MIGRATORY POLICY IN DEVELOPING COUNTRIES: HOW TO BRING BEST PEOPLE BACK?

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Abstract

This paper analyzes the decision of a migrant to return or stay within the framework of a signaling model with exogenous migratory costs. If employers have only imperfect information about the type of a worker and good workers migrate, bad workers might copy their strategy in order to get the same high wage as the good workers. Employers will therefore reduce the wage they pay to migrants and good workers incur a loss compared to the perfect information setup. In one hybrid equilibrium of the game, the more bad workers migrate, the higher the incentive for good workers to come back. Policy implications follow.

Keywords: Temporary migration, Return migrants, Hybrid Bayesian Equilibrium, Signaling model.

JEL Classification: J61, F22, D82

1. Introduction

Compared to the other dimensions of economic globalization -- international trade and movements of capital -- international flows of labour used to be traditionally small. The existence of a system of double barriers, with restrictions on people to leave poor countries and restrictions to reach the developed ones, can explain both why immigration flows were small and why most of the migrants were of the permanent type. However, in the last few years, subject to an aging population and shortages of labor in some sectors, many governments in the developed countries become more favorable to open their countries to foreign workers. True, political support to immigration of skilled workers is much stronger than for the non skilled. To the contrary, in the developing countries, many policymakers are upset about the "brain-drain" phenomenon, where skilled workers are attracted by the perspective of higher living standards in the developed countries, thus depleting what seems to be a very scarce resource in these areas. Migration of the unskilled workforce is seen as a less harmful phenomenon, especially if unemployment in the developing country is high.

In 2005-2007, twelve relatively poor Eastern European countries joined the European Union. This created an exceptional opportunity for workers form the East to live and work in the West (Mansour and Quillin, 2006). According to the European Commission's latest report on cross-border labor mobility (European Commission, 2008), more and more workers from the EU's 12 newest member states have been relocating to the Western regions of Europe since being allowed to move freely. However, their numbers remain small as compared to the population of the host countries. For instance, the number of Bulgarians and Romanians who found a job in one of the EU's 15 older member states grew to 1.6 million in 2007, that is 0.4 percent of the total population of the EU's richest nations, up from 1.3 million in 2006 -- when those two countries were not yet part of the EU. Citizens from Poland and from the other nine countries that joined the EU in 2004 now account for 0.5 percent of the resident population of the EU's richest nations, up from 0.3 percent in 2004.

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Another element to be taken into account when analyzing international movements of labor pertains to the distinction between temporary and permanent migration. At difference with permanent migrants, temporary migrants work abroad for a pre-determined time period, then return. It may be argued that workers hired under a fixed-term contract have no other choice but to return, so there is no genuine economic decision to analyze. However, in many cases, workers who go abroad on temporary contracts can stay longer should they really want it.

In general, temporary migration is seen as bringing a net positive contribution to the development of the sending country. True, migration, even if it is temporary, diminishes the amount of available labor at home. If there are labor shortages, this first impact of temporary migration is negative; yet, if the unemployment in the developing country is high, temporary migration can alleviate the pressure on the welfare system. Other benefits stem from the improvement in human capital connected to short spells of work abroad and the investment in the origin country of the migrants' savings (Ruhs, 2005). It turns out that a non-negligible proportion of the new East-West European migrants are temporary. From the outset, they do not commit on staying forever in the host country. They consider the case for working for some time in the West, then to come back (Dustmann, 2000; Dustmann and Weiss, 2007).[3] For example, data for the UK and Ireland suggest that around half of the EU-8 citizens who have come to work in the UK since 2004 may have already left the country again (European Commission, 2008).

Several economists aimed at explaining the migrant's decision to return. In general, in these analyses, critical elements are the costs and benefits of migration. Benefits are most often interpreted as a better wage, given that in general migrants come from less developed regions (Hicks, 1932). Costs to migration measure some form of disutility connected to living far from one's friends and family. A standard model of return migration was worked out by Borjas and Bratsberg (1996), building on the methodology introduced by Borjas (1987) in an early paper.[4] The basic framework is a self-selection model with stochastic income. From the outset, skill distribution of the migrants dominates the skill distribution of the stayers. Upon arriving in the rich country, the migrant makes a draw from a known distribution of wages; if the wage is low enough, he will return, if not he will stay. If he returns, he will make again a draw from a random distribution. The decision to migrate, then to return is driven by a comparison between the actual and expected gains. One important conclusion is that if both cost of migrating and the cost of returning increase, the frequency of return migrants declines.[5] Stark (1995) works out a migration model with asymmetric information about the type of the migrants, where migrants' true skills are revealed with a lag. When low-skilled workers are no longer pooled with high-skilled workers, they return. Dustmann and Weiss (2007) analyze the worker's decision to migrate, stay or return within a continuous time model with investment in human capital; the worker decides on the optimal migration and return moments such as to maximize intertemporal utility, given that he must weight the cost of living among foreigners against the benefit of enhancing his skills by working in a more demanding environment. Indeed, migrants might take advantage of their stay abroad to foster their productivity by acquiring new skills, learning new production and organization methods, foreign languages, or join useful professional networks.[6]

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[3]Temporary migration can also be observed between Latin and North America, and within the East-Asian region.

[4]Itself an extenssion of the classical Roy model (Roy, 1951).

[5]See also De Coulon and Piracha (2002) for an empirical test of a variant of this model with Albanian data.

[6]Mesnard (2004) uses data from a Tunisia survey to show that the evidence about this process of

Some economists have unveiled from the data that return migrants tend to find a job easier, and that sometimes they get better wages than similar left-home workers. For instance, Iara (2006) found that young Eastern European man who moved and came back tend to claim in average 30% higher earnings than equivalent left-home workers. Hazans (2008) shows that Latvian return migrants command an earnings' premium as high as 15% compared to identical stayers.[7] Such empirical evidence is consistent with both the self-selection cum bad luck model or the human capital accumulation model.

This paper develops an original, complementary explanation that is consistent with these stylized facts. Migration is analyzed as a signal for hidden productivity along the lines of the classical model by Spence (1973). Our analysis is cast as a simple two-period game, with two types of workers -- highly productive and less productive, under imperfect information of the employers about the type of the worker. To neutralize one important cause of migration, we assume that worker's productivity is the same in the sending and the destination country. Firms pay the worker a wage identical to the expected productivity. Migration can have signaling virtues only if migratory costs are larger for bad workers than for good workers. In this paper, we build on a cost structure where all good workers migrate at the first period. At the second period, they can either return back home or and stay in the host country. Despite bearing higher migratory costs, bad workers can choose to migrate in order to be perceived as good workers and get a better wage. If they migrate, they can either return or stay. The game presents various equilibria depending on parameter values. In some cases, equilibria are multiple: which one actually materializes depends on firm equilibrium beliefs. The most interesting case is a complete hybrid equilibrium where both good and bad workers implement mixed strategies: some but not all good workers return, some but not all bad workers migrate and return.

Besides the productivity differential, an important variable in our analysis is the migratory cost. Such a cost has a strong psychological component, related to the energy that the migrant needs to spend in order to adapt to a different environment. Other components such as traveling costs have a "transaction cost" nature, and can be easier converted into monetary expenses. Governments in the origin country can have an impact on such costs. They may for instance provide free language courses for prospective emigrants, subsidize transport (for instance, subsidize a discount journey every year), set up cultural centers in the destination country, provide good consular services, and so on. By choosing their country of destination, and the "distance" between home and destination, good workers can also have a bearing on migratory costs. In this context, the concept of distance is not only geographical, but also cultural. Notice that when migration is used as a signaling device, bad workers can only follow good workers, they have no word to say about choosing the destination.

The logic of strategic signaling has already been applied to the one-way migration decision by Katz and Stark (1987). In their model, employers in the rich country know only the distribution of immigrants' skills and pay them the average expected productivity. Imperfect information is responsible for inefficient migration patterns as compared to the perfect information setup. They show that the highly skilled workers may want to pay the price of signalling, should such a signalling device exist.

Our analysis builds on several simplifying assumptions: at difference with Borjas and Bratsberg (1996) and other companion papers, in our setup wages are deterministic (there is no

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human capital accumulation is weak.

[7]The test controls for demographic characteristics, education, foreign and unemployment experience of family members.

random shock to be discovered by the migrant once abroad). We also rule out the possibility of investing in human capital, which was an essential element in the paper by Dustmann and Weiss (2007). These simplifications will allow us to focus on the pure signaling virtues of migratory strategies. As in the permanent migration analysis of Katz and Stark (1987), a migrant's wage depends not only on his own characteristics, hard work and luck, but also on the various strategies of the other workers.

The paper is organized as follows. The next section introduces the model. Section 3 presents the pure strategy equilibria of the game. Hybrid equilibria are analyzed in section 4. Policy issues are introduced in section 4. The last section presents the conclusion.

2. The model

2.1. Main assumptions

There are two countries, the sending and the destination country. The internationally mobile labor force of the sending country is normalized to 1. A worker has the same productivity in the sending and the destination country. In the sending country there are α highly productive workers, with a productivity θ^g (good type) and $1-\alpha$ workers with a low productivity θ^b (bad type) , with $\theta^g > \theta^b$. Worker productivity is a deterministic variable; it is the same in the sending and the host country. Firms make zero expected profits: they pay wages identical to the expected productivity of each worker.

Migratory costs per period are c^g for the type g and c^b for the type b, with $c^g < \theta^g$ and $c^b < \theta^b$. Furthermore, migration can be a useful signaling device only if $c^g < c^b$. We assume that this condition holds hereafter.[8]

Workers live for two periods. At the first period, workers can migrate (M) or not ($\bar{M}$); at the second period, those who migrated at the first period can return home (R), or stay in the host country (S). In order to keep the model as simple as possible, we restrict the range of parameters such as to rule out the cases where good workers have no incentive migrate even if this action allows them to signal their type. This implies that the migratory cost of the good workers is low enough, more precisely that $c^g < 2(1-\alpha)(\theta^g - \theta^b)$. [9]

We define by w_1 (and w_2) the wage expected by a worker at the end of period 1 (and respectively period 2), depending on the history of the game (i.e., the observed decisions).

We denote by π the proportion of good migrants who choose to return and by $1-\pi$ the proportion of good migrants who choose to stay.

Bad workers can either migrate or not; if they migrate they can either stay or return. The

[8]To keep the model as simple as possible, we assume that migratory costs are time-invariant. In a more powerful model, migratory cost could change in time. However, the direction of change is not clear, some cost components should go down (migrants adapt to the new environment), some cost components rise (migrants miss their friends and family).

[9] The proof is straightforward if we compare the two-period payoff of a good worker that firstly migrates then comes back $(2\theta^g - c^g)$ with the payoff of a good worker who decides to fond into the mass of workers $2[\alpha\theta^g + (1-\alpha)\theta^b]$. It can be shown that this condition also rules out a hybrid equilibrium where good workers are indifferent between migrating or not.

proportion of bad workers who leave and stay is q, the proportion of workers who leave and return is p, thus the proportion of bad workers who do not migrate is $(1-p-q)$.

The basic sequence of decisions is summarized by a decision tree in Figure 1.

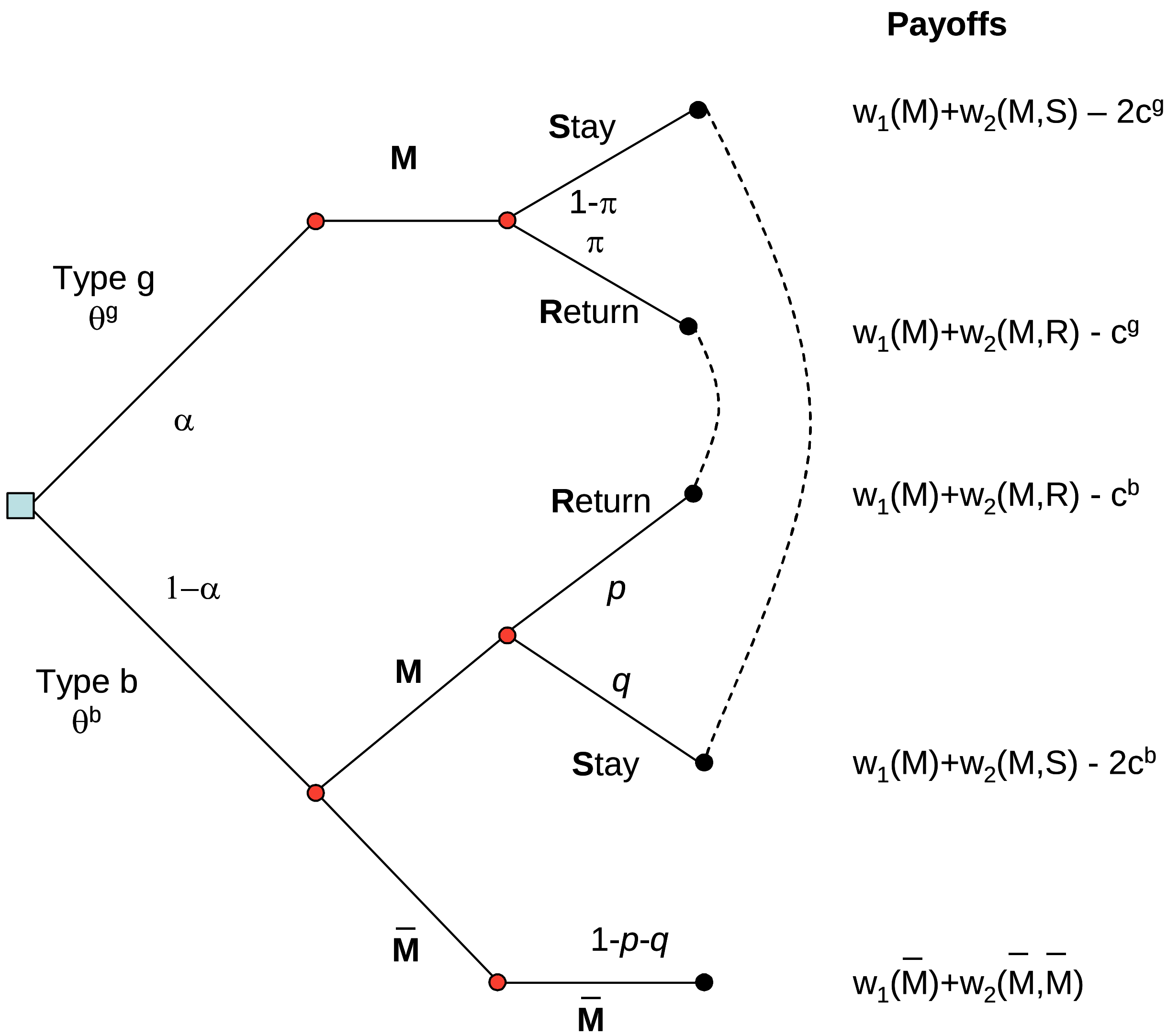

Figure 1. Decision tree

At the beginning of the game, Nature decides on the type of worker, b or g. At time $t = 1$, good workers migrate, bad workers have the choice between migrating or not; at $t = 2$ all migrants, bad or good, have the choice between returning home or staying in the host country. There are three main strategies: $(\bar{M},\bar{M})$ - do not migrate, (M,S) -- migrate and stay and (M,R) -- migrate and return. Only the first one reveals the type of worker. The two others can be implemented by both good and bad workers, hence the dotted lines that connects the similar strategies.

2.2. Strategies, beliefs, payoffs

We define the *strategy* of the g -type worker by a linear combination of the two pure strategies: (M,R) and (M,S) .

$$s^g = \begin{cases} \text{play } (M,R) \text{ with probability } \pi \\ \text{play } (M,S) \text{ with probability } (1-\pi) \end{cases}$$

The strategy of the b -type worker is a linear combination of the three pure strategies: $(\bar{M},\bar{M})$, (M,R) and (M,S) :

$$s^b = \begin{cases} \text{play } (M,R) \text{ with probability } p \\ \text{play } (M,S) \text{ with probability } q \\ \text{play } (\bar{M},\bar{M}) \text{ with probability } (1-p-q) \end{cases}$$

Let us define by μ^s the conditional probability that the worker is good given his past strategy s . Under our assumptions, employers' beliefs are:

a) After the first period:

$$\begin{cases} \mu^M = \Pr[\theta^g|M] = \dfrac{\Pr[M|\theta^g]\Pr[\theta^g]}{\Pr[M]} = \dfrac{\Pr[M|\theta^g]\Pr[\theta^g]}{\Pr[M|\theta^g]\Pr[\theta^g]+\Pr[M|\theta^b]\Pr[\theta^b]} = \dfrac{\alpha}{\alpha+(1-\alpha)(p+q)} \\ \mu^{\bar{M}} = \Pr[\theta^g|\bar{M}] = 0 \end{cases}$$

b) After the second period:

$$\begin{cases} \mu^{MR} = \Pr[\theta^g|(M,R)] = \dfrac{\Pr[(M,R)|\theta^g]\Pr[\theta^g]}{\Pr[(M,R)|\theta^g]\Pr[\theta^g]+\Pr[(M,R)|\theta^b]\Pr[\theta^b]} = \dfrac{\alpha\pi}{\alpha\pi+(1-\alpha)p} \\ \mu^{MS} = \Pr[\theta^g|(M,S)] = \dfrac{\Pr[(M,S)|\theta^g]\Pr[\theta^g]}{\Pr[(M,S)|\theta^g]\Pr[\theta^g]+\Pr[(M,S)|\theta^b]\Pr[\theta^b]} = \dfrac{\alpha(1-\pi)}{\alpha(1-\pi)+(1-\alpha)q} \\ \mu^{\bar{M}\bar{M}} = \Pr[\theta^g|(\bar{M},\bar{M})] = 0 \end{cases}$$

Since firms pay wages identical to the worker's expected productivity, workers' equilibrium payoffs contingent upon their strategy are:

$$U^b(\bar{M},\bar{M}) = w_1(\bar{M}) + w_2(\bar{M}) = 2\theta^b$$

$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = \frac{\alpha\theta^g + (1-\alpha)(p+q)\theta^b}{\alpha + (1-\alpha)(p+q)} - c^i + \frac{\alpha\pi\theta^g + (1-\alpha)p\theta^b}{\alpha\pi + (1-\alpha)p}$$

$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = \frac{\alpha\theta^g + (1-\alpha)(p+q)\theta^b}{\alpha + (1-\alpha)(p+q)} + \frac{\alpha(1-\pi)\theta^g + (1-\alpha)q\theta^b}{\alpha(1-\pi) + (1-\alpha)q} - 2c^i$$

where $i \in \{g,b\}$.

A Nash *equilibrium* of this game is defined as a situation where workers choose their optimal migratory strategy given employers' beliefs, and employers' beliefs are correct given workers' optimal migratory strategies. We can distinguish between three types of equilibria: a separating configuration -- where each type of worker chooses a specific migratory strategy, a pooling configuration -- where all workers carry out the same migratory strategy, and a hybrid configuration -- where at least one type of worker is randomizing between pure strategies.

The list of all logically possible combinations of strategies can be drawn easily. Hereafter we will analyze only on the feasible equilibria.[10] We firstly analyze the pure strategy equilibria of the game then turn to mixed strategy equilibria.

3. Pure strategy equilibria

Proposition 1. The game presents a socially efficient separating equilibrium where bad workers do not migrate $(\bar{M},\bar{M})$ and good workers migrate and return (M,R) , under the sufficient and necessary condition:

$$(\theta^g - \theta^b) < \frac{c^b}{2}.$$

Proof See Appendix A

If the migratory cost of bad workers is too high, they do not migrate and migration is a strategy specific to the good worker. The latter has no incentive to stay for good, since migration signals him as a good worker (and he can spare the migratory cost at the second period).

In this equilibrium, firms in the origin country can use the migratory track record of an individual as an efficient screening device. Furthermore, because high productivity workers come back, overall output in the origin country edges up.

Proposition 2. The game presents a socially inefficient separating equilibrium where bad workers do not migrate $(\bar{M},\bar{M})$ and good workers migrate and stay (M,S) , under the sufficient and necessary condition:

$$c^g < (\theta^g - \theta^b) < c^b.$$

[10]The proof of inexistence of the other equilibria can be provided on request.

Proof See Appendix A

In this equilibrium, employers in the sending country do not expect good workers to come back. Equilibrium beliefs are such that the return strategy is associated to a bad worker. Hence, such an equilibrium can exist only if the migratory cost of good workers is not too high. To the opposite, the migratory cost c^b of the bad workers must be large enough to prevent them from copying the strategy of the good workers.

Compared to the former efficient separating equilibrium, at time $t = 2$ the economy-wide output is lower because all the highly productive workers have left for good. The only left home workers are the low productive ones.

Proposition 3. The game presents a pooling equilibrium where all workers ***migrate and stay,*** under the sufficient and necessary condition:

$$\frac{c^b}{\alpha} < (\theta^g - \theta^b).$$

Proof See Appendix A.

Here, the migratory cost is so low that bad workers would leave too, in order to mimic the good ones. Furthermore, if a worker does not migrate, he will be perceived as a bad worker. The same rationale prompts them to stay abroad, since the decision to return is associated to a bad worker. The good workers are therefore "trapped" into an inefficient strategy.

Proposition 4. The game presents a pooling equilibrium where all workers ***migrate and return,*** under the sufficient and necessary condition:

$$\frac{c^b}{2\alpha} < (\theta^g - \theta^b)$$

Proof See Appendix A.

In this equilibrium the good worker will return, but will not benefit from the signalling effect. However, he has no other choice but to migrate, since if he stays he will be perceived as a bad one. Despite the high migratory cost, $b-$ type workers also migrate in a first step, because the large frequency of good workers allow them to benefit of a high wage.[11]

4. Hybrid equilibria

Probably the most interesting situation is that where both types of workers play Nash mixed strategies. Indeed, in real life, patterns of migration seldom display pure strategies. Before analyzing these equilibria, we should state a proposition that allows to simplify the list of possible actions.

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[11]Appendix A shows that this equilibrium can occur for $\frac{c^b}{2\alpha} < (\theta^g - \theta^b)$ if firms beliefs are $\Pr[g|(MS)] = 0$. If $\Pr[g|(MS)] = 1$, the equilibrium exists only for $\frac{c^b}{2\alpha} < (\theta^g - \theta^b) < \frac{c^g}{1-\alpha}$.

Proposition 5. If good workers are indifferent between returning or staying $(\pi \in]0,1[)$, all bad workers who have migrated at the first period prefer to return $(q = 0)$.

Proof. Starting from the indifference condition:

$$\begin{aligned} U^g(M,R) &= U^g(M,S) \\ w_1(M) - c^g + w_2(M,R) &= w_1(M) + w_2(M,S) - 2c^g \\ w_1(M) + w_2(M,R) &= w_1(M) + w_2(M,S) - c^g \end{aligned}$$

given that $c^b > c^g$, we can write:

$$\begin{aligned} w_1(M) + w_2(M,R) &> w_1(M) + w_2(M,S) - c^b \\ w_1(M) + w_2(M,R) - c^b &> w_1(M) + w_2(M,S) - 2c^b \end{aligned}$$

The later inequality is equivalent to $U^b(M,R) > U^b(M,S)$, thus $q = 0$. ■

We have thus established that $\pi \in]0,1[\Rightarrow q = 0$. We can now analyze the equilibria.

4.1. Full Hybrid Equilibrium. Some good workers return, the other stay. Some bad workers migrate and return, the other do not migrate.

In this equilibrium, $\pi \in]0,1[$, $p \in]0,1[$ and $q = 0$.

Proposition 6. The game presents an equilibrium where a fraction $\pi \in]0,1[$ of good migrants decide to return, the other $(1-\pi)$ good workers stay in the host country; a fraction $p \in]0,1[$ of bad workers migrate and return, the other $(1-p)$ do not migrate, with:

$$\pi^* = \frac{(\theta^g - \theta^b - c^g)}{c^g} \frac{[2(\theta^g - \theta^b) - (c^g + c^b)]}{[(c^g + c^b) - (\theta^g - \theta^b)]}$$

$$p^* = \frac{\alpha}{(1-\alpha)} \frac{[2(\theta^g - \theta^b) - (c^g + c^b)]}{[(c^g + c^b) - (\theta^g - \theta^b)]}$$

provided that:

$$\frac{(c^g + c^b)}{2} < (\theta^g - \theta^b) < \min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^g + c^b}{1+\alpha}\right)\right\}$$

Proof With $\pi \in]0,1[$, $p \in]0,1[$, (and $q = 0$), workers' payoffs become:

$$U^b(\bar{M},\bar{M}) = w_1(\bar{M}) + w_2(\bar{M},\bar{M}) = 2\theta^b$$

$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = \frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} - c^i + \frac{\alpha\pi\theta^g + (1-\alpha)p\theta^b}{\alpha\pi + (1-\alpha)p}$$

$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = \frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} + \theta^g - 2c^i$$

A first equilibrium condition:

$$U^g(M,R) = U^g(M,S)$$

$$\frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} - c^g + \frac{\alpha\pi\theta^g + (1-\alpha)p\theta^b}{\alpha\pi + (1-\alpha)p} = \frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} + \theta^g - 2c^g$$

$$\alpha\pi c^g = (1-\alpha)p[(\theta^g - \theta^b) - c^g]$$

allows to define the probability π as a function of p and various parameters:

$$\pi = \frac{(1-\alpha)}{\alpha}\frac{(\theta^g - \theta^b - c^g)}{c^g}p$$

Notice the necessary condition for existence:

$$(\theta^g - \theta^b - c^g) > 0 \Leftrightarrow c^g < \theta^g - \theta^b.$$

The second equilibrium condition defines p according to parameters and π :

$$U^b(M,R) = U^b(\bar{M},\bar{M})$$

$$\frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} - c^b + \frac{\alpha\pi\theta^g + (1-\alpha)p\theta^b}{\alpha\pi + (1-\alpha)p} = 2\theta^b$$

The equilibrium probability p^* can be determined if we substitute π by its former expression :

$$\frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} - c^b + \frac{\alpha\frac{(1-\alpha)}{\alpha}\frac{(\theta^g-\theta^b-c^g)}{c^g}p\theta^g + (1-\alpha)p\theta^b}{\alpha\frac{(1-\alpha)}{\alpha}\frac{(\theta^g-\theta^b-c^g)}{c^g}p + (1-\alpha)p} = 2\theta^b$$

$$p^* = \frac{\alpha}{(1-\alpha)}\frac{[2(\theta^g - \theta^b) - (c^g + c^b)]}{[(c^g + c^b) - (\theta^g - \theta^b)]}$$

We then get :

$$\pi^* = \frac{(1-\alpha)}{\alpha}\frac{(\theta^g - \theta^b - c^g)}{c^g}p^* = \frac{(\theta^g - \theta^b - c^g)}{c^g}\frac{[2(\theta^g - \theta^b) - (c^g + c^b)]}{[(c^g + c^b) - (\theta^g - \theta^b)]}$$

This equilibrium exists if both $p^* \in [0,1]$ and $\pi^* \in [0,1]$. We check first the conditions for $p^* > 0$ and $\pi^* > 0$. We must have either $[2(\theta^g - \theta^b) - c^g - c^b] > 0$ and $[(c^g + c^b) - (\theta^g - \theta^b)] > 0$ or $[2(\theta^g - \theta^b) - c^g - c^b] < 0$ and $[(c^g + c^b) - (\theta^g - \theta^b)] < 0$. Only the former case is possible; it entails that:

$$\frac{(c^g + c^b)}{2} < (\theta^g - \theta^b) < (c^g + c^b)$$

with $p^* = 0$ and $\pi^* = 0$ for $(\theta^g - \theta^b) = \frac{(c^g + c^b)}{2}$.
Then condition $\pi^* < 1$ requires that:

$$\frac{(\theta^g - \theta^b - c^g)}{c^g}\frac{[2(\theta^g - \theta^b) - (c^g + c^b)]}{[(c^g + c^b) - (\theta^g - \theta^b)]} < 1 \Leftrightarrow (\theta^g - \theta^b) < c^g + \frac{1}{2}c^b$$

and condition $p^* < 1$ needs:

$$\frac{\alpha}{(1-\alpha)}\frac{[2(\theta^g - \theta^b) - (c^g + c^b)]}{[(c^g + c^b) - (\theta^g - \theta^b)]} < 1 \Leftrightarrow (\theta^g - \theta^b) < \frac{1}{(1+\alpha)}(c^g + c^b)$$

All these conditions can be written in a compact form :

$$\frac{(c^g + c^b)}{2} < (\theta^g - \theta^b) < \min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^g + c^b}{1+\alpha}\right)\right\}$$

■

We can easily see that $\frac{(c^g + c^b)}{2} < \min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^g + c^b}{1+\alpha}\right)\right\},$. thus there are always some values of $(\theta^g - \theta^b)$ such as this equilibrium can exist. We can also remark that the efficient separating equilibrium is not consistent with this hybrid equilibrium. Indeed, the separating equilibrium is possible if $2(\theta^g - \theta^b) < c^b$ which is in stark contradiction with $(c^g + c^b) < 2(\theta^g - \theta^b)$.

In this equilibrium, the probability that the good worker comes back π^* is a decreasing function in both c^g and c^g. If policymakers aim at increasing the proportion of good workers that return, they should reduce migratory costs. This policy would also lead to an increase in the proportion of bad workers that migrate and return.

4.2. Bad workers are indifferent between "not migrate" and "migrate-return". Good

workers migrate and return.

Proposition 7. There is a partial Hybrid equilibrium 1 where all good workers migrate and return $(\pi = 1)$, a fraction $p \in]0,1]$ of the bad workers migrate and return, no bad worker migrates and stays $(q = 0)$, with

$$p = \frac{\alpha}{(1-\alpha)} \frac{2(\theta^g - \theta^b) - c^b}{c^b}$$

provided that:

$$\frac{c^b}{2} < (\theta^g - \theta^b) < \min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^b}{2\alpha}\right)\right\}.$$

Proof Equilibrium conditions are: $U^b(M,R) = U^b(\bar{M},M)$, $U^b(M,R) > U^b(M,S)$ and $U^g(M,R) > U^g(M,S)$.

Assume that good workers migrate and return so ($\pi = 1$) . Bad workers are indifferent between "not migrate" and "migrate-return". Thus, we can write :

$$U^b(M,R) = U^b(\bar{M},\bar{M})$$

$$\frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} - c^b + \frac{\alpha\pi\theta^g + (1-\alpha)p\theta^b}{\alpha\pi + (1-\alpha)p} = 2\theta^b$$

$$p = \frac{\alpha}{(1-\alpha)} \frac{[2(\theta^g - \theta^b) - c^b]}{c^b}$$

Here p can be seen as an increasing function in $(\theta^g - \theta^b)$. An equilibrium exists only if:

$$0 < p < 1 \Leftrightarrow \frac{1}{2}c^b < (\theta^g - \theta^b) < \frac{1}{2\alpha}c^b$$

Indeed, $2(\theta^g - \theta^b) - c^b > 0 \Leftrightarrow \frac{c^b}{2} < (\theta^g - \theta^b)$ and $\frac{\alpha}{(1-\alpha)} \frac{2\left(\theta^g - \theta^b\right) - c^b}{c^b} < 1 \Leftrightarrow (\theta^g - \theta^b) < \frac{c^b}{2\alpha}$.

Given the structure of the full Hybrid equilibrium, should one migrant decide to stay, then employers believe that he is of the good type**:**

$$\mu^{MS} = \Pr[\theta^g | (M,S)] = 1$$

Thus the payoff of a worker who stays in the host country is:

$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = \frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} + \theta^g - 2c^i, \text{ with } i \in \{b,g\}.$$

Given these beliefs, the strategy (M,S) is dominated for the b -worker if :

$$U^b(M,R) > U^b(M,S)$$

$$\frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} - c^b + \frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} > \frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} + \theta^g - 2c^b$$

$$p < \frac{\alpha}{(1-\alpha)} \frac{c^b}{(\theta^g - \theta^b) - c^b}$$

We replace p by its equilibrium expression:

$$\frac{\alpha}{(1-\alpha)} \frac{2(\theta^g - \theta^b) - c^b}{c^b} < \frac{\alpha}{(1-\alpha)} \frac{c^b}{(\theta^g - \theta^b) - c^b} \Leftrightarrow (\theta^g - \theta^b) < \frac{3}{2}c^b$$

Consider now the g -workers. For them, this equilibrium implies that (M,R) is a dominant strategy given the previous beliefs :

$$U^g(M,R) > U^g(M,S)$$

$$w_1(M) - c^g + w_2(M,R) > w_1(M) + w_2(M,S) - 2c^g$$

$$\frac{\alpha\theta^g + (1-\alpha)p\theta^b}{\alpha + (1-\alpha)p} > \theta^g - c^g$$

$$p < \frac{\alpha}{(1-\alpha)} \frac{c^g}{(\theta^g - \theta^b - c^g)}$$

For the equilibrium p , this condition is tantamount to:

$$\frac{2(\theta^g - \theta^b) - c^b}{c^b} < \frac{c^g}{(\theta^g - \theta^b - c^g)} \Leftrightarrow (\theta^g - \theta^b) < c^g + \frac{1}{2}c^b$$

Given that $c^g + \frac{1}{2}c^b < c^b + \frac{1}{2}c^b$, the necessary condition for this equilibrium is:

$$\frac{c^b}{2} < (\theta^g - \theta^b) < \min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^b}{2\alpha}\right)\right\}.$$

■

Notice that the "efficient separating equilibrium", requiring $(\theta^g - \theta^b) < \frac{c^b}{2}$, is mutually exclusive with this equilibrium.

4.3. Good workers are indifferent between "return or stay". Bad workers migrate and return.

Proposition 8. There is a partial Hybrid equilibrium 2 where all bad workers migrate and return ($p = 1$), no bad worker migrants and stays $(q = 0)$ and a fraction π of the good workers migrate and return, and the other $1 - \pi$ good workers migrate and stay, with

$$\pi = \frac{(1-\alpha)}{\alpha}\frac{(\theta^g - \theta^b - c^g)}{c^g}$$

provided that:

$$\frac{c^g + c^b}{1+\alpha} < (\theta^g - \theta^b) < \frac{c^g}{(1-\alpha)}$$

Proof Equilibrium conditions are: $U^g(M,R) = U^g(M,S)$, $U^b(M,R) > U^b(M,S)$ and $U^b(M,R) > U^b(\bar{M},M)$. We have show in Proposition 5 that $\pi \in [0,1] \Rightarrow q = 0$, that is $U^g(M,R) = U^g(M,S) \Rightarrow U^b(M,R) > U^b(M,S)$. For $\pi \in [0,1]$ and $p = 1$, we have:

$$U^b(\bar{M},\bar{M}) = w_1(\bar{M}) + w_2(\bar{M},\bar{M}) = 2\theta^b$$

$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = \alpha\theta^g + (1-\alpha)\theta^b - c^i + \frac{\alpha\pi\theta^g + (1-\alpha)\theta^b}{\alpha\pi + (1-\alpha)}$$

$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = \alpha\theta^g + (1-\alpha)\theta^b + \theta^g - 2c^i$$

First condition: good workers play a mixed strategy if: $U^g(M,R) = U^g(M,S)$. With $p = 1$, this implies:

$$(\theta^g - \theta^b)(1-\alpha) = c^g(\alpha\pi + (1-\alpha))$$

$$\pi = \frac{(1-\alpha)}{\alpha}\frac{(\theta^g - \theta^b - c^g)}{c^g}$$

We know that this equilibrium exists for $0 < \pi < 1$ which is tantamount to:

$$0 < \frac{(1-\alpha)}{\alpha}\frac{(\theta^g - \theta^b - c^g)}{c^g} < 1.$$

This imposes additional constraints on parameters:

$$\theta^g - \theta^b - c^g > 0 \Leftrightarrow c^g < \theta^g - \theta^b$$

$$\frac{(1-\alpha)}{\alpha}\frac{(\theta^g - \theta^b - c^g)}{c^g} < 1 \Leftrightarrow (\theta^g - \theta^b) < \frac{c^g}{(1-\alpha)}$$

In a compact form, the necessary conditions can be written:

$$c^g < (\theta^g - \theta^b) < \frac{c^g}{(1-\alpha)}$$

Second condition, $U^b(M,R) > U^b(\bar{M},\bar{M})$, is true for:

$$\alpha\theta^g + (1-\alpha)\theta^b - c^b + \frac{\alpha\frac{(1-\alpha)}{\alpha}\frac{(\theta^g-\theta^b-c^g)}{c^g}\theta^g + (1-\alpha)\theta^b}{\alpha\frac{(1-\alpha)}{\alpha}\frac{(\theta^g-\theta^b-c^g)}{c^g} + (1-\alpha)} > 2\theta^b$$

$$\frac{c^g + c^b}{1+\alpha} < (\theta^g - \theta^b).$$

So, in a compact form, the necessary conditions for this equilibrium to exist are:

$$\max\left\{c^g, \frac{c^g + c^b}{1+\alpha}\right\} < (\theta^g - \theta^b) < \frac{c^g}{(1-\alpha)}$$

But because $c^g < c^b$, we have $c^g < \frac{c^g+c^b}{1+\alpha}$. So the necessary and sufficient condition is:

$$\frac{c^g + c^b}{1+\alpha} < (\theta^g - \theta^b) < \frac{c^g}{(1-\alpha)}$$

■

This equilibrium can exist only if if the proportion of good workers in the total population is large enough: $(1-\alpha)(c^g + c^b) < c^g(1+\alpha) \Leftrightarrow \alpha > \frac{c^b}{2c^g+c^b}$.

5. A synthesis and policy implications

The analysis of temporary migration has been developed in the case where good workers have an incentive to migrate, more precisely if their migratory cost is relatively low:

$$c^g < 2(1-\alpha)(\theta^g - \theta^b) \Leftrightarrow (\theta^g - \theta^b) > \frac{c^g}{2(1-\alpha)}.$$

In this context, we have shown that the game presents several equilibria, that are summarized in the Table 1.

EQ.	π^*	p^*	q^*	Necessary and sufficient conditions
Sep. "efficient"	1	0	0	$(\theta^g - \theta^b) < \frac{c^b}{2}$
Sep. "inefficient"	0	0	0	$c^g < (\theta^g - \theta^b) < c^b$
Pooling MS	0	0	1	$\frac{c^b}{\alpha} < (\theta^g - \theta^b)$
Pooling MR	1	1	0	$\frac{c^b}{2\alpha} < (\theta^g - \theta^b)$
Hybrid Full	$0 < \pi^* < 1$	$0 < \pi^* < 1$	0	$\frac{(c^g+c^b)}{2} < (\theta^g - \theta^b) < \min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^g+c^b}{1+\alpha}\right)\right\}$
Hybrid 1	1	$0 < \pi^* < 1$	0	$\frac{c^b}{2} < (\theta^g - \theta^b) < \min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^b}{2\alpha}\right)\right\}$
Hybrid 2	$0 < \pi^* < 1$	1	0	$\frac{c^g+c^b}{1+\alpha} < (\theta^g - \theta^b) < \frac{c^g}{(1-\alpha)}$, if $\alpha > \frac{c^b}{2c^g+c^b}$

Table 1. A summary of the equilibria

The most complex configuration of this game appears for $\alpha > \frac{c^b}{2c^g+c^b}$. In the opposite case, the Hybrid 2 equilibrium does not exist. In the following, we will develop more in detail the complex picture.

We can notice that $\alpha > \frac{c^b}{2c^g+c^b} \Rightarrow \left(c^g + \frac{1}{2}c^b\right) > \left(\frac{c^g+c^b}{1+\alpha}\right)$ and $\left(c^g + \frac{1}{2}c^b\right) > \left(\frac{c^b}{2\alpha}\right)$. So, for $\alpha > \frac{c^b}{2c^g+c^b}$, $\min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^g+c^b}{1+\alpha}\right)\right\} = \left(\frac{c^g+c^b}{1+\alpha}\right)$ and $\min\left\{\left(c^g + \frac{1}{2}c^b\right), \left(\frac{c^b}{2\alpha}\right)\right\} = \left(\frac{c^b}{2\alpha}\right)$. We also have for $\alpha > \frac{c^b}{2c^g+c^b} \Rightarrow \left(\frac{c^g+c^b}{1+\alpha}\right) > \left(\frac{c^b}{2\alpha}\right)$.

The efficient separating equilibrium exists if $(\theta^g - \theta^b) < \frac{c^b}{2}$. Yet the model has been developed for the case where good workers do migrate, i.e. $(\theta^g - \theta^b) > \frac{c^g}{2(1-\alpha)}$. So the efficient separating case can be feasible only if:

$$\frac{c^g}{2(1-\alpha)} < (\theta^g - \theta^b) < \frac{c^b}{2}.$$

There is a non empty set for $(\theta^g - \theta^b)$ only if:

$$\frac{c^g}{(1-\alpha)} < c^b \Leftrightarrow c^g < c^b(1-\alpha) \Leftrightarrow \alpha < \frac{c^b - c^g}{c^b}$$

On the other hand, we argued that the full configuration of equilibria requires $\alpha > \frac{c^b}{2c^g+c^b}$. Hence, the most general picture obtains only for:

$$\frac{c^b}{2c^g + c^b} < \alpha < \frac{c^b - c^g}{c^b}$$

There is a non empty interval for α if:

$$\frac{c^b}{2c^g + c^b} < \frac{c^b - c^g}{c^b} \Leftrightarrow c^g < c^b/2$$

Figure 2 provides a graphic representation of the regionning of equilibria in this case. To bring some intuition about the thresholds, we choose $c^b = 2$, $c^g = 0.5$ and $\alpha = 0.7$ ($0.66 = \frac{2}{1+2} < \alpha < \frac{2-0.5}{2} = 0.75$).

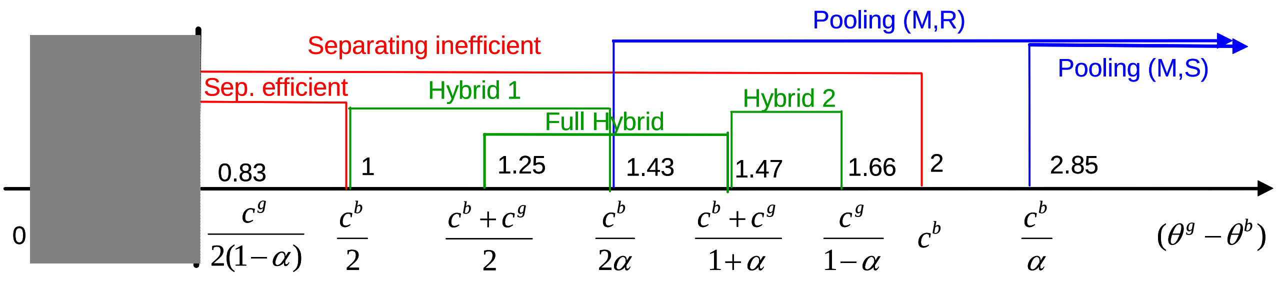

Figure 2. Regionning of the equilibria

Some policy implications can be inferred from this simple model. We can notice that, depending on parameters, the game can present multiple equilibria. For instance, for $\frac{c^b}{2\alpha} < (\theta^g - \theta^b) < \frac{c^b + c^g}{1+\alpha}$, either the Pooling MR or the Inefficient Separating equilibrium or the Full Hybrid equilibrium can occur. Which one actually materializes depends on firms' equilibrium beliefs. In turn, if the economic model is prone for multiple equilibria, it is very difficult for policymakers to work out effective policies, since they cannot infer what is the type of the prevailing equilibrium.

From the origin country policymakers' point of view, the most desired equilibrium is the "efficient separating one". For a given productivity differential, they might be tempted to reach it by rising migratory costs of the bad workers. This policy might not always be efficient. For instance, in this configuration of the game the efficient separating equilibrium always comes with the inefficient separating one. Unfortunately policymakers have no method to impose their preferred situation. Policymakers may also try to manipulate the productivity differential, by improving training programs, such as to narrow the gap between good and bad workers along the hidden but valuable characteristics.

The full hybrid equilibrium is an interesting situation, insofar as both good and bad workers play mixed strategies. Contrary to what intuition would suggest, if this equilibrium prevails, more good workers will return if migratory costs are small. Indeed, if migratory costs are low, more bad workers will migrate, and the wage of the good workers will decline. Hence, they will have a stronger incentive to come back and avoid the migratory cost.

In all the hybrid equilibria good workers are penalized as compared to separating equilibria because, due to bad migrants, their wage is lower. They may try to signal themselves by choosing such a migratory destination that the migratory cost c^g (and implicitly c^b , because by assumption $c^b > c^g$) becomes so high that the bad workers have no incentive to follow them (in other words, they might push costs so high that only the separating equilibria does prevail).[12] If this logic holds, one can expect to see migration flowing toward "hard" places, even if such a tough experience has no impact on the migrant's productivity.

6. Conclusion

Temporary migration called the attention of policymakers and economists in the recent period. In particular, temporary migration seems to be the dominant contemporary pattern of migration between Eastern and Western European regions. In general, in developed countries temporary migrants benefit of a more favorable public opinion than permanent migrants, since they are seen as filling a well identified labor shortage (mainly in the hospitality sector, cleaning, agriculture, food processing, etc.). From the developing country perspective, whatever workers' qualifications, temporary migration is often seen as a source of additional income, since temporary migrants use to reinvest most of their earnings in the origin country. Furthermore, there is a strong belief that working abroad might help improving a worker's human capital.

Many factors drive an individual's decision to migrate then return. Existing literature has emphasized two of them: investment in human capital -- individuals work abroad for some time in order to learn and improve their skills then come back home, and errors -- workers go abroad hoping to get a better wage; some of them have bad luck, get low wages, thus they prefer to come back. In this paper we put forward another possible motive, which can be matched with both the former explanations. In our model, good workers always migrate at the first period. They do it because their migratory cost is rather low and because by migrating they can get a better wage than they could get at home. At the second period, some of them return, the other don't. Whether good workers return or not depends on the strategy of the bad workers. If bad workers do not migrate, the mere decision to migrate signals a worker as being of the high-productivity type and allows him to claim a high wage. If at least some bad workers mimic the behavior of the good workers and migrate as well, migration becomes a less efficient signaling strategy. Rational employers would adjust wages accordingly, thus penalizing good workers as compared to the perfect information setup. Notice that the signaling effect of migration can be obtained independently of any improvement in migrants' human capital.

From the point of view of the sending country, the most appealing configuration corresponds to the separating equilibrium with return migration. In this configuration, migration is a useful signaling device: firms can use the migratory track record to screen individuals. Stayers and migrants are paid to their true productivity; furthermore, the latter come back and contribute to output growth. Unfortunately, this equilibrium might not be single. One important contribution of this paper is to emphasize the scope for multiple equilibria. In turn, this makes efficient return policies hard to design, since policymakers have no reliable means to detect the type of the prevailing equilibrium. Policy recommendations differ depending on the equilibrium. In general, migratory costs must be raised in order to obtain a separating equilibrium. Yet, if the full hybrid equilibrium is at work, a developing country that aims at bringing back its best people must

[12]Of course, it should be checked that this strategy is rational, i.e., that good workers' payoff is larger with such a high cost than in the hybrid case.

reduce migratory costs.

If migrants can control migratory costs, for instance by choosing their destination, good migrants might implement a policy of over-signaling: they can choose such a remote location that bad workers cannot follow. In this case, the separating equilibrium prevails, at the expense of good migrants who bear abnormal migratory costs. This is the price that good workers must pay in order to remove the informational asymmetry. In this context, any policy that helps suppressing imperfect information would be welfare improving.

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Appendix A. Proofs of existence of the pure strategy equilibria

A 1. Separating equilibria

A 1.1. Bad workers do not migrate $(\bar{M},\bar{M})$. **Good workers migrate and stay abroad** (M,S) **.**

Equilibrium probabilities are $\pi = 0$ and $q = p = 0$. Equilibrium conditions are: $U^b(\bar{M},\bar{M}) > U^b(M,S)$, $U^b(\bar{M},\bar{M}) > U^b(M,R)$, $U^g(M,R) < U^g(M,S)$.

In this equilibrium, the payoffs become:

$$U^b(\bar{M},\bar{M}) = w_1(\bar{M}) + w_2(\bar{M}) = 2\theta^b$$

$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = 2\theta^g - 2c^i$$

$U^i(M,R)$ depends on beleifs. There can be investigated two situations:

Case 1 : $\mu^{MR} = \Pr[\theta^g|(M,R)] = 1.$ We can check that $U^g(M,R) < U^g(M,S) \Leftrightarrow 2\theta^g - c^g < 2\theta^g - 2c^g$ is impossible.

Case 2 : $\mu^{MR} = \Pr[\theta^g|(M,R)] = 0.$

$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = \theta^g - c^i + \theta^b$$

$$U^b(\bar{M},\bar{M}) > U^b(M,S) \Leftrightarrow 2\theta^b > 2\theta^g - 2c^b \Leftrightarrow c^b > \theta^g - \theta^b$$

$$U^b(\bar{M},\bar{M}) > U^b(M,R) \Leftrightarrow 2\theta^b > \theta^g - c^b + \theta^b \Leftrightarrow c^b > \theta^g - \theta^b$$

$$U^g(M,R) < U^g(M,S) \Leftrightarrow \theta^g - c^g + \theta^b < 2\theta^g - 2c^g \Leftrightarrow c^g < \theta^g - \theta^b$$

Sufficient and necessary condition: $c^g < \theta^g - \theta^b < c^b$

A.1. 2. Bad workers do not migrate $(\bar{M},\bar{M})$. **Good workers migrate and return** (M,R) **.**

In this case $\pi = 1,$ and $q = p = 0.$

The payoffs are:

$$U^b(\bar{M},\bar{M}) = w_1(\bar{M}) + w_2(\bar{M}) = 2\theta^b$$

$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = 2\theta^g - c^i$$

$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = \theta^g - 2c^i + \theta^b$$

Equilibrium conditions: $U^b(\bar{M},\bar{M}) > U^b(M,S),$ $U^b(\bar{M},\bar{M}) > U^b(M,R),$ $U^g(M,R) > U^g(M,S)$.

Case 1. Out-of-equilibrium beliefs: $\mu^{MS} = \Pr[\theta^g|(M,S)] = 0$

$$U^g(M,R) > U^g(M,S)$$
$$2\theta^g - c^g > \theta^g - 2c^g + \theta^b$$
$$\theta^g - \theta^b > -c^g$$

is true.
The two other conditions are

$$U^b(\bar{M},\bar{M}) > U^b(M,S) \Leftrightarrow 2\theta^b > \theta^g - 2c^b + \theta^b \Leftrightarrow c^b > \frac{1}{2}(\theta^g - \theta^b)$$

$$U^b(\bar{M},\bar{M}) > U^b(M,R) \Leftrightarrow 2\theta^b > 2\theta^g - c^b \Leftrightarrow c^b > 2(\theta^g - \theta^b)$$

Notice that the latter encompasses the former.
Case 2 : Out-of-equilibrium beliefs: $\mu^{MS} = \Pr[\theta^g|(M,S)] = 1$.

$$U^b(\bar{M},\bar{M}) = w_1(\bar{M}) + w_2(\bar{M}) = 2\theta^b$$
$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = 2\theta^g - c^i$$
$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = 2\theta^g - 2c^i$$

Condition $U^g(M,R) > U^g(M,S) \Leftrightarrow 2\theta^g - c^g > 2\theta^g - 2c^g$ is true. The other two conditions are

$$U^b(\bar{M},\bar{M}) > U^b(M,S) \Leftrightarrow 2\theta^b > 2\theta^g - 2c^b \Leftrightarrow c^b > \theta^g - \theta^b$$

$$U^b(\bar{M},\bar{M}) > U^b(M,R) \Leftrightarrow 2\theta^b > 2\theta^g - c^b \Leftrightarrow c^b > 2(\theta^g - \theta^b)$$

The latter encompasses the former.
Hence, the sufficient and necessary condition is:

$$(\theta^g - \theta^b) < c^b/2.$$

A.2. Pooling equilibria

A. 2.1All workers migrate and stay (M,S)

In this equilibrium, $\pi = 0,\quad q = 1$ and $p = 0$

Equilibrium conditions: $U^b(M,S) > U^b(M,R)$, $U^b(M,S) > U^b(\bar{M},\bar{M})$, $U^g(M,S) > U^g(M,R)$.

The payoffs:

$$U^b(\bar{M},\bar{M}) = w_1(\bar{M}) + w_2(\bar{M}) = 2\theta^b$$
$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = 2(\alpha\theta^g + (1-\alpha)\theta^b) - 2c^i$$

Case 1 : beliefs : $\mu^{MR} = \Pr[\theta^g|(M,R)] = 1.$

$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = \alpha\theta^g + (1-\alpha)\theta^b - c^i + \theta^g$$

Equilibrium conditions:

$$U^b(M,S) > U^b(M,R)$$
$$2(\alpha\theta^g + (1-\alpha)\theta^b) - 2c^b > \alpha\theta^g + (1-\alpha)\theta^b - c^b + \theta^g$$
$$(\alpha\theta^g + (1-\alpha)\theta^b) - c^b > \theta^g$$

Impossible.

Case 2 : beliefs : $\mu^{MR} = \Pr[\theta^g|(M,R)] = 0.$ Thus:

$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = \alpha\theta^g + (1-\alpha)\theta^b - c^i + \theta^b$$

Equilibrium conditions:

$$U^b(M,S) > U^b(M,R) \Leftrightarrow 2(\alpha\theta^g + (1-\alpha)\theta^b) - 2c^b > \alpha\theta^g + (1-\alpha)\theta^b - c^b + \theta^b \Leftrightarrow \alpha(\theta^g - \theta^b) > c^b$$

$$U^b(M,S) > U^b(\bar{M},\bar{M}) \Leftrightarrow 2(\alpha\theta^g + (1-\alpha)\theta^b) - 2c^b > 2\theta^b \Leftrightarrow \alpha(\theta^g - \theta^b) > c^b$$

$$U^g(M,S) > U^g(M,R) 2(\alpha\theta^g + (1-\alpha)\theta^b) - 2c^g > \alpha\theta^g + (1-\alpha)\theta^b - c^g + \theta^b \Leftrightarrow \alpha(\theta^g - \theta^b) > c^g$$

Necessary and sufficient condition:

$$\frac{c^b}{\alpha} < (\theta^g - \theta^b).$$

A. 2.2.All workers migrate and return (M,R)

Equilibrium probabilities $\pi = 1$ and $p = 1.$

Equilibrium conditions: $U^b(M,R) > U^b(M,S),$ $U^b(M,R) > U^b(\bar{M},\bar{M}),$ $U^g(M,R) > U^g(M,S).$

Payoffs:

$$U^b(\bar{M},\bar{M}) = w_1(\bar{M}) + w_2(\bar{M}) = 2\theta^b$$
$$U^i(M,R) = w_1(M) - c^i + w_2(M,R) = 2(\alpha\theta^g + (1-\alpha)\theta^b) - c^i$$

Case 1. Let us consider that the firm beliefs are such as $\mu^{MS} = \Pr[\theta^g|(M,S)] = 0.$ It follows that:

$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = \alpha\theta^g + (1-\alpha)\theta^b + \theta^b - 2c^i$$

Equilibrium conditions are:

$$U^b(M,R) > U^b(\bar{M},\bar{M}) \Leftrightarrow (\theta^g - \theta^b) > \frac{c^b}{2\alpha}$$

$$U^b(M,R) > U^b(M,S) \Leftrightarrow \alpha[\theta^g - \theta^b] > -c^b$$

which is always true and

$$U^g(M,R) > U^g(M,S) \Leftrightarrow \alpha[\theta^g - \theta^b] > -c^b$$

Which is true as well. So this equilibrium exists for these beliefs for $(\theta^g - \theta^b) > \frac{c^b}{2\alpha}$.

Case 2. Let us consider now the alternative beliefs: $\mu^{MS} = \Pr[\theta^g|(M,S)] = 1$. In this case, the payoff connected to the strategy (MS) is:

$$U^i(M,S) = w_1(M) + w_2(M,S) - 2c^i = \alpha\theta^g + (1-\alpha)\theta^b + \theta^g - 2c^i$$

Equilibrium conditions are:

$$U^b(M,R) > U^b(M,S) \Leftrightarrow \frac{c^b}{(1-\alpha)} > (\theta^g - \theta^b)$$

$$U^b(M,R) > U^b(\bar{M},\bar{M}) \Leftrightarrow (\theta^g - \theta^b) > \frac{c^b}{2\alpha}$$

The two conditions are jointly fulfilled if:

$$\frac{c^b}{2\alpha} < (\theta^g - \theta^b) < \frac{c^b}{(1-\alpha)}$$

The third condition is:

$$U^g(M,R) > U^g(M,S) \Leftrightarrow 2(\alpha\theta^g + (1-\alpha)\theta^b) - c^g > \alpha\theta^g + (1-\alpha)\theta^b + \theta^g - 2c^g \Leftrightarrow (\theta^g - \theta^b) < \frac{c^g}{(1-\alpha)}$$

But $c^g < c^b$. So the two former conditions entail the sufficient and necessary condition:

$$\frac{c^b}{2\alpha} < (\theta^g - \theta^b) < \frac{c^g}{(1-\alpha)}$$

In the text, we refer to the broader domain of existence of this equilibrium, more precisely $(\theta^g - \theta^b) > \frac{c^b}{2\alpha}$, which builds on the former set of beliefs.