

Djajić, Slobodan; Michael, Michael S.

**Working Paper**

## Temporary migration policies and welfare of the host and source countries : a game-theoretic approach

CESifo Working Paper, No. 2811

**Provided in Cooperation with:**

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

*Suggested Citation:* Djajić, Slobodan; Michael, Michael S. (2009) : Temporary migration policies and welfare of the host and source countries : a game-theoretic approach, CESifo Working Paper, No. 2811, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:

<https://hdl.handle.net/10419/30598>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Temporary Migration Policies and Welfare of the Host and Source Countries: A Game-Theoretic Approach

Slobodan Djajić  
Michael S. Michael

CESIFO WORKING PAPER NO. 2811  
CATEGORY 8: TRADE POLICY  
OCTOBER 2009

*An electronic version of the paper may be downloaded*

- *from the SSRN website:* [www.SSRN.com](http://www.SSRN.com)
- *from the RePEc website:* [www.RePEc.org](http://www.RePEc.org)
- *from the CESifo website:* [www.CESifo-group.org/wp](http://www.CESifo-group.org/wp)

# Temporary Migration Policies and Welfare of the Host and Source Countries: A Game-Theoretic Approach

## Abstract

This paper examines the interaction between migration policies of the host and source countries in the context of a model of guest-worker migration. For the host, the objective is to provide low-cost labor for its employers while avoiding illegal immigration. It optimizes over these objectives by setting the time limit of a guest-worker permit. The source country seeks remittance flows and return migration by offering fiscal benefits to returnees. Within this framework, we solve for the Nash equilibrium values of the migration policy instruments and compare them with the ones that emerge in a cooperative setting.

JEL Code: F22.

Keywords: temporary migration, remittances, migration policy.

*Slobodan Djajić*  
*The Graduate Institute*  
*11A, Avenue de la Paix*  
*1202 Geneva*  
*Switzerland*  
*slobodandjajic@yahoo.com*

*Michael S. Michael*  
*Department of Economics*  
*University of Cyprus*  
*Nicosia, Cyprus*  
*m.s.michael@ucy.ac.cy*

September 2009

# 1 Introduction

The wide international wage differentials for labor of similar skill and quality are indicative of the large potential gains that can be enjoyed by the world economy from an increase in the volume of international migration. While the host countries recognize the potential benefits, past experience suggests that immigration does not only involve the import of labor, but a more complex transaction that can potentially lower the perceived welfare of the host country. Given the elaborate welfare state that exists in the advanced countries and various considerations related to the possible negative externalities from hosting permanent unskilled immigrants, many of them have shown a strong preference for guest-worker programs. So have the labor-importing countries of the Middle East and East Asia, which seem to be more concerned about the long term implications of changes in the ethnic composition of their population than they are over the fiscal consequences of international migration.<sup>1</sup> The objective of guest-worker programs in these economies is to address labor-market shortages, while avoiding, to the extent possible, the unwanted consequences of permanent immigration of unskilled workers.

From the perspective of the source countries, there is also a keen interest in benefiting from international migration. One key benefit is the flow of remittances from emigrants employed abroad. Worker remittances from the advanced to the developing countries are an important source of income and capital for millions of households. For all the developing countries combined, officially recorded flows are significantly in excess of two hundred billion dollars per year. These transfers affect not only the direct recipients, but also other members of the community, as the spending of remittances has an impact on commodity and factor prices as well as employment opportunities throughout the economy.<sup>2</sup> Remittances, however, are more likely to

---

<sup>1</sup>Prominent among the countries that recruit temporary foreign workers are the USA, Canada, UK, Germany, Australia, New Zealand, Spain, the Netherlands, Belgium, Ireland, Austria, Poland, Portugal, Cyprus, Israel, the oil-producing economies of the Middle East and the rapidly growing East Asian economies such as South Korea, Taiwan (province of China), Malaysia, and Singapore. For a description of temporary foreign-worker programs in the major labor-importing countries, see GAO (2006).

<sup>2</sup>There is a very large literature on remittance flows and how they affect the families left behind and investment in small businesses in the source country. See for example, Adams

come from temporary migrants who leave their families behind, rather than from permanent migrants who have weaker ties with the source country.<sup>3</sup> From the perspective of the policymakers of both the labor-exporting and labor-importing countries, the benefits of migration of low-skilled labor are therefore likely to be higher in a system of temporary rather than permanent migration [see Djajić (2009)].

Within this setting, a number of important questions emerge. From the point of view of the host country, what are the characteristics of an optimal immigration policy concerning low-skilled, temporary foreign workers? What is the optimal duration of a work permit? What should the source country do to maximize its own welfare, given the immigration policies of the host? How would these policies differ, depending on whether or not both countries cooperate to maximize joint welfare? The purpose of the present study is to address these questions within a game-theoretic framework of analysis. As temporary migration of low-skilled workers is likely to grow in importance in the decades to come, these and other related issues should be high on the research agenda. Surprisingly, very little theoretical work has been conducted so far on these crucial issues.<sup>4</sup>

---

(1991), Ammasari (2003), Brauw and Rozelle (2003), Durand et al.(1996), Escobar-Patapi and Martinez-Castellanos (1991), Lianos (1997), Lucas (1987), Massey and Parrado (1998), Nega et al.(2004), Penny (1986), Puri and Ritzema (1999), and Woodruff and Zenteno (2001). See also Djajić (1986, 1998), Kirwan and Holden (1986), Quibria (1997), and Rivera-Batiz (1986), among others, for the analysis of macro effects.

<sup>3</sup>See, e.g., Glytsos (1997) and Black (2003). In surveying the evidence on remittance flows to the developing countries, Lucas (2005) notes the importance of *temporary* migration to the Gulf states and East Asia, both in absolute terms and as a fraction of a migrant's earnings abroad.

<sup>4</sup>There is a vast literature on policy issues related to migration of *skilled* workers as well as *illegal immigration* of unskilled workers. Concerning legal migration of unskilled labor, the literature on the choice between labor and capital mobility does address a range of important policy issues (see Bhagwati and Srinivasan (1983), Calvo and Wellisz (1983), Jones, Coelho and Easton (1986) and other contributions on this topic). More recently, Martin (2003) and Ruhs (2002) analyse various guest-worker programs and offer policy recommendations. Schiff (2007) looks at optimal immigration policy with a focus on the distinctions between permanent migration, guest-worker migration and Mode IV under the GATS. Winters et al (2003) discuss issues related to liberalizing Mode IV, while Hatton (2007) raises the question of whether the potential gains from international migration could be realized through international cooperation along the lines similar to what the WTO has done for trade. Jensen et al (2007) examine the implications of immigration-policy coordination among host countries in a model where immigrants are heterogeneous

In order to keep the analysis simple and tractable, the focus of our model is limited to several key aspects of guest-worker migration. One of these is the problem of ensuring that the guest-workers return to their country of origin at the moment their work permit expires. It is often the case that temporary workers wish to convert their status to that of a permanent immigrant. When lawful possibilities are limited or very costly, it is not unusual for them to extend their stay as illegal aliens. This is obviously undesirable from the perspective of the host country, but also from that of the source country. Permanent migrants are less likely to send remittances or contribute to growth and development of their country of origin by bringing back human and physical capital.

Another feature of guest-worker migration that we focus on are the benefits enjoyed by the employers. In the economies of East Asia, such as South Korea and Taiwan, temporary workers are recruited from abroad and paid by their employers considerably lower wages than those paid to native workers.<sup>5</sup> Similarly, in the advanced Western economies, the possibility of hiring a guest worker to perform tasks that native workers are not willing to undertake at the going wage is a source of large rents. The longer the foreign worker remains in the host county, however, the greater is the worker's awareness of its labor-market opportunities and compensation structures. To the extent possible, a guest worker can be expected to take advantage of such opportunities and thereby achieve gradual assimilation in terms of earnings in relation to native workers. This reduces the rents enjoyed by the employers, diminishing to some extents the benefits of employing a foreign worker. In addition, the longer a guest worker stays in the host country, the easier it is to transit from temporary to permanent status, whether legal or illegal. This reflects the possibility of acquiring relevant information over time and developing networks in the host country that can serve to reduce the cost of status adjustment.

The authorities of the host and source countries can also influence return-migration decisions. Very tough enforcement policies of the host can guaran-

---

with respect to their performance in the labor market.

<sup>5</sup>According to Stein (2003), native factory workers in Taiwan "...earn between \$600 and \$850 per month, while their foreign counterparts get the minimum wage of \$460. ...In South Korea, which limits foreign laborers to a single three-year visit, workers are considered trainees their first two years, so they are exempt from most of the country's labor laws, including minimum wages and overtime" (pp. 2-3).

tee that a vast majority of temporary foreign workers do in fact return at the end of their contract. Tough enforcement measures, however, can absorb a large amount of public resources as well as tarnish a country's international reputation in relation to humanitarian and human-rights issues. Cooperation with the source countries in the form of repatriation agreements, preferential guest-worker arrangements, and other modes of cooperation (related to visas, travel documents, border controls, development cooperation, foreign direct investment, etc.) can also lower the chances that a guest worker would seek to remain in the host country as an illegal alien. Other measures taken by a source country can have a similar effect. Special tax treatment for household goods and capital brought from abroad can go a long way to encourage migrants to return. Preferential rates of return on repatriated savings and favorable exchange rates when foreign currency is converted into local currency also support return.<sup>6</sup> While these measures impose costs on the treasuries (and hence taxpayers) of the source countries, they can prove to be beneficial in the long run by stimulating development.

Our two-country model, presented in Section 2, tries to capture some of these features of contemporary guest-worker migration. Its structure is most relevant for the host countries such as South Korea, Taiwan (province of China), Singapore, Cyprus, Israel, and GCC States, where the concern over illegal immigration is relatively high, low-skilled guest workers are recruited on multi-year contracts from distant (rather than neighbouring) countries, and are typically paid lower wages than those earned by the native workers.<sup>7</sup>

---

<sup>6</sup>A number of source countries have initiated special programs that provide returnees rates of interest on savings in excess of those available abroad. For example, India and Pakistan have pursued a policy of enabling return migrants to deposit their savings into special foreign currency accounts on which they earn a premium over world financial market rates. Puri and Ritzema (1999) report that in 1991, the margin over Eurodollar deposit rates ranged from .75% to 1.62%, depending on the maturity of the deposit. Special accounts, exchange rates, fiscal incentives, and other programs designed to channel remittances into productive investments and small business activities have also emerged in Egypt, Jordan, Bangladesh, Sudan, Turkey, and the Philippines [see Nega *et al* (2004) and Puri and Ritzema (1999)]. See also de Haas and Plug (2006) for the case of Morocco.

<sup>7</sup>Our model is less relevant for host countries such as the U.S.A., Canada, and many of the Western European economies that seem to show less concern over illegal immigration and where low-skilled guest workers are typically recruited on contracts lasting for less than a year, with employers obliged to pay the same wage to migrants as they do to native workers.

From the perspective of the host country, we focus on one key dimension of a temporary immigration policy which has not been adequately treated in the theoretical literature: Namely, the optimal duration of a guest-worker permit. We also examine the implications of that policy for the source country and the objectives that its authorities may try to achieve. This is followed in Section 3 by an analysis of the interaction between the migration-policy instruments of both countries within a game-theoretic framework. A non-cooperative setting is considered first, where each country tries to maximize its own welfare, given the policy of the other. In Section 4, we examine the possibility of both countries cooperating on migration issues to maximize joint welfare and compare the policies that emerge with those in the absence of cooperation. Section 5 concludes the paper.

## 2 The Analytic Framework

Consider the host country, H, that allows its employers to import foreign workers temporarily from the source country, S, in order to meet any labor-market shortages that may tend to push the wage paid to native workers above some constant level  $W^H$ . The overriding objective of the host country's immigration policy is, therefore, to stabilize the wage enjoyed by the native workers. It achieves this objective by continuously adjusting the number of temporary work permits issued to foreign labor. This leaves open the interesting question of how long should any one guest worker be allowed to stay.

Let us assume for simplicity that temporary immigrants are granted non-renewable work permits of the duration  $\tau$ . As a condition for being granted a permit, they are required to have a job contract of the same duration from an eligible local employer that sets the initial wage at the level  $w_0 < W^H$ . The employer, in turn, incurs the cost C for the privilege of being able to hire a guest worker. This cost includes travel and recruitment expenses as well as any other initial costs of participation in the guest-worker program.<sup>8</sup>

---

<sup>8</sup>In countries such as Switzerland, Austria, Cyprus, Singapore, Australia, Netherlands,



The hiring of low-cost foreign labor generates a rent for an employer. This implies that there is an excess demand for imports of labor. For simplicity, we assume that employers are invited to participate in the program after being chosen at random by the authorities of country H.

As part of their employment contract, migrants are given food and housing by their employers in addition to the starting wage,  $w_0$ .<sup>9</sup> Let us assume that the cost of food and housing amounts to  $K$  per unit of time and that the entire cash portion of the migrant's wage is saved and repatriated to the source country at the point of return.

### *The Question of Rents*

While their initial, guest-worker wage is set by the authorities at  $w_0$ , migrants slowly learn about labor-market opportunities in the host country. They observe that native workers are receiving a considerably higher wage  $W^H$ . Over time, therefore, an employer of a guest worker is increasingly in competition with other employers for the services of his migrant worker and the implied rent. We shall assume that this enables migrants to obtain wage increases that bring them closer to the level of earnings of the native workers<sup>10</sup>. More specifically, we assume that the money wage received by a migrant is simply given by

$$(1) \quad W^M = \inf\{w_0 + \alpha t, W^H - K\}$$

---

and Germany, employers must pay a fee for the work permits of their foreign workers. See GAO (2006). Although we do not explicitly account for such fees in this paper, they can easily be included in the analysis.

<sup>9</sup>Many of the seasonal guest-worker programs impose the free-housing requirement on the employers. Examples include Canada's Seasonal Agricultural Workers Program, UK's Seasonal Agricultural Workers Scheme, the H-2A program for foreign agricultural workers in the US, as well as similar programs in Germany, France and Switzerland [see Martin (2006)].

<sup>10</sup>See Hillman, Epstein and Weiss (1999) for a more detailed description of a competitive mechanism that can generate this type of earnings assimilation of guest workers in relation to the natives. Schiff (2007) makes use of a similar mechanism in his analysis of an optimal immigration policy. Also note that in some countries, the employment contracts contain provisions that require the employer to raise the wage paid to the immigrant every year (e.g., Cyprus) or, in their third (and last) year, as in South Korea. Whether the guest-worker program does or does not allow a worker to change employers, employment-switching often occurs, as it did during the Bracero program [see Martin (2006)], allowing migrants to improve their earnings and working conditions.

where the constant  $\alpha > 0$  reflects the migrant's rate of earnings assimilation and  $t$  represents the amount of time since arrival in the host country. It follows that for each migrant worker brought into the host country on a work permit of duration  $\tau$ , his employer enjoys a rent amounting to the difference between the marginal productivity of labor, which is constant at the level  $W^H$ , and the cost of recruiting and transporting ( $C$ ), housing and feeding ( $K$ ), and paying ( $W^M$ ) an immigrant worker. Considering the range of  $\tau$  for which  $W^M < W^H - K$ , this rent amounts to

$$(2) \quad \rho = \int_0^\tau (W^H - K - w_0 - \alpha t) dt - C,$$

which we assume to be positive in the relevant range of analysis.

For a given employment position that is filled by foreign labor over a time horizon of the length  $T$ , an employer will have a total of  $T/\tau$  migrants if each of them is allowed to work in H on a permit of duration  $\tau$ . The total employer rent,  $R$ , per employment position over the interval  $T$  is therefore

$$(3) \quad R = (T/\tau)\{(W^H - K - w_0)\tau - \alpha\tau^2/2 - C\}.$$

Let us suppose that the immigration authorities set  $\tau$  to maximize  $R$ . From eq. (3), the rent-maximizing value of  $\tau$  is

$$(4) \quad \tau = \sqrt{2C/\alpha}.$$

Thus the lower the fixed cost of recruiting and transporting foreign labor and the higher the rate of earnings assimilation of guest workers, the shorter the optimal duration of a guest-worker permit if the sole objective of the immigration authorities is to maximize the rents enjoyed by the employers. In reality, the authorities are likely to have a number of additional arguments in their objective function. The following subsection extends the model by assuming that the authorities are also concerned about the possibility that some of the guest workers might become illegal immigrants.

### *The Possibility of Overstaying*

Experience of advanced countries that have had guest-worker programs in the past, shows that temporary migrants do not always return to their country of origin when their work permit expires. Some manage to remain legally in the host country by adjusting their status, while others may stay without authorization. To keep the analysis simple, let us suppose that there are no legal options for overstaying and that the welfare of the host country is negatively affected when a guest worker remains on its territory as an illegal alien.<sup>11</sup> Since the number of guest workers that rotate in a given employment position over a time horizon of the length  $T$  is  $T/\tau$ , the stock of illegal aliens,  $A$ , generated per position that is filled by guest workers over that interval is

$$(5) \quad A = (T/\tau)\pi(\tau),$$

where  $\pi(\tau)$  is the probability that any given guest worker will remain in the host country illegally after the expiration of his work permit. We shall assume that the function  $\pi(\tau) < 1$  for all  $\tau$ , is continuously twice differentiable with  $\pi'(\tau) > 0$ ,  $\pi''(\tau) \geq 0$ , and  $\lim_{\tau \rightarrow 0} \pi(\tau) = 0$ . This reflects the notion that guest workers learn over time about the possibilities of successfully remaining in the host country as illegal aliens, while simultaneously developing networks that can help reduce the expected lifetime cost of transiting to illegal alien status. It is therefore more likely that a guest worker stays illegally, the larger the value of  $\tau$  chosen by the authorities. The second derivative of  $\pi(\tau)$  is likely to be negative in reality, although we shall also devote some attention to the case of  $\pi''(\tau) > 0$  later in the paper<sup>12</sup>.

---

<sup>11</sup>While many of the advanced countries exhibit a rather permissive attitude with respect to illegal immigration, this is clearly not the case in the oil-producing countries of the Middle East, or the rapidly growing East Asian economies. In reference to the guest-worker programs of the latter, Stein (2003) notes that "...the contracts are meant to be short term. Once they are finished, importing nations are eager to ensure that the workers won't find a way to stay." (p. 3).

<sup>12</sup>Our analysis focuses on employer rents and illegal immigration generated per employment position that is filled by guest workers over any given time horizon. Alternatively, one may wish to consider the consequences of a guest-worker policy designed to meet a labor-market shortage amounting to  $N$  units of unskilled labor over a time horizon of the length  $T$ . The total number of illegal aliens generated is then given by  $N\{1-[1-\pi(\tau)]^{T/\tau}\}$  and the total undiscounted rents enjoyed by all the employers participating in the program are  $N\rho(\tau)\{1-[1-\pi(\tau)]^{T/\tau}\}/\pi(\tau)$ , where  $\rho$  is defined in eq.(2). With the use of this specification, the algebra quickly becomes very tedious, without offering much in terms

*The optimal value of  $\tau$*

If in addition to the employer rents we introduce the disutility of hosting illegal aliens into the objective function,  $V$ , of the host country, we obtain a more general function that the authorities will seek to maximize.

$$(6) \quad V = R - \lambda A = \frac{T}{\tau}[(w^H - w_0 - K)\tau - \frac{\alpha\tau^2}{2} - C - \lambda\pi(\tau)],$$

where the constant  $\lambda > 0$  is the weight attached by the authorities to the cost of hosting an additional illegal immigrant relative to the benefit of generating an additional unit of employer rents through the guest-worker program. Maximizing  $V$  with respect to  $\tau$  yields

$$(7) \quad \frac{\partial V}{\partial \tau} = 0 \Rightarrow C - \frac{\alpha\tau^2}{2} + \lambda\pi(\tau)[1 - \eta_\tau] = 0$$

where  $\eta_\tau = (\partial\pi/\partial\tau)(\tau/\pi) > 0$ . We shall assume in what follows that  $\eta_\tau$  is constant. Thus, for the case  $\pi''(\tau) < 0$ ,  $\eta_\tau < 1$ , while for  $\pi''(\tau) > 0$ ,  $\eta_\tau > 1$ . Eq. (7) provides an implicit solution for the optimal value of  $\tau$  from the perspective of country H.<sup>13</sup>

When  $\eta_\tau = 1$ , the optimal  $\tau$  is exactly the same as if the authorities were simply maximizing employer rents (see eq.(4)). In that case, the private objectives of the employers perfectly coincide with those of the host-country authorities. For  $\eta_\tau > 1$  any increase in  $\tau$  generates a proportionately larger increase in  $\pi(\tau)$ , which implies that a larger number of illegal aliens is generated per employment position filled by a guest worker over any given time horizon.<sup>14</sup> Accordingly, when illegal immigration is a problem for the host country, the immigration authorities have an incentive to reduce the duration of the work permit if  $\pi(\tau)$  is elastic with respect to  $\tau$ . Alternatively, if  $\eta_\tau < 1$ , an increase in  $\tau$  reduces the number of illegal immigrants per employment

---

of additional insights. We therefore retain our assumption that the authorities of H are concerned about the employer rents and illegal immigration generated *per employment position* filled by a guest worker.

<sup>13</sup>It can be easily verified with the aid of eqs.(6) and (7) that the second order condition is satisfied.

<sup>14</sup>Differentiating eq. (5) with respect to  $\tau$  we obtain  $\partial A/\partial\tau = (\eta_\tau - 1)T\pi(\tau)/\tau^2$ . It follows that the number of illegal aliens,  $A$ , generated per employment position filled by a guest worker increases with  $\tau$  when  $\eta_\tau > 1$  (i.e.,  $\pi$  is elastic with respect to  $\tau$ ) and diminishes with  $\tau$  when  $\eta_\tau < 1$ .

position over a given time horizon. The optimal  $\tau$  is then larger than its rent-maximizing value. To be sure that employers keep their migrant workers for the entire period  $\tau$  set by the authorities, we assume that employers are subject to a penalty that guarantees compliance.

*The Source-Country Perspective*

The source country also has a stake when it comes to temporary migration. Let us suppose that it is interested in maximizing the flow of worker remittances from H. Since we assumed that guest workers repatriate at the point of return all of their money income earned abroad, the total amount of repatriated savings per employment position filled by a guest worker in H over T units of time is given by

$$(8) \quad F = \frac{T}{\tau}[w_0\tau + (\alpha\tau^2/2)][1 - \pi(\tau)],$$

where  $[1 - \pi(\tau)]$  is the probability that a guest worker does in fact return to S with accumulated savings at the moment the work permit expires.

The source country obviously does not have the power to set the duration  $\tau$  of the work permit enjoyed by its citizens in H, but it may have policies available that enhance the probability of return for any given  $\tau$ . To the extent that such policies come into play, we need to generalize the function  $\pi(\cdot)$  to reflect the measures employed by the authorities of S.

As noted in the Introduction, various fiscal benefits and one-time advantages, as well as bureaucratic simplifications have been offered by source countries to induce emigrants to return with accumulated savings. These benefits are costly to the taxpayers. Moreover, they are sometimes seen as contributing to greater income inequality, because they assist returning migrants who are in many cases relatively better off than the average source-country resident. On the other hand, to the extent that such programs attract migrants to come back with their savings, they also attract critically needed capital (and, in a more general setting, human capital) that has a positive effect on job creation, growth and development.

Let us therefore assume that the objective function,  $V^*$ , of the policy-makers of S has two arguments: The repatriated savings,  $F$ , brought back

by the returning migrants, and the cost of fiscal and other benefits,  $B$ , offered to returnees who complete their guest-worker contracts abroad, which has a negative weight of  $\lambda^*$ .

$$(9) \quad V^* = (T/\tau)[w_0\tau + (\alpha\tau^2/2) - \lambda^*B][1 - \pi(\tau, B)],$$

where  $T/\tau$  is the total number of migrants per employment position in H over a time horizon  $T$ . Only a fraction  $1 - \pi(\tau, B)$  of them will return, each receiving a package of benefits  $B$ , which in addition to  $\tau$ , affect the probability that a migrant will return to S. One would expect that the effect of an increase in  $B$  on the probability of return,  $1 - \pi(\tau, B)$ , to be positive but diminishing. This implies that  $\pi_B < 0$  and  $\pi_{BB} > 0$ . In addition, we continue to assume that  $\pi_\tau > 0$  and  $\pi_{\tau\tau} \geq 0$ .

Within our framework of analysis, the policy of H concerning  $\tau$  has an impact not only on its own welfare, but also on that of country S. Similarly, return-related policies of S, summarized by  $B$ , have an impact on the welfare of both countries. This is an environment in which there may be scope for both countries to improve world welfare through international cooperation on issues related to temporary migration. We begin, however, by characterizing a non-cooperative equilibrium, where each country sets the level of its migration-policy instrument to maximize its own welfare, given the policy of the other country.

### 3 Nash Equilibrium

Maximization of the objective function,  $V$ , of the host country with respect to  $\tau$  yielded eq.(7). We now rewrite this expression to take into account the migration policy of the source country and obtain the reaction function of H.

$$(10) \quad \frac{\partial V}{\partial \tau} = 0 \Rightarrow \frac{T}{\tau^2} \left[ C - \frac{\alpha\tau^2}{2} + \lambda\pi(\tau, B)(1 - \eta_\tau) \right] = 0, \quad (\text{RF})$$

The partial derivatives of (10) with respect to  $\tau$  and  $B$  are given by

$$(11) \quad V_{\tau\tau} = \frac{T}{\tau^2} [\lambda(1 - \eta_\tau)\eta_\tau \frac{\pi}{\tau} - \alpha\tau] < 0.$$

$$(12) \quad V_{\tau B} = -\frac{T}{\tau^2} [\lambda(1 - \eta_\tau)\eta_B \frac{1-\pi}{B}] \geq 0, \quad \text{as } \eta_\tau \geq 1,$$

where  $\eta_B = \frac{\partial(1-\pi)}{\partial B} \frac{B}{1-\pi} > 0$  is assumed to be constant and the arguments of the function  $\pi$  have been suppressed for notational simplicity.

With the aid of eqs.(6) and (7), it can be easily shown that  $V_{\tau\tau}$  is unambiguously negative regardless of whether  $\eta_\tau$  is greater or smaller than unity. This guarantees that the second-order condition for maximization of  $V$  with respect to  $\tau$  is satisfied.

Similarly,  $S$  will set  $B$  at a value that maximizes its objective function (9)

$$(13) \quad \frac{\partial V^*}{\partial B} = 0 \Rightarrow \frac{T(1-\pi)}{B\tau} \left[ (\tau w_0 + \frac{\alpha\tau^2}{2})\eta_B - \lambda^* B(1 + \eta_B) \right] = 0. \quad (\text{RF}^*)$$

The partial derivatives of (13) with respect to  $\tau$  and  $B$  are

$$(14) \quad V_{B\tau}^* = \frac{T(1-\pi)}{B\tau} (w_0 + \alpha\tau)\eta_B > 0,$$

$$(15) \quad V_{BB}^* = -\frac{T(1-\pi)}{B\tau} \lambda^* (1 + \eta_B) < 0,$$

where we used (13) to simplify the expression in (14). With  $V_{BB}^* < 0$ , the second-order condition for the maximization of  $V^*$  with respect to  $B$  is satisfied. Eqs.(14) and (15) imply that the slope of the reaction function of  $S$  is simply  $\frac{dB}{d\tau}|_{V_B^*=0} = (w_0 + \alpha\tau)\eta_B / \lambda^*(1 + \eta_B) > 0$ . In figures 1a and 1b,  $\text{RF}^*$  is therefore depicted as a positively sloped schedule, convex to the origin. Similarly, on the basis of (11) and (12), the slope of  $\text{RF}$  is  $\frac{dB}{d\tau}|_{V_\tau=0} = [\lambda(1 - \eta_\tau)\eta_\tau \frac{\pi}{\tau} - \alpha\tau] / [\lambda(1 - \eta_\tau)\eta_B \frac{1-\pi}{B}]$ . Since the numerator of

this expression is negative [see eq. (11)] RF can be either negatively or positively sloped, depending on whether  $\eta_\tau$  is smaller or greater than unity. This is illustrated in figures 1a and 1b, respectively. In the latter case, RF\* is shown to be flatter than RF, as required for stability.

### *Comparative Statics*

Total differentiation of the system of equations (10) and (13) yields

$$(17) \quad \begin{bmatrix} \lambda(1 - \eta_\tau)\frac{\pi}{\tau}\eta_\tau - \alpha\tau & -\lambda(1 - \eta_\tau)\frac{1-\pi}{B}\eta_B \\ (w_0 + \alpha\tau)\eta_B & -\lambda^*(1 + \eta_B) \end{bmatrix} \begin{bmatrix} d\tau \\ dB \end{bmatrix} = \begin{bmatrix} \frac{\tau^2}{2}d\alpha - dC - \pi(1 - \eta_\tau)d\lambda \\ -\frac{\tau^2}{2}\eta_B d\alpha - \tau\eta_B^*dw_0 + B(1 + \eta_B)d\lambda^* \end{bmatrix}$$

where the determinant of the coefficient matrix  $\Delta = -(\lambda(1 - \eta_\tau)\frac{\pi}{\tau}\eta_\tau - \alpha\tau)\lambda^*(1 + \eta_B) + (w_0 + \alpha\tau)\eta_B\lambda(1 - \eta_\tau)\frac{1-\pi}{B}\eta_B$  is assumed to be positive, as required for stability. It can be easily seen that  $\Delta > 0$  for  $\eta_\tau < 1$  but it can also be shown to be positive for  $\eta_\tau > 1$ , provided that  $\eta_\tau < \tau^2(\alpha\tau + w_0 - \alpha)/\pi(\alpha\tau^2/2 - C)$ .

From (17) we are able to solve for the effects of changes in the exogenous variables, including C,  $\alpha$ ,  $w_0$ ,  $\lambda$ , and  $\lambda^*$  on the optimal values of migration policy instruments  $\tau$  and B in a non-cooperative equilibrium.

### *Increase in the cost of recruiting and transporting guest workers*

If there is an increase in C, the host country prefers a higher value of  $\tau$  for any given B to economize on the cost of importing labor. This shifts RF to the right, while leaving RF\* unaffected in figures 1a and 1b. Thus, an increase in C results in an unambiguous increase in both  $\tau$  and B in the new equilibrium. From (17), we obtain

$$(18) \quad \Delta \frac{d\tau}{dC} = \lambda^*(1 + \eta_B) > 0,$$



$$(19) \quad \Delta \frac{dB}{dC} = (w_0 + \alpha\tau)\eta_B > 0,$$

where the increase in the equilibrium value of B reflects the source country's heightened interest in attracting migrants to return with their accumulated assets, which are greater when country H chooses a larger  $\tau$ .

### *Higher rate of earnings assimilation*

An increase in  $\alpha$  shifts RF to the left in figures 2a and 2b, as more rapid earnings assimilation of guest workers calls for a lower  $\tau$  at any given B in order to protect employer rents in the host country. At the same time the implied increase in the rate of saving by migrant workers requires that the authorities of S offer a larger B to returnees for any given  $\tau$ . As a result, the RF\* schedule shifts up and to the left. When  $\eta_\tau < 1$ , it can be shown that the leftward shift of RF is larger than that of RF\*, guaranteeing lower values of both  $\tau$  and B in the new equilibrium.<sup>15</sup> The intuition behind the decline in B following an increase in  $\alpha$  is quite simple. There are two conflicting effects on B: A direct one that calls for a higher B, as described above, and an induced one associated with a reduction in  $\tau$ . A lower  $\tau$  reduces the amount of accumulated assets that are repatriated by each of the returnees, making it optimal for country S to reduce B. In the case of  $\eta < 1$ , the induced effect dominates the direct effect so that B is lower in the new Nash equilibrium. This is illustrated in figure 2a as a shift from the initial equilibrium at  $E_0$  to the new one at  $E_1$  and also confirmed by the solutions that emerge from (17).

$$(20) \quad \Delta \frac{d\tau}{d\alpha} = -\frac{\tau^2}{2} \left[ \lambda^*(1 + \eta_B) + \lambda\eta_B^2(1 - \eta_\tau)\frac{1-\pi}{B} \right] \geq 0, \\ \text{as } \eta_\tau \geq 1 + \frac{\lambda^*(1+\eta_B)B}{\lambda(1-\pi)\eta_B^2},$$

$$(21) \quad \Delta \frac{dB}{d\alpha} = -[\lambda(1 - \eta_\tau)\frac{\pi}{\tau}\eta_\tau + w_0]\frac{\tau^2}{2}\eta_B \geq 0, \text{ as } w_0 \leq \lambda(\eta_\tau - 1)\frac{\pi}{\tau}\eta_\tau$$

---

<sup>15</sup>The absolute value of the horizontal shift of the RF schedule in response to an increase in  $\alpha$  is given by  $-\tau^2/2 [\lambda(1 - \eta_\tau)\eta_\tau\frac{\pi}{\tau} - \alpha\tau]$ , while that of the FR\* amounts to  $\tau^2/2 [w_0 + \alpha\tau]$ . Thus, for  $\eta_\tau < 1 + \frac{w_0\tau}{\lambda\eta_\tau\pi}$ , the leftward shift of the RF schedule is larger than that of RF\*. This is equivalent to the condition that  $w_0 > \lambda(\eta_\tau - 1)\frac{\pi}{\tau}\eta_\tau$ .

Alternatively, if  $\eta_\tau > 1$ , the leftward shift of RF may be either larger or smaller than that of RF\*, depending on whether  $w_0$  is larger or smaller than  $\lambda(\eta_\tau - 1)\frac{\pi}{\tau}\eta_\tau$  (see footnote 12). It follows that for  $w_0 > \lambda(\eta_\tau - 1)\frac{\pi}{\tau}\eta_\tau$ , both  $B$  and  $\tau$  are once again lower in the new equilibrium, depicted by  $E_1$  in figure 2b. For  $w_0 < \lambda(\eta_\tau - 1)\frac{\pi}{\tau}\eta_\tau$ , however, the RF\* schedule shifts to the left by *more* than RF, giving rise to an increase, rather than a decline in  $B$ . The direct effect on  $B$  of an increase in  $\alpha$  then dominates the induced effect of a reduction in  $\tau$ . This is illustrated by a new equilibrium at  $E_2$ .

#### *Higher initial guest-worker wage*

An increase in  $w_0$  results in a higher guest-worker saving rate, which requires  $S$  to offer an increase in returnee benefits for any given  $\tau$ . This shifts the RF\* schedule up, while the reaction function of  $H$  remains unaffected. In consequence, when  $\eta_\tau < 1$  the equilibrium value of  $B$  increases and that of  $\tau$  declines. Alternatively, when  $\eta_\tau > 1$  (case depicted in figure 1b) the upward shift of the RF\* schedule generates an increase in both  $B$  and  $\tau$ . The intuition behind the opposite direction of change in  $\tau$  is simple to grasp. With an increase in  $B$ , illegal immigration is reduced for any given  $\tau$ , allowing the host country to pull back on its efforts to combat the problem of unauthorized overstaying. This calls for a lower  $\tau$  when  $\eta_\tau < 1$  and a higher  $\tau$  when  $\eta_\tau > 1$ . On the basis of (17), we thus have

$$(22) \quad \Delta \frac{d\tau}{dw_0} = -\tau\eta_B^2\lambda(1 - \eta_\tau)\frac{1-\pi}{B} \gtrless 0, \quad \text{as } \eta_\tau \gtrless 1,$$

$$(23) \quad \Delta \frac{dB}{dw_0} = -[\lambda(1 - \eta_\tau)\frac{\pi}{\tau}\eta_\tau - \alpha\tau]\tau\eta_B > 0.$$

showing an unambiguous increase in  $B$ , while  $\tau$  increases when  $\pi$  is elastic with respect to the length of the work permit and declines when it is inelastic.

#### *Change in preferences of $S$*

An increase in the weight  $\lambda^*$  of fiscal expenditures relative to that of repatriated savings in the objective function of the source country shifts RF\* down while leaving RF unaffected. The comparative statics results are therefore the opposite of those reported in the case of an increase in  $w_0$ : A

rise in  $\lambda^*$  lowers B and either increases or lowers  $\tau$ , depending on whether  $\eta_\tau$  is smaller or larger than unity.

$$(24) \quad \Delta \frac{d\tau}{d\lambda^*} = B\lambda(1 - \eta_\tau)(1 + \eta_B)\frac{1-\pi}{B}\eta_B \gtrless 0, \quad \text{as } \eta_\tau \lesseqgtr 1,$$

$$(25) \quad \Delta \frac{dB}{d\lambda^*} = [\lambda(1 - \eta_\tau)\frac{\pi}{\tau} - \alpha\tau]B(1 + \eta_B) < 0.$$

The result concerning  $\tau$  reflects the need for the host country to step up its efforts to confront illegal immigration by adjusting  $\tau$  when the source country lowers the fiscal benefits offered to returnees. A reduction in the stock of illegal immigrants generated per employment position is achieved by increasing  $\tau$  when  $\eta_\tau < 1$  and by lowering  $\tau$  when  $\eta_\tau > 1$ .

#### *Change in preferences of H*

We finally consider the implications of an increase in the perceived cost of illegal immigration in the host country. With an increase in  $\lambda$ , the host country will try to reduce the number of overstayers over any given time horizon by raising (lowering)  $\tau$  when  $\eta_\tau < 1$  ( $\eta_\tau > 1$ ) for any given B. In the case corresponding to figure 1a, this shifts the RF schedule to the right, while in the case depicted in figure 1b, it shifts it to the left. It follows that both  $\tau$  and B increase when  $\eta_\tau < 1$  and they both decline when  $\eta_\tau > 1$ .

$$(26) \quad \Delta \frac{d\tau}{d\lambda} = \pi(1 - \eta_\tau)\lambda^*(1 + \eta_B) \gtrless 0, \quad \text{as } \eta_\tau \lesseqgtr 1,$$

$$(27) \quad \Delta \frac{dB}{d\lambda} = (w_0 + \alpha\tau)\eta_B\pi(1 - \eta_\tau) \gtrless 0, \quad \text{as } \eta_\tau \lesseqgtr 1.$$

In each case, the change in B reflects the induced effect of policy adjustment in H on the incentive of S to alter the fiscal benefits offered to returnees. The benefits are increased when  $\tau$  is extended and reduced with a cut in  $\tau$ .

Our findings can be summarized in the following proposition.

*Proposition 1:* Assume that country H chooses  $\tau$  and country S chooses  $B$  to maximize, respectively, its own welfare (i.e., Nash behavior).

- The Nash equilibrium level of  $\tau$ 
  - a) increases with an increase in  $C$ ;
  - b) increases with an increase (decrease) in  $w_0$  if  $\eta_\tau > 1$  ( $\eta_\tau < 1$ );
  - c) increases with an increase (decrease) in  $\lambda$  and  $\lambda^*$  if  $\eta_\tau < 1$  ( $\eta_\tau > 1$ );
  - d) increases with a decrease in  $\alpha$  if  $\eta_\tau < 1$  but may decrease if  $\eta_\tau > 1$ .
  
- The Nash equilibrium level of  $B$ 
  - a) increases with an increase in  $C$ ,  $w_0$  and with a decrease in  $\lambda^*$ ;
  - b) increases with an increase (decrease) in  $\lambda$  if  $\eta_\tau < 1$  ( $\eta_\tau > 1$ );
  - c) increases with a decrease in  $\alpha$  if  $\eta_\tau < 1$  but may decrease if  $\eta_\tau > 1$ .

For example, if  $\eta_\tau < 1$ , the Nash equilibrium maximum duration  $\tau$  of a guest-worker permit increases with an increase in  $C$ ,  $\lambda$ ,  $\lambda^*$ , and with a decrease in  $w_0$  and  $\alpha$ . Under the same condition, the Nash equilibrium benefit  $B$  offered to returnees increases with an increase in  $C$ ,  $w_0$ ,  $\lambda$ ,  $\lambda^*$  and with a decrease in  $\alpha$ .

## 4 Cooperative Equilibrium

Assume now that both countries are interested in maximizing their joint welfare. That is, the host country chooses the level of  $\tau$  that maximizes world welfare  $W = V + V^*$ , while the source country tries to do the same when choosing  $B$ . In doing so, the source country sets the value of  $B$  such that

$$(28) \quad W_B = V_B + V_B^* = 0,$$

From eq.(6), and taking into account that  $\pi$  is now a function of both  $\tau$  and  $B$ , we note that the level of welfare of the host country is an increasing function of  $B$ .

$$(29) \quad V_B = -\frac{T}{\tau} \lambda \pi_B > 0.$$

This is because more generous benefits received by returning migrants in S reduce illegal immigration in H. Since  $V_B$  is always positive, we conclude on the basis of (28) that at the Nash equilibrium, where  $V_B^* = 0$ , the value of  $W_B$  is also positive. The cooperative level of  $B$ , call it  $B^C$ , that maximizes the joint level of welfare, is therefore higher than its Nash level,  $B^N$ . This can be seen with the help of figure 3. When  $B = B^N$ , the slope of  $V^*$  is zero, while  $V_B$  is positive. That means that the slope of  $W$  at  $B = B^N$  is also positive and the maximum of  $W$  is achieved at a higher level of  $B = B^C$ .

Similarly, the host country chooses the level of  $\tau$  to maximize its own and the source country's welfare. This requires that

$$(30) \quad W_\tau = V_\tau + V_\tau^* = 0$$

Differentiating eq.(9) with respect to  $\tau$  and using the condition that  $V_B^* = 0$  at the Nash equilibrium, we get

$$(31) \quad V_\tau^* = T(1 - \pi) \left\{ \frac{\alpha}{2} + \lambda^* \frac{B}{\tau^2} \left[ 1 - \frac{\pi \eta_\tau}{(1 - \pi) \eta_B} \right] \right\}.$$

From eq.(31), we see that a sufficient but not necessary condition for  $V_\tau^*$  (and thus  $W_\tau$ ) to be positive at the Nash equilibrium is that

$$(32) \quad (1 - \pi) \eta_B > \pi \eta_\tau.$$

If this condition is satisfied, the level of  $\tau$  that maximizes the joint level of welfare (i.e., the cooperative solution  $\tau^C$ ) is higher than its Nash value,  $\tau^N$ . Condition (32) requires that the ratio of the elasticity of the probability of return with respect to  $B$  to the probability of overstaying with respect to

$\tau$  be higher than  $\frac{\pi}{1-\pi}$ . The relative magnitudes of these two elasticities is an empirical question which is beyond the scope of the present study. What we can say is that the cooperative solution for  $\tau$  is larger, the greater the value of  $\eta_B$  relative to  $\eta_\tau$  and the smaller the value of  $\pi$  at the Nash equilibrium. In other words, the greater the effectiveness of  $B$  relative to  $\tau$  in promoting return of guest workers back to the source country, the larger the value of  $\tau$  in the cooperative equilibrium when compared to Nash. This reflects the tendency of policymakers to rely more heavily on  $B$  and less on  $\tau$  as an instrument aimed at combating illegal immigration in a cooperative setting when the former instrument is relatively more efficient.

It is also interesting to note that maximization of joint welfare in a cooperative equilibrium may not result in an improvement in welfare of *both* countries relative to Nash. As demonstrated above, the cooperative value of  $\tau$  may be either greater or smaller than its Nash level. Consider the borderline case where  $\tau^C = \tau^N$ . Since  $B^C > B^N$ , it follows that cooperation raises the joint level of welfare and that of the host country, while *lowering* the level of welfare of the source country. This is because cooperation requires S to raise  $B$  beyond the value that maximizes its own welfare while in the borderline case, it does not call for any change in  $\tau$  that can potentially offset the loss experienced by S as it raises  $B$  from  $B^N$  to  $B^C$ . This illustrates that achieving cooperation may require side payments as an inducement for the source country to set its policy instrument at a value that maximizes joint welfare.

We summarize our findings in the following proposition.

*Proposition 2:* Assume that country H chooses  $\tau$  and country S chooses  $B$  to maximize the joint level of welfare (i.e., cooperative behavior).

- The cooperative level of  $B$  is higher than the Nash level.
- The cooperative level of  $\tau$  is higher than the Nash level if  $\frac{\eta_B}{\eta_\tau} > \frac{\pi}{1-\pi}$  (sufficient but not necessary).
- Cooperation may lower the welfare of the source country, implying that a side payment may be necessary to induce it to raise the value of  $B$  from  $B^N$  to  $B^C$ .

## 5 Conclusions

This paper examines the interaction between migration policies of the host and source countries in the context of a model of guest-worker migration. For the host, the objective is to provide low-cost labor for its employers while also addressing the problem of illegal immigration. It optimizes over these objectives by setting the maximum duration,  $\tau$ , of a guest-worker permit. As for the source country, we assume that it wants to stimulate the flow of repatriated savings of migrants by offering fiscal benefits and other advantages,  $B$ , to returnees. Within this framework, we solve for the Nash equilibrium and analyse the implications of changes in the exogenous variables for the optimal levels of policy instruments of both countries.

The possibility of international cooperation is also examined assuming that the two countries wish to maximize joint welfare. In comparison with the Nash equilibrium, our results are not as clear cut. Nonetheless, we find that the fiscal benefits offered to returnees by the source country are unambiguously higher in a cooperative equilibrium. The optimal value of  $\tau$  in the cooperative equilibrium is also likely to be greater than its Nash level, although a smaller  $\tau$  cannot be ruled out for certain parameter values. What we can say is that the greater the effectiveness of  $B$  relative to  $\tau$  in encouraging guest workers to return to the source country, the larger the value of  $\tau$  in a cooperative equilibrium when compared to its Nash level. Cooperation, however, may result in a decline in the level of welfare of the source country. To achieve cooperation and get the source country to raise the value of its policy instrument to the cooperative level, it may be necessary for the host country to offer a side payment.

In comparison with other dimensions of international economic relations, there seems to be at the present time too little international cooperation when it comes to policies that affect migration of labor. Immigration policies are often set unilaterally, without adequate consideration given to the interests of the source countries. This has contributed to the rapid growth of illegal immigration and the disorder that it generates in the labor market of the host country as well as in the lives of the migrants. As shown above, it may also result in an inefficient use of policy instruments in both the host and source countries. There is clearly scope for finding superior solutions through

international cooperation in those areas where both the sending and receiving countries have key interests. Bilateral agreements on temporary migration of low-skilled labor between Canada and Mexico, Canada and Caribbean states or Spain and Ecuador are steps in the right direction. More are needed. The main objective of this paper is to stimulate interest in and further research on this increasingly important issue.



## References

Adams, R.H., Jr., 1991, "The Economic Uses and Impact of International Remittances in Rural Egypt," *Economic Development and Cultural Change*, vol. 39: 695-722.

Ammasari, S., 2003, "From Nation-Building to Entrepreneurship: The Impact of élite Return Migrants in Côte d'Ivoire and Ghana." Paper presented to the International Workshop on Migration and Poverty in West Africa, University of Sussex.

Bhagwati, J.N. and T.N. Strinivasan, 1983, "On the Choice between Capital and Labor Mobility," *Journal of International Economics*, vol. 14: 209-221.

Black, R., 2003, "Soaring Remittances Raise New Issues," migration Information Source, San Diego: Migration Policy Institute, June.

de Brauw, A. and S. Rozelle, 2003, "Household Investment through Migration in Rural China," working paper no. 200, Department of Economics, Williams College.

Calvo, G.A. and S. Wellisz, 1983, "International Factor Mobility and National Advantage," *Journal of International Economics*, vol. 14: 103-114.

de Haas, H. and R. Plug, 2006, "Cherishing the Goose with the Golden Eggs: Trends in Migrant Remittances from Europe to Marocco 1970-2004," *International Migration Review*, 40: 603-634.

Djajić, S., 1986, "International Migration, Remittances and Welfare in a Dependent Economy," *Journal of Development Economics*, vol. 21: 229-234.

Djajić, S., 1998, "Emigration and Welfare in an Economy with Foreign Capital," *Journal of Development Economics*, vol. 56: 433-445.

Djajić, S., 2009, "On the Welfare Implications of Temporary and Permanent Immigration," mimeo, Graduate Institute, Geneva.

Durand, J., W. Kandel, E.A. Parrado and D.S. Massey, 1996, "International Migration and Development in Mexican Communities," *Demography*, vol. 33: 249-264.

Epstein, G, A. Hillman and A. Weiss, 1999, "Creating Illegal Aliens," *Journal of Population Economics*, Vol. 12: 3-21.

Escobar-Patapi, A. and M. de la O. Martinez-Castellanos, 1991, "Small Scale Industry and International Migration in Guadalajara." In S. Diaz-Briquets and S. Weintraub, eds., *Migration, Remittances, and Small Business Development: Mexico and Caribbean Basin Countries*. Boulder: Westview.

GAO, 2006, "Foreign Workers: Information on Selected Countries' Experiences," United States Government Accountability Office, September 2006.

Glytsos, N., 1997, "Remmiting Behaviour of 'Temporary' and 'Permanent' Migrants: The Case of Greeks in Germany and Australia," *Labour*, vol. 11: 409-435.

Hatton, T.J., 2007, "Should We Have a WTO for International Migration?" *Economic Policy*, Vol. 22, No. 50, pp. 339-383.

Jensen, C.A., N. Malchow-Moller and L.R. Skaksen, 2007, "Does Coordination of Immigration Policies among Destination Countries Increase Immigration?" DP 2007-15, Centre for Economic and Business Research, Odense, Denmark.

Jones, R.W., I. Coelho, and S.T. Easton, 1986, "The Theory of International Factor Flows: The Basic Model," *Journal of International Economics*, vol. 20: 313-327.

Kirwan, F. and D. Holden, 1986, "Emigrants' Remittances, Non-Traded Goods and Economic Welfare," *Journal of Economic Studies*, vol. 13: 52-58.

Lianos, T., 1997, "Factors Determining Migrant Remittances: The Case of Greece," *International Migration Review*, vol. 31: 72-87.

Lucas, R.E.B., 1987, "Emigration to South Africa's Mines," *American Economic Review*, vol. 77: 313-330.

Lucas, R.E.B., 2005, *International Migration Regimes and Economic Development*, Edward Elgar Publishing.

Martin, P., 2003, "Managing Labor Migration: Temporary Worker Programs for the 21st Century," ILO, Geneva.

Massey, D.S. and E.A. Parrado, 1998, "International Migration and Business Formation in Mexico," *Social Sciences Quarterly*, vol. 79: 1-20.

Nega, B., K. Taddese, S. Nuru, and Z. Mamma, 2004, "Using Resources from Migration for Development in Ethiopia," paper presented at the IOM Workshop on "Mobilization and Utilization of Diaspora Resources for Development in Ethiopia."

Penny, N.J.H., 1986, "Migrant Labour and the South African Gold Mining Industry: A Study of Remittances," *The South African Journal of Economics*, vol. 54: 186-95.

Puri, S. and T. Ritzema, 1999, "Migrant Worker Remittances, Micro-Finance and the Informal Economy: Prospects and Issues," ILO Working Paper No. 21.

Quibria, M.G., 1997, "International Migration, Remittances and Income Distribution in the Source Country: A Synthesis," *Bulletin of Economic Research*, vol. 49: 29-46.

Rivera-Batiz, F., 1986, "International Migration, Remittances and Economic Welfare in the Source Country," *Journal of Economic Studies*, vol. 13: 3-19.

Ruhs, M., 2002, "Temporary Foreign Worker Programs: Policies, Adverse Consequences and the Need to Make them Work," CCIS Working Paper no. 56.

Schiff, M., 2007, "Optimal Immigration Policy: Permanent, Guest-Worker, or Mode IV," IZA discussion paper No. 3083, September 2007.

Stein, N., 2003, "No Way Out," *Fortune*, January 20, 2003.

Swallow, B.M. and R.F. Brokken, 1987, "An Integrated Model of the Lesotho Livestock Range Complex." Paper presented at ILCA Livestock

Policy and Social Sciences Seminar Series, ILCA. Addis Ababa, Ethiopia, 4 February.

Winters, A., T.L. Walmsley, Z.K. Wang and R. Grynberg, 2003, "Liberalizing Temporary Movement of Natural Persons: An Agenda for the Development Round," *The World Economy*, vol. 26: 1137-61.

Woodruff, C. and R. Zenteno, 2007, "Migration Networks and Microenterprises in Mexico," *Journal of Development Economics*, 82: 509-528.

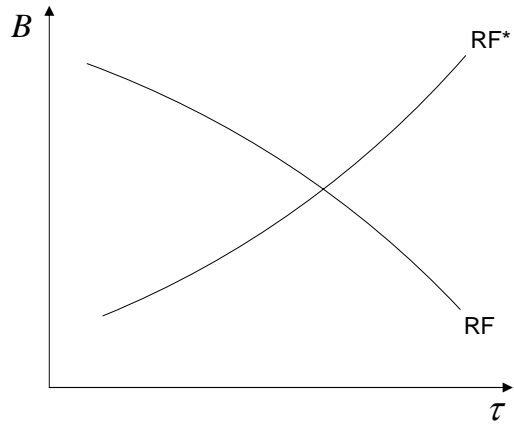


Figure 1a: Nash equilibrium with  $\eta_\tau < 1$

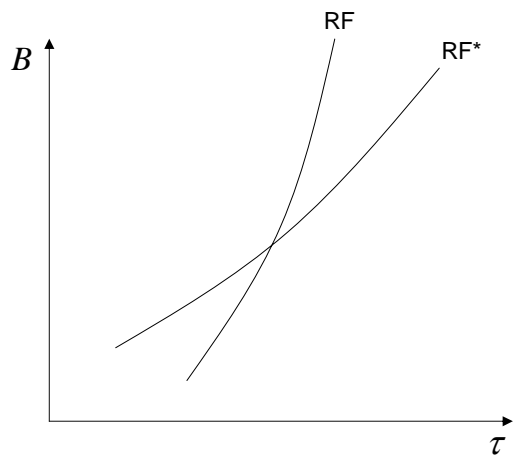


Figure 1b: Nash equilibrium with  $\eta_\tau > 1$

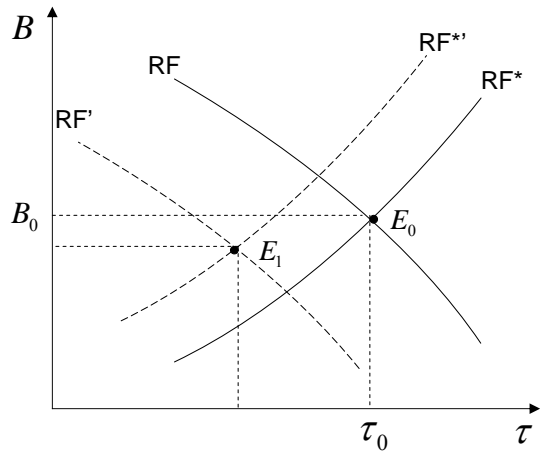


Figure 2a: Effect of an increase in  $\alpha$  when  $\eta_\tau < 1$

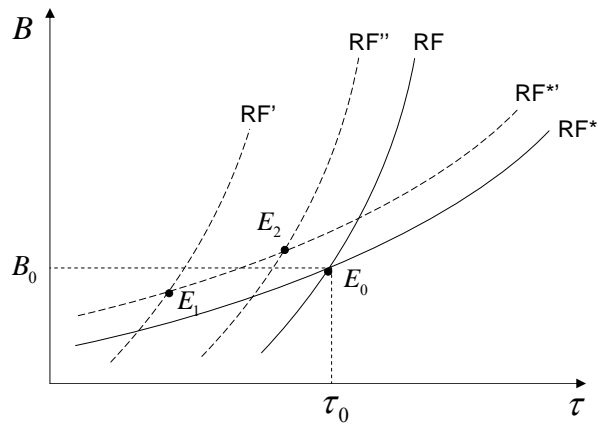


Figure 2b: Effect of an increase in  $\alpha$  when  $\eta_\tau > 1$

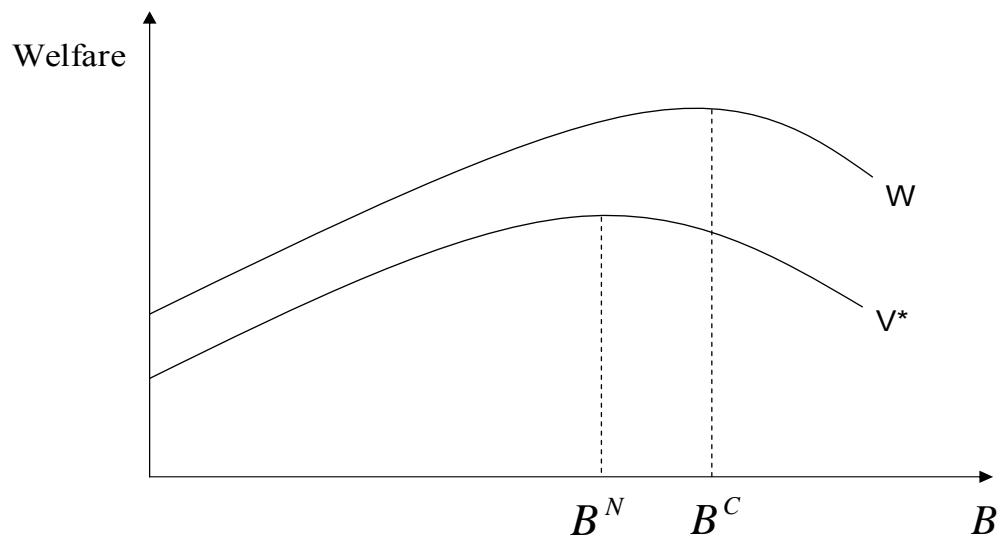


Figure 3: Cooperative and Nash solutions for B

# CESifo Working Paper Series

for full list see [www.cesifo-group.org/wp](http://www.cesifo-group.org/wp)

(address: Poschingerstr. 5, 81679 Munich, Germany, [office@cesifo.de](mailto:office@cesifo.de))

---

- 2749 Rüdiger Pethig and Christian Wittlich, Interaction of Carbon Reduction and Green Energy Promotion in a Small Fossil-Fuel Importing Economy, August 2009
- 2750 Kai Carstensen, Oliver Hülsewig and Timo Wollmershäuser, Monetary Policy Transmission and House Prices: European Cross-country Evidence, August 2009
- 2751 Olaf Posch, Explaining Output Volatility: The Case of Taxation, August 2009
- 2752 Beatrice Scheubel, Daniel Schunk and Joachim Winter, Don't Raise the Retirement Age! An Experiment on Opposition to Pension Reforms and East-West Differences in Germany, August 2009
- 2753 Daniel G. Arce, Dan Kovenock and Brian Roberson, Suicide Terrorism and the Weakest Link, August 2009
- 2754 Mario Larch and Wolfgang Lechthaler, Comparative Advantage and Skill-Specific Unemployment, August 2009
- 2755 Horst Raff and Nicolas Schmitt, Buyer Power in International Markets, August 2009
- 2756 Seppo Kari, Hanna Karikallio and Jukka Pirttilä, The Impact of Dividend Taxation on Dividends and Investment: New Evidence Based on a Natural Experiment, August 2009
- 2757 Mirco Tonin and Michael Vlassopoulos, Disentangling the Sources of Pro-social Behavior in the Workplace: A Field Experiment, August 2009
- 2758 Nicole Grunewald and Inmaculada Martínez-Zarzoso, Driving Factors of Carbon Dioxide Emissions and the Impact from Kyoto Protocol, August 2009
- 2759 Yu-Fu Chen and Michael Funke, Booms, Recessions and Financial Turmoil: A Fresh Look at Investment Decisions under Cyclical Uncertainty, August 2009
- 2760 Jan-Egbert Sturm and Jakob de Haan, Does Central Bank Communication really Lead to better Forecasts of Policy Decisions? New Evidence Based on a Taylor Rule Model for the ECB, August 2009
- 2761 Larry Karp, Sacrifice, Discounting and Climate Policy: Five Questions, August 2009
- 2762 Marianna Belloc and Samuel Bowles, International Trade, Factor Mobility and the Persistence of Cultural-Institutional Diversity, August 2009
- 2763 Charles Noussair and Fangfang Tan, Voting on Punishment Systems within a Heterogeneous Group, August 2009



- 2764 Birgit Bednar-Friedl and Karl Farmer, Internationally Coordinated Emission Permit Policies: An Option for Withdrawers from the Kyoto Protocol?, August 2009
- 2765 Pierre M. Picard and David E. Wildasin, Labor Market Pooling, Outsourcing and Labor Contracts, August 2009
- 2766 Stefan Voigt and Lorenz Blume, The Economic Effects of Federalism and Decentralization – A Cross-Country Assessment, August 2009
- 2767 David S. Jacks, Christopher M. Meissner and Dennis Novy, Trade Booms, Trade Busts, and Trade Costs, August 2009
- 2768 Mario Jametti and Thomas von Ungern-Sternberg, Hurricane Insurance in Florida, August 2009
- 2769 Alessandro Balestrino, Kind of Black: The Musicians' Labour Market in Italy, August 2009
- 2770 Yosr Abid Fourati and Cathal O'Donoghue, Eliciting Individual Preferences for Pension Reform, August 2009
- 2771 Christian Breuer and Chang Woon Nam, VAT on Intra-Community Trade and Bilateral Micro Revenue Clearing in the EU, August 2009
- 2772 Choudhry Tanveer Shehzad, Jakob De Haan and Bert Scholtens, Growth and Earnings Persistence in Banking Firms: A Dynamic Panel Investigation, August 2009
- 2773 Erdal Yalcin, Uncertain Productivity Growth and the Choice between FDI and Export, August 2009
- 2774 Klaus Abberger, Wolfgang Nierhaus and Shynar Shaikh, Findings of the Signal Approach for Financial Monitoring in Kazakhstan, September 2009
- 2775 Sascha O. Becker, Francesco Cinnirella and Ludger Woessmann, The Trade-off between Fertility and Education: Evidence from before the Demographic Transition, September 2009
- 2776 Thomas Aronsson and Erkki Koskela, Optimal Income Taxation, Outsourcing and Policy Cooperation in a Dynamic Economy, September 2009
- 2777 Joel Slemrod, Old George Orwell Got it Backward: Some Thoughts on Behavioral Tax Economics, September 2009
- 2778 Cagri Seda Kumru and Athanasios C. Thanopoulos, Social Security Reform and Temptation, September 2009
- 2779 Alessandro Buccioli and Roel M. W. J. Beetsma, Inter- and Intra-generational Consequences of Pension Buffer Policy under Demographic, Financial and Economic Shocks, September 2009

- 2780 Eduardo Strube and Marcelo Resende, Complementarity of Innovation Policies in the Brazilian Industry: An Econometric Study, September 2009
- 2781 Henry Tulkens and Vincent van Steenberghe, "Mitigation, Adaptation, Suffering": In Search of the Right Mix in the Face of Climate Change, September 2009
- 2782 Maria L. Loureiro, Anna Sanz-de-Galdeano and Daniela Vuri, Smoking Habits: Like Father, Like Son, Like Mother, Like Daughter, September 2009
- 2783 Momi Dahan, Tehila Kogut and Moshe Shalem, Do Economic Policymakers Practice what they Preach? The Case of Pension Decisions, September 2009
- 2784 Eytan Sheshinski, Uncertain Longevity and Investment in Education, September 2009
- 2785 Nannette Lindenberg and Frank Westermann, How Strong is the Case for Dollarization in Costa Rica? A Note on the Business Cycle Comovements with the United States, September 2009
- 2786 Leif Danziger, Noncompliance and the Effects of the Minimum Wage on Hours and Welfare in Competitive Labor Markets, September 2009
- 2787 Gerlinde Fellner, Rupert Sausgruber and Christian Traxler, Testing Enforcement Strategies in the Field: Legal Threat, Moral Appeal and Social Information, September 2009
- 2788 Gabriel J. Felbermayr, Mario Larch and Wolfgang Lechthaler, Unemployment in an Interdependent World, September 2009
- 2789 Sebastian G. Kessing, Federalism and Accountability with Distorted Election Choices, September 2009
- 2790 Daniel Gros, Global Welfare Implications of Carbon Border Taxes, September 2009
- 2791 Louis N. Christofides, Michael Hoy and Ling Yang, The Gender Imbalance in Participation in Canadian Universities (1977-2005), September 2009
- 2792 Jan K. Brueckner and Robert W. Helsley, Sprawl and Blight, September 2009
- 2793 Vidar Christiansen and Stephen Smith, Externality-correcting Taxes and Regulation, September 2009
- 2794 John Beirne, Guglielmo Maria Caporale, Marianne Schulze-Ghattas and Nicola Spagnolo, Global and Regional Spillovers in Emerging Stock Markets: A Multivariate GARCH-in-mean Analysis, September 2009
- 2795 Rüdiger Pethig and Frieder Kolleß, Asymmetric Capital-Tax Competition, Unemployment and Losses from Capital Market Integration, September 2009
- 2796 Ngo Van Long, Horst Raff and Frank Stähler, Innovation and Trade with Heterogeneous Firms, September 2009

- 2797 Margit Osterloh and Bruno S. Frey, Research Governance in Academia: Are there Alternatives to Academic Rankings?, September 2009
- 2798 Thiess Buettner and Clemens Fuest, The Role of the Corporate Income Tax as an Automatic Stabilizer, September 2009
- 2799 Annette Alstadsæter, Measuring the Consumption Value of Higher Education, September 2009
- 2800 Peter Friedrich, Chang Woon Nam and Janno Reiljan, Local Fiscal Equalization in Estonia: Is a Reform Necessary?, September 2009
- 2801 Evžen Kočenda and Jan Hanousek, State Ownership and Control in the Czech Republic, September 2009
- 2802 Michael Stimmelmayer, Wage Inequality in Germany: Disentangling Demand and Supply Effects, September 2009
- 2803 Biswa N. Bhattacharyay, Towards a Macroprudential Surveillance and Remedial Policy Formulation System for Monitoring Financial Crisis, September 2009
- 2804 Margarita Katsimi, Sarantis Kalyvitis and Thomas Moutos, “Unwarranted” Wage Changes and the Return on Capital, September 2009
- 2805 Christian Lessmann and Gunther Markwardt, Aid, Growth and Devolution, September 2009
- 2806 Bas Jacobs and Dirk Schindler, On the Desirability of Taxing Capital Income to Reduce Moral Hazard in Social Insurance, September 2009
- 2807 Hans Gersbach and Noemi Hummel, Climate Policy and Development, September 2009
- 2808 David E. Wildasin, Fiscal Competition for Imperfectly-Mobile Labor and Capital: A Comparative Dynamic Analysis, September 2009
- 2809 Johan Eyckmans and Cathrine Hagem, The European Union’s Potential for Strategic Emissions Trading through Minimal Permit Sale Contracts, September 2009
- 2810 Ruediger Bachmann and Christian Bayer, The Cross-section of Firms over the Business Cycle: New Facts and a DSGE Exploration, October 2009
- 2811 Slobodan Djajić and Michael S. Michael, Temporary Migration Policies and Welfare of the Host and Source Countries: A Game-Theoretic Approach, October 2009