *Journal of Public Economics* 94, 540–548.
Tamura, Y. (2013), "Migrant Smuggling when Exploitation is Private Information", forthcoming, *Canadian Journal of Economics* 46, 1463–1479.
Woodland, A. D. and C. Yoshida (2006), "Risk Preference, Immigration Policy and Illegal Immigration", *Journal of Development Economics* 81, 500–513.
Yoshida, C. (2000), *Illegal Immigration and Economic Welfar*, Springer, Heidelberg, Germany.

Appendix A: Proof of Proposition 3

Using the system of Equation (14) we obtain the effects of a reduction in F on the three policy variables

$$\frac{d\mu}{dF} = \frac{V_{\alpha\alpha} V^D_{\mu\alpha^*} V^*_{\alpha^* F} + V^*_{\alpha^*\alpha^*} V^D_{\mu\alpha} V_{\alpha F}}{\Delta} \tag{A1}$$

$$\frac{d\alpha}{dF} = \frac{V_{\alpha F}\left[V^*_{\alpha^*\mu} V^D_{\mu\alpha^*} - V^D_{\mu\mu} V^*_{\alpha^*\alpha^*}\right]}{\Delta} - \frac{V_{\alpha\mu} V^D_{\mu\alpha^*} V^*_{\alpha^* F}}{\Delta} \tag{A2}$$

$$\frac{d\alpha^*}{dF} = \frac{V^*_{\alpha^* F}\left[V_{\alpha\mu} V^D_{\mu\alpha} - V^D_{\mu\mu} V_{\alpha\alpha}\right]}{\Delta} - \frac{V^*_{\alpha^*\mu} V^D_{\mu\alpha} V_{\alpha F}}{\Delta} \tag{A3}$$

where we recall that $\Delta < 0, V^D_{\mu\alpha} = \Lambda\varepsilon\beta E^{\varepsilon}/\mu\alpha > 0, V^D_{\mu\alpha^*} = -\Lambda\varepsilon(1-\beta)E^{*\varepsilon}/(1-\mu)\alpha^* < 0$, $V_{\alpha\mu} = Fu'(.)[\eta - \zeta], V^*_{\alpha^*\mu} = Fu^{*\prime}(.)[\zeta^* - \eta^*]$, and note that $V_{\alpha F} = \mu u'(.)[\eta - \zeta]$, and $V^*_{\alpha^* F} = -(1-\mu)u^{*\prime}(.)[\zeta^* - \eta^*]$. Since $V_{\alpha\alpha} < 0$ and $V^*_{\alpha^*\alpha^*} < 0$, it immediately follows from Equation (24) that if $V_{\alpha F} > 0$ and $V^*_{\alpha^* F} < 0$, the sign of $d\mu/dF$ is unambiguously positive. This is the case if $\eta > \zeta$ and $\eta^* < \zeta^*$, so that T lowers α in response to a reduction in the amount of aid it receives while T^* does the opposite. The donor then obviously allocates a larger share of its aid to T^*. Alternatively, if $V_{\alpha F} < 0$ and $V^*_{\alpha^* F} > 0$, the situation is reversed and hence $d\mu/dF < 0$. The effect of a reduction in F on μ is ambiguous, however, if $V_{\alpha F}$ and $V^*_{\alpha^* F}$ are of the same sign. Both recipients then change the fraction of aid they spend on IC in the same direction as they both receive less aid. The donor in that case allocates a larger share of aid to the country that uses it relatively more effectively in meeting the objective of reducing the flow of transit migrants.

The implications of an increase in F for α and α^* can be seen in Equations (A.2) and (A.3), respectively. In each case there is a direct and an indirect effect. Assuming stability of the bilateral relationships between the donor and the two recipients (that is, $[V^*_{\alpha^*\mu} V^D_{\mu\alpha^*} - V^D_{\mu\mu} V^*_{\alpha^*\alpha^*}] < 0$ and $[V_{\alpha\mu} V^D_{\mu\alpha} - V^D_{\mu\mu} V_{\alpha\alpha}] < 0$) the direct effects of a reduction in F on α and α^*, captured by the first term in Equations (A.2) and (A.3), depend on the sign of $V_{\alpha F} = \mu u'(.)[\eta - \zeta]$, and $V^*_{\alpha^* F} = -(1-\mu)u^{*\prime}(.)[\zeta^* - \eta^*]$, respectively. Thus the direct effect

of a reduction in F contributes to a lower (higher) α if $\eta > \zeta$ ($\eta < \zeta$). The same applies to T^* in that the direct effect contributes to a lower (higher) α^* if $\eta^* > \zeta^*$ ($\eta^* < \zeta^*$).

The indirect effect is represented by the last term in each of the two equations. Thus in Equation (A.2), we observe that if a reduction in F raises α^* (that is, if $V^*_{\alpha^* F} < 0$ because $\eta^* < \zeta^*$), D has an incentive to shift the burden of aid reduction away from T^* (that is, $V^D_{\mu\alpha^*} < 0$), which then has an indirect effect on α that depends on the sign of $V_{\alpha\mu} = Fu'(.)[\eta - \zeta]$. If $\eta > \zeta$, the indirect effect on α is negative, reinforcing the direct effect. If, instead, $\eta < \zeta$, the indirect effect on α is positive, but this again serves to reinforce the direct effect, which in this case is also positive. Alternatively, if a reduction in F lowers α^* (that is, if $V^*_{\alpha^* F} > 0$ because $\eta^* > \zeta^*$), this gives the donor an incentive to shift the burden of aid reduction towards T^*. The indirect effect on α is then (a) positive if $\eta > \zeta$ and (b) negative if $\eta < \zeta$. In both cases the indirect effect is now in conflict with the direct effect, which is negative in case (a) and positive in case (b). Note, however, that each transit country will receive at least a little less aid in each case, which guarantees that the direct effect dominates, although the magnitude of the overall effect depends, of course, on the direction of the indirect effect.

The analysis of how a reduction in F affects α^* is perfectly symmetrical.