SELF-ENFORCING MIGRATION POLICIES

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This paper considers whether countries might mutually agree a policy of allowing free movement of workers. For the countries to agree, the short run costs must outweighed by the long term benefits that result from better labor market flexibility and income smoothing. We show that such policies are less likely to be adopted for less risk averse workers and for countries that trade more. More surprisingly we find that some congestion costs can help. This reverses the conventional wisdom that congestion costs tend to inhibit free migration policies.

KEYWORDS: Migration, Self-enforcing Mechanism, Repeated Games

JEL CLASSIFICATION: F22 · J61 · R23

1. INTRODUCTION

Since its early inception, the European Union aims at implementing free movement of workers across its member states. Whereas the benefit of such a policy may seem obvious to many economic advisers, some member states have been reluctant implement the policy rapidly or have applied different standards of implementation and in some cases applied policies as restrictive as for non-EU immigrants. The main reason of this reluctance lies in the fear that inflows of migrant workers may depress labor market conditions and the welfare of the host country workers.

In this paper, we investigate the relationship between countries when they consider opening their borders to migrants. We impose the condition that countries will only implement a policy of free movement of workers if the policy is sustainable or self-enforcing for the countries: both countries should be better-off with the policy at each point in time taking into account any short run costs and any expected long term future benefits. In the model we present migrants may impose an externality on locals through increased congestion of local factors (land, local resources, etc.) or through changes in terms of trade. However by agreeing on a policy of free movement of labor a country may increase the future expected utility

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of its citizens it permits the long term reallocation of labor supplies in response to future productivity shocks and therefore increases the potentials for labor market flexibility. In addition if workers are risk averse it has the advantage of smoothing incomes.

We develop a two-country four-good trade model. Individuals consume the local non-traded good and the traded good produced in each country. Countries face productivity shocks. Under Cobb-Douglas preferences, the traded goods of each country are not perfect substitutes and the terms of trade adjust to partially smooth the incomes of countries' residents. We show that worker migration is a substitute for trade in the sense that larger shares of trade between countries reduce the income disparities and thus for migration and thus that free migration policies between countries are less likely to be implemented the greater the extent of trade between them. We also show that free migration policies yield excess migration when countries incur weak congestion of local factors and when they trade a significant but not too important share of their production. Because countries are less likely to support free migration policies when migration is likely to be excessive, free migration policies are not implemented between countries characterized with weak congestion effects or intermediate shares of trade. This result strongly contrasts with the common idea that migration would be easy to implement if countries were not characterized by congestion of local factors. Finally, migration policies are more likely to be implemented when individuals are more risk averse. In this case, migration smooths individual income and plays the role of an insurance scheme. Therefore the the more risk averse are workers the more likely it is that policies of free migration of workers can be supported.

Finally, we distinguish between two migration policies according to whether workers obtain the host country citizenship or not. We show that the above results are less likely to be applicable if migrants (and their descendants) obtain their initial citizenship. We show that migration policies are more likely to be implemented in countries that deliver only work permits but not citizenship and we show that for some parameter values if countries were to offer citizenship to all migrants, free migration policies are never implemented.

1.1. Related literature

This paper is related to two literatures: the literature on dynamic political economy and commitment constraints (see e.g. Aceomglu, Golosov and Tsyvinski 2010) and the literature on migration where immigrations impacts on the local labor market. The literature on political economy constraints emphasizes that

politicians cannot commit to policies in advance and will re-evaluate policy at each point in time weighing current losses from the policy against future expected gains. It builds upon the work of Chari and Kehoe (1990) on sustainable plans. Our analysis has some similarities with Thomas and Worrall (1988) who discuss informal insurance as a self-enforcing insurance mechanism.[1]

The present paper differs however in two regards from this literature. First the motivation for exchange comes from labor flexibility and the potential beneficial effects of migration. Such gains from flexibility help countries offset the short term cost of immigration by the longer term expected future benefits. Secondly, the present paper focuses on the adoption of market based policies rather than first best policies. That is we shall suppose that governments do not have the ability to finely control migration decisions but can either opt for free movement or no movement of labor. Thus with free movement of labor the allocation is determined by individual migration decisions and market forces and is not in the direct control of government. This significantly simplifies the analysis but adds a potential inefficiency as individual migration decisions do not take into account the effect of reducing wages in the destination country or raising wages in the origin country.

Secondly we analyze a general equilibrium model with a neoclassical labor market where immigration is likely to impact local wages. The empirical relevance of such impact is a debated issue. In a summary of the empirical literature, Okkerse (2008) concludes that competition from foreigners is likely to harm workers, especially those at the bottom end of the income scale. In fact, the empirical literature on the effect of migration on local labor markets does not reach a clear consensus. As a case in point, early studies could not confirm strong and significant long-run effects of immigration on local wages (Card 1990, Borjas, Freeman and Katz 1997). While it was admitted that most of the economic gain from migration accrues to the migrants (Boeri and Brucker 2005), the impact of worker's conditions in the receiving countries has been more debated (Faini, et al. 1999). Because the above studies were not concerned with the crowding out of natives by immigrant workers, which potentially eliminated any wage effects (Filer 1992), researchers have then been tempted to avoid spatial studies of localized labor inflows and have preferred to consider the impact on the entire

[1] Empirical applications of informal insurance theory have primarily focused on individual relationships within villages in less developed country (Thomas, Ligon and Worrall 2002).

labor market.[2] Under such a strategy, Borjas (2003) measured significant and negative effects of immigration on U.S. wages, harming more importantly the low skilled. Ottaviano and Peri (2008) recently analysed the effect of migration by modeling labor as a differentiated input in general equilibrium. Those authors found negative partial effect of immigrants on natives within the same group of workers but with significantly mitigated effects on the overall economy.

By presenting a general equilibrium model encompassing the cases where migration can have a negative or a zero impact on welfare, we claim to fit broadly to the above empirical facts. However, for the sake of analytical tractability, our neoclassical analysis of the labor market focuses on the benchmark case of homogenous workers. As a result, the interpretation of our results must probably be restricted to the situations where governments consider the welfare of low skilled workers, either because of distributional concerns or because of the weight of low skilled workers in the political decision making process (perhaps along median voter lines). Our discussion is nevertheless driven by a general concern about public opinion in many democratic countries, which appear relatively hostile to immigration.[3] As reported by Scheve and Slaughter (2001), Chiswick and Hatton (2003) and Mayda (2006), public opinion in democratic countries has been far more anti-immigrant than has public policy in recent decades.[4] Our discussion anchors to this negative attitude of the working class towards immigration and focusses on the willingness of their constituencies to implement free movement of labor with other states and countries. In our discussion the motivation of this attitude is rooted in individuals' anticipations of labor markets rather than in possible (mis-)perceptions on multiculturalism or criminality.

Finally, the analysis of the acceptability of free movement of workers becomes even more relevant in the E.U. because of recent suspicions of a "race to the top" in the migration policies between the E.U. member states particularly in respect of the

[2] For example, the 1980 Cuban immigration may have been important in Miami but small for the whole U.S. labor market

[3] The number of citizens stating that there are "too many" immigrants is 77% in the U.S., 67% in France, 78% in the U.K. (PEW global attitude report, 2007). In Australia, his number rose for 16% to 68% during the period 1961-1988. In many democratic countries the support for anti-immigration political parties is not negligible (e.g. see the importance of U.K. National Front in 1960 or the presence of extreme right in the second tours of French Presidential Election in 1974 and 2002).

[4] This puzzle can be explained by the presence of industry interest groups and by the existence of an election bias due to voters' participation incentives (Mayda, 2004; Facchini and Mayda, 2008; Mueller and Tai, 2009).

new member countries (Kvist 2004). Whereas E.U. member states recently opened their borders to labor, many seemed to strengthen their migration requirements. The current paper offers a possible explanation for this issue. Migration and trade are seen to be substitute policies to smooth negative productivity shocks. In this case, migration is less likely to be implemented in countries that trade more. E.U. member states may thus have increasingly been reluctant to free the movement of workers as trade barriers have been removed. Those countries may simply expect that terms of trade will attenuate income discrepancies and they do not expect that future gains from migration outweigh the current loss of an increased congestion of local factors.[5]

The paper is organized as it follows. We present the model in Section 2 while Section 3 derives and discusses the short run equilibrium. Section 4 discusses sustainable policies of free movement of workers that grant work permits to moving workers. Section 5 extends those policies to immigration policies that grant citizenship rights to moving workers. Section 6 studies some important extensions to permanent productivity differences and to countries with unemployment. The last section concludes.

2. THE MODEL

We consider a two-country four-good model in which a domestic country produces a tradeable good X and a local non-tradeable good Z. The foreign country produces another tradeable good X^* and local non-tradeable good Z^*. Consumer's preferences for goods are given by the utility function $U(C)$ where U is an increasing and concave function and where C is a Cobb-Douglas composite good $C \equiv KX^{\gamma/2}(X^*)^{\gamma/2}Z^{1-\gamma}$ and K is a constant. The parameter $\gamma \in [0,1]$ expresses the preferences for tradeable goods as well as their share in the whole economy. If $\gamma = 0$ there are no traded goods and if $\gamma = 1$ there are no non-traded goods. Therefore, we use the parameter γ to discuss the importance of trade between the countries. The domestic country has L worker-consumers and the foreign country L^* where $L + L^* = \bar{L}$. For the sake of analytical tractability we assume that labor is homogeneous. Each individual inelastically supplies a unit of labor. In the domestic (foreign) country, L_X (L_X^*) individuals work in the tradeable good sector while L_Z (L_Z^*) are employed in the local non-tradeable good sector. Workers freely move between sectors and are thus paid the same wage w (w^*) in each sector.

[5] The idea of substitution between trade and migration is also used as by politicians. Promoting the NAFTA agreement, the Mexican President Salinas stated in 1991 freer trade means "more jobs... [and] higher wages in Mexico, and this in turn will mean fewer migrants to the United States and Canada. We want to export goods, not people." (*op. cit.*, Martin 2005, p. 7.)

Each tradeable and non-tradeable sector includes a unit mass of firms that produce according to a production function $F_i(L_i) = \alpha L_i^{\beta}$, $i \in \{X,Z\}$, where L_i is the firm's labor and where $\alpha > 0$ and $\beta \in (0,1]$ denote two parameters for productivity and congestion, which we assume to be identical across firms and sectors for the sake of simplicity. The same production function applies to the foreign country with a productivity parameter α^* (though with β common across countries). For $\beta < 1$ the firm's marginal product $F_i'(L_i) = \alpha\beta L_i^{\beta-1}$ decreases with the size of the labor force L_i. Production displays constant returns to scale or no congestion if $\beta = 1$ and displays decreasing returns to scale or congestion if $\beta < 1$. In the limit, $\beta \to 0$, there is full congestion and output is fixed independent of the size of the labor force. The congestion force can be interpreted either at a firm or sector level. At a firm level each firm which hires L_i workers can be thought of holding a unit of local indivisible capital, which embeds either natural resources like land or water or local human resources like local human capital, entrepreneurial skills, etc. At the sector level decreasing returns to scale can be interpreted as the sharing of common infrastructures, resources and land. In this case, the production function $F_i(L_i)$ applies to each sector $i \in \{X,Z\}$ with L_i being the sector employment and then each firm can be interpreted as experiencing a sector specific productivity $g_i = F_i'(L_i) = \alpha\beta L_i^{\beta-1}$. Hamermesh (1993) provide ample empirical evidence about such downward sloping labor demand functions at the firm and sector levels while Borjas (2003) presents evidence at the country levels. The fact that migration impacts on wages is crucial for a possible reluctance to implement policies of free migration in our model. Finally, we initially assume no trade friction and no price rigidity in neither the labor nor the product markets.[6] For simplicity we assume that profits are redistributed to local individuals.

3. SHORT RUN EQUILIBRIUM

We now determine the short run equilibrium where individuals consider just current payoffs in their migration decisions. For the sake of conciseness, we characterize the variables for the domestic country, those for the foreign country being symmetric. We first establish the equilibrium for immobile labor, then we characterize and discuss the equilibrium under free movement of worker and we finally discuss the issue of excess migration.

Market equilibrium Let us first suppose that labor is not allowed to move between countries. The equilibrium consists of the set of prices, wages, income

[6] The assumption is relaxed in Section 6.2.

and sectorial labor distribution that satisfy both profit maximization conditions and market clearing for labor and goods. The solution of the model is standard and detailed in Appendix 1. Firms hire workers so that their marginal product of labor equates wages: $P_i F_i'(L_i) \equiv P_i \alpha\beta L_i^{\beta-1} = w$. Under iso-elastic labor demand, their sales and profits are proportional to wage bills so that $P_i F_i(L_i) = wL_i/\beta$. Because production functions are similar across sectors, labor allocates across the tradeable and non-tradeable sectors according to their respective product demands: $L_X = \gamma L$ and $L_Z = (1-\gamma)L$. When the markets of the tradeable goods clear, the terms of trade adjust to balance the values of exports and imports. As consequence, one can show that wages adjust so that

$$w/w^* = L^*/L \tag{1}$$

This shows that the relative wage rate adjusts to changes in the allocation of labor between countries.

The individual consumption in each country is given by the equilibrium consumption of the composite good $C = (P_X)^{-\gamma/2}(P_X^*)^{-\gamma/2}(P_Z)^{\gamma-1}Y/L$ where the constant K defined above is normalized so that the constant terms multiplying this expression are canceled out. Given $Y/L = \beta^{-1}w$ and using the prices in wage units computed above we have

$$C(L) = A\left(\frac{L^*}{L}\right)^{\beta\gamma/2} L^{\beta-1} \tag{2}$$

where $A = \alpha(\alpha^*/\alpha)^{\gamma/2}$. A symmetric expression holds for individual consumption in the foreign country:

$$C^*(L) = \left(\frac{\alpha^*}{\alpha}\right)^{(1-\gamma)} C(\bar{L} - L).$$

Individual consumption and migration responds to the existence of congestion and trade in the following ways. First, when there is no congestion ($\beta = 1$), the individual consumption becomes $C(L) = A(L^*/L)^{\gamma/2}$, which declines as more labor is allocated to the home country. This fall in consumption occurs because the relative wage rate declines and foreign traded goods become relatively more expensive (see equation (1)). When there exists some congestion ($\beta < 1$), a greater labor supply also leads to lower real wages making home products also relatively more expensive. Second, when congestion is very important ($\beta \to 0$),

the individual consumption becomes $C(L) = AL^{-1}$, which inversely depends on the local labor supply. This case corresponds to a situation where local workers evenly share a fixed crop that depends only on the state of nature. Workers are nevertheless able to exchange a part of their crop so that their final consumption is diversified and is proportional to the average shock A rather than their own shock α. Third, when no goods are traded ($\gamma = 0$), the individual consumption becomes $C(L) = \alpha L^{\beta-1}$, which depends only on local labor and local productivity. This configuration corresponds to a situation where local workers equally share a production factor that is subject to congestion. Finally, when all goods are traded ($\gamma = 1$), individual consumption is the same in both countries, $C^*(L) = C(\bar{L} - L)$. Exogenous productivity differentials (α^*/α) are fully absorbed by changes in the terms of trade so that labor mobility between counties will confer no benefits.

Free movement of workers Let us now consider that both countries adopt the policy of free movement of workers. Under such a policy workers will move until individual utilities and therefore individual consumptions are equalized between countries: $C(L) = C^*(L)$. If productivity is higher in the home country ($\alpha > \alpha^*$) and $\gamma < 1$, then the free movement of workers implies that $C(L) < C(\bar{L} - L)$ since $(\alpha^*/\alpha)^{(1-\gamma)} < 1$. Since $C(L)$ is decreasing we have therefore that $L > \bar{L} - L$ or $L > \bar{L}/2 > L^*$ so that workers relocate to the more productive country. In the present Cobb-Douglas setting, free migration yields a unique equilibrium for the allocation of workers between countries. The labor allocation satisfies

$$\frac{\hat{L}^*}{\hat{L}} = \left(\frac{\alpha^*}{\alpha}\right)^{\frac{1-\gamma}{1-\beta(1-\gamma)}} \tag{3}$$

where the hat $\hat{}$ denotes the short run equilibrium outcome under free movement of workers. One can check that $d(\hat{L}^*/\hat{L})/d(\alpha^*/\alpha) > 0$, while $d(\hat{L}^*/\hat{L})/d\beta < 0$ and $d(\hat{L}^*/\hat{L})/d\gamma > 0$ if $\alpha > \alpha^*$. As expected, workers move into the most productive country because the latter offers higher wages. However, the equilibrium number of immigrants in the most productive country decreases with the intensity of local congestion and the share of tradeable goods.

Congestion and trade have the following impact on the distribution of labor. When local factor congestion rises (smaller β) the reallocation of labor in response to productivity differences becomes smaller because changes in labor has a greater impact on reducing local wages and consumption: local congestion diminishes productivity gains and wage differentials and therefore migration incentives. A

larger share of the tradeable sector in the economy augments the impact that terms of trade have on earnings and consumption. Immigrants arriving in the higher productivity country earn larger wages and this increases their demand for the goods produced in their country of origin. As a result, wages rise in the country of origin and migration incentives are mitigated. The effect of terms of trade is particularly noticeable when all goods are tradeable ($\gamma \to 1$). In this case, condition (3) implies that individuals spread equally across countries so that the terms of trade absorb any exogenous productivity difference. Perfect labor mobility needs then to adjust only for the differences stemming from local factor congestion. Since countries are assumed to have the same congestion parameter β, it follows naturally that the equilibrium labor allocation is symmetric. When some goods are not traded ($\gamma < 1$), the terms of trade do not fully absorb productivity differences and more individuals locate in the country with the higher productivity. As pointed out by Mundell (1957), the labor reallocation in response to productivity differences is smaller the more open is the economy (larger γ) because trade and labor mobility are substitutes.

Welfare It is instructive to consider the welfare consequences of policies promoting free movement of workers. For simplicity, we focus on the case of a world utilitarian planner who assigns individuals' residence and is able to redistribute income through lump sum transfers. To highlight the effect of labor market flexibility we sterilize the possible risk sharing effects by supposing workers are risk neutral, $U(C) = C$. The planner maximizes world per-capita welfare

$$W(L) = \omega(L)C(L) + (1 - \omega(L))\,C^*(L)$$

where $\omega(L) = L/\bar{L}$ is the proportion of the population allocated to the home country. It is interesting to ask whether the social planner allocates more labor to the high productivity country and if so whether the planner allocates more or less labor than at the free labor mobility outcome.

Under free movement of workers, we have $C(\hat{L}) = C^*(\hat{L})$ so that the marginal per-capita welfare is (see computation in Appendix B)

$$W'(\hat{L}) = \frac{\beta C(\hat{L})}{\bar{L}} \frac{\gamma}{2} \left[\frac{\hat{L}^*}{\hat{L}} - \frac{\hat{L}}{\hat{L}^*} \right].$$

From the above discussion we know that the home country hosts a larger share of labor at the equilibrium if it gets higher productivity ($\alpha > \alpha^* \iff \hat{L} > \hat{L}^*$).

This implies that $W'(\hat{L}) < 0$ if $\beta \neq 0$ and $\gamma \neq 0$ and if $\hat{L} \neq \hat{L}^*$, which happens only for $\gamma \neq 1$. Likewise $W'(\hat{L}) > 0$ if $\alpha < \alpha^*$. Thus the planner prefers less labor dispersion and prefers to restrict the movement of workers, except in three polar cases: full congestion ($\beta \to 0$), no trade ($\gamma = 0$) and full trade ($\gamma = 1$).

Likewise we can check whether the social planner prefers to allocate more labor to the more productive country. Since at $L = \bar{L}/2$, $C^*(\bar{L}/2)/C(\bar{L}/2) = (\alpha^*/\alpha)^{(1-\gamma)}$, we have

$$W'(\bar{L}/2) = \frac{\beta C(\bar{L}/2)}{\bar{L}}(1-\gamma)\left[1 - \left(\frac{\alpha^*}{\alpha}\right)^{(1-\gamma)}\right].$$

For $\alpha > \alpha^*$ we have $W'(\bar{L}/2) > 0$ and likewise $W'(\bar{L}/2) < 0$ for $\alpha < \alpha^*$. Therefore, unless $\gamma = 1$, the planner will always prefer to allocate more labor to the more productive country but not as much as allocated at the free labor mobility equilibrium.

We summarize this result in the following proposition.

PROPOSITION 1: *The policy of free movement of workers yields excessive agglomeration of workers in the high productivity country compared to the utilitarian optimal spatial distribution of risk neutral workers as soon as there simultaneously exist weak congestion and both tradeable and non tradeable goods.*

This proposition highlights a well-know externality in migration decisions. When a worker decides to relocate to another country, he/she considers only the average or per capita consumption in each country and does not take into account his/her impact on reducing consumption in the destination country or raising it in the origin country. The planner in considering a marginal change weighs not only the change in the per capita consumption of the marginal migrant but also the effect on the consumption of all workers in the origin and destination countries. Consider the effect of moving a worker from the foreign to the home country. The fall in consumption in the destination country is given by $-LC'(L) = (1-\beta)C(L) + (\beta\gamma/2)(\bar{L}/(\bar{L}-L))C(L)$ and the rise in consumption in the origin country is $(\bar{L}-L)C^{*\prime}(L) = (1-\beta)C^*(L) + (\beta\gamma/2)(\bar{L}/L)C^*(L)$. From these equations it can be seen that the externality works mainly through the trade effect. At $C(L) = C^*(L)$ and $L > L^*$ with $\gamma > 0$ the fall in consumption in the destination country will be larger than the rise in consumption in the origin country and the planner will prefer to allocate fewer workers to the home country. The reason is as workers are shifted from the home to the foreign country the price of the foreign

traded good rises more than the price of the home traded good falls. If there is no traded good then this effect is not present and the planner will also choose the allocation where $C(L) = C^*(L)$.[7]

To measure the excess agglomeration of workers we define the excess agglomeration index $e \equiv (\hat{L}/\hat{L}^*)/(\tilde{L}/\tilde{L}^*)$ where $(\tilde{L}, \tilde{L}^*)$ is the planner's labor allocation that solves $W'(\tilde{L}) = 0$ (see Appendix B). Figure 1 plots the value of excess agglomeration index e in the space of congestion and trade parameters (β, γ). The figure confirms that there is no excess agglomeration when all goods are traded, when no goods are traded or when there is a very high congestion. In the first case ($\gamma = 1$), the terms of trade exactly absorb productivity differences and eliminates any migration incentives. The welfare optimum naturally coincides with the equilibrium. In the second case ($\gamma = 0$), local workers evenly share a local production factor that is subject to congestion. Wages then reflect local productivity and also the local consumption of local goods. Wages fall when there is an inflow of workers and provide workers an appropriate signal for their migration decisions. The equilibrium also exactly replicates the planner's outcome. In the last case ($\beta \to 0$), the economy approximates a situation where local workers evenly share a fixed crop that depends only on the state of nature. The planner is indifferent to the location of workers because he/she can redistribute the global crop $(\alpha + \alpha^*)$ through lump sum transfers. So, the equilibrium simply coincides with the labor allocation that the planner chooses when she needs to make no transfer. Wages and incomes are therefore also appropriate signals for location decisions.

There is however, excess agglomeration when there is weak congestion and both tradeable and non tradeable goods. In particular, the more productive country attracts too many migrants when there exists no congestion or constant returns to scale. A standard argument is that migration is innocuous under constant returns to scale because workers move with both their constant productivity and consumption to the hosting country. However, in this model with productivity shocks, workers increase their productivity when they move to the more productive country. As a result, they produce more of the good of this country, increase congestion and depress its price and local wages. They also demand more of the good produced in the low productivity country and increase its price. Native workers in the more productive country therefore see their wage fall and the price of import rise. A planner would prefer to reduce migration to restore partly the wages and

[7] The externality is still present when $\gamma = 0$ but the fall in consumption in the destination country is exactly matched by the rise in origin country and the planner makes the same choice as the market based outcome where per capita consumption is equalized.

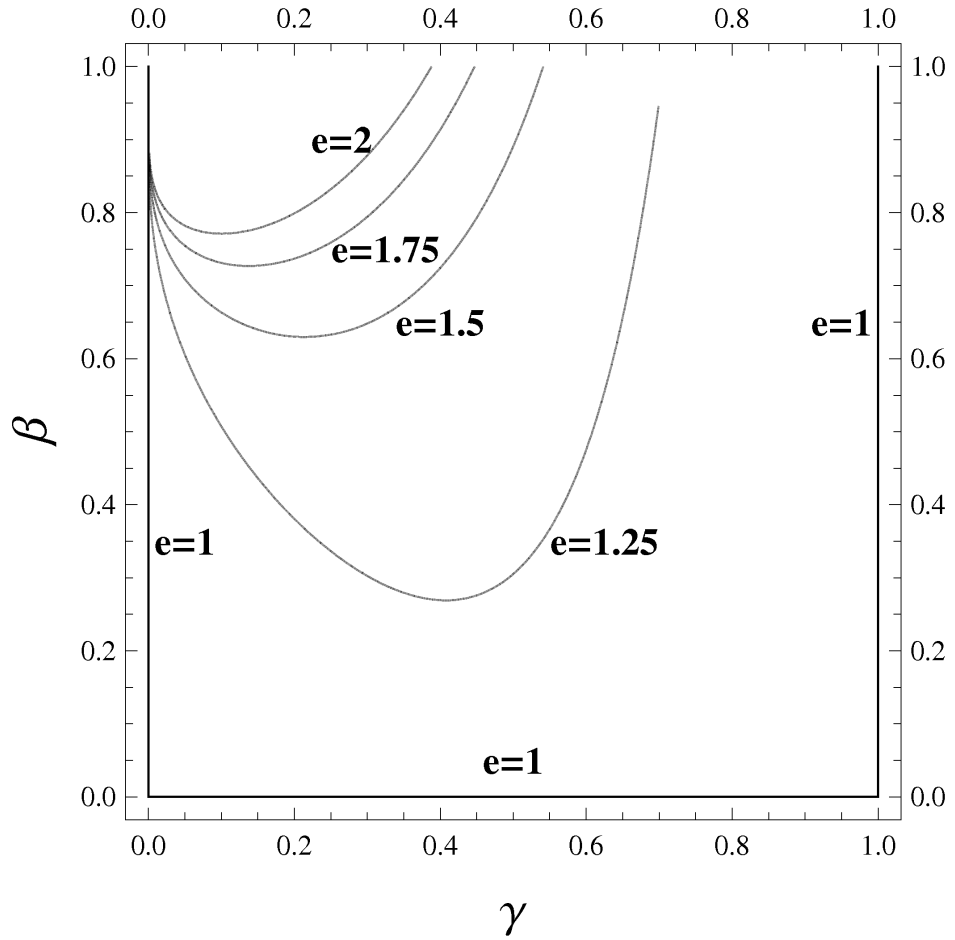

FIGURE 1: LOCI OF EXCESSIVE AGGLOMERATION - (γ,β)-SPACE $(\alpha/\alpha^* = 2, \bar{L} = 1)$.

consumption levels of those in the more productive country. It must be noticed that such a conclusion applies only where consumers purchase a mix of tradeable and non-tradeable goods.

Figure 1 also shows that the agglomeration of workers becomes increasingly excessive as β rises. In fact, it can be shown that the equilibrium labor level $\hat{L}$ increases faster than the planner's level $\tilde{L}$ as β rises. When local factor congestion is weaker, agglomeration in the higher productivity country is more pronounced both in the free migration equilibrium and in the planner's allocation. The externality in the migration decisions however exacerbates the agglomeration process at the cost of reducing aggregate consumption. This is because, as β increases, equilibrium

wages become less elastic to the relocation of workers and do not give appropriate location incentives to workers. Therefore, *the agglomeration of workers becomes increasingly excessive for weaker local factor congestion*.

Finally, Figure 1 shows that the impact of trade on excess of agglomeration is non-monotonic with respect to the size of the tradeable sector. Excessive agglomeration increases with γ for small γ while it decreases with it for large γ. Therefore, *the agglomeration of workers is the most excessive for intermediate shares of trade in the production*. More formally, we have that $W'(\hat{L}) = 0$ if $\gamma = 0$ whereas $W'(\hat{L}) = W'(\bar{L}/2) = 0$ if $\gamma = 1$. So, the welfare optimum and the equilibrium allocation coincide for those two parameter values. Hence, we expect that the agglomeration of workers becomes more inefficient as γ lies between those two bounds

To sum up, policies promoting free movement of workers can lead to excessive migration. Models with no trade, full trade and full congestion are not instructive about this effect.

4. SUSTAINABLE POLICIES FOR FREE MOVEMENT OF WORKERS

We now study whether policies of free movement of workers will be adopted by the two countries. In the previous section we highlighted the fact that high productivity countries may incur short run costs as too many workers migrate there. In the long run, countries may face bad productivity shocks and may use migration option to increase the welfare of their residents by allowing them to work in another country. So, countries balance the short run costs of accepting inflows of migrants in good states of nature and the long run benefit of allowing its population work in foreign countries in bad states.

To discuss this trade-off between costs and benefits in the short and long runs, we focus on a discrete time dynamic model with infinite horizon. First, we assume that individuals are infinitely lived and have the same discount factor $\delta \in (0,1)$. Under this assumption agents can also be interpreted as dynasties where each generation has an altruism coefficient δ. Second, we assume that countries are hit by productivity shocks. In each period of time t, a state of nature $s \in \mathscr{S} \equiv \{1,...,S\}$ determines the domestic and foreign productivity (α_s, α_s^*). States of nature are i.i.d. and have non-zero probability p_s where $\sum_s p_s = 1$. The operator $\mathrm{E}_s[\ ]$ denotes the expected value, i.e. $\mathrm{E}_s[x_s] = \sum_s p_s x_s$. Note that because the states of nature are i.i.d., agents' decisions depend only on the current state, so that we are allowed to analyze all decisions in the current time period and to drop the reference to time. To highlight the state dependence, we denote the consumption of a worker residing

in the domestic and foreign country by $C_s(L_s)$ and $C_s^*(L_s)$ while we denote the corresponding utility by $u_s(L_s) = U[C_s(L_s)]$ and $u_s^*(L_s) = U[C_s^*(L_s)]$.

In this context, we define a policy of *free movement of workers* as the removal of any control over economic migration between countries. More precisely, it is a *common* migration policy in which each countries *unconditionally* grant *non-permanent* work permits to any workers who obtain a job in their jurisdiction. As most economic migration policies do, non-permanent work permits are automatically associated with non-permanent residence permits. In this section, we also keep a distinction between, on the one hand, work permits and, on the other hand, the citizenship and socioeconomic and political rights that are associated with it. This distinction is important for two reasons. First, it fixes the group of individuals that each government represents to its nationals wherever they work and reside. When workers do not change citizenship or nationality, this group is invariant to the possible relocation of labor between country. Second, this distinction determines the alternative immigration policy of a country that does not adopt free movement of workers or that decides to breach from this policy. In such cases, we assume that the opting out and breaching countries are able to exert a control on the issue of work permits by putting restrictions and conditions on the number of non-permanent work permits. As a result they are able to stop renewing existing work permits granted to non citizens and therefore to legally reduce the local labor supplies. We discuss this distinction further in Section 5.

Many practical situations fit to the above setting. Typical alternative policies for local labor access to non-nationals are embedded in third-country association agreements or guest worker programs. Those agreements and programs permit the economic immigration of third-country nationals into a host country under the control of quotas or individualized labor certifications. For example, E.U. had such agreements with many Eastern European countries during the 1990s and still has such agreements with its neighboring countries like Turkey and Morocco. Hence, our discussion relates to the E.U. decision to adopt a policy of free movement of workers with Eastern European countries in the 1990s or to the current debate about Turkey's accession into the E.U. labor market. Our discussion may be relevant for the popular concerns about migration issues during the 2005 French referendum about the European Constitution. Similarly, the North American Free Trade Agreement (NAFTA) includes policies in favor of free movement of workers. In particular, the TN status that grants the equivalent of a non-permanent visa to U.S., Canadian and Mexican citizens who get the opportunity to work in each other's countries in certain professional occupations. The TN status is limited to

three years but can be renewed indefinitely. In practice, the U.S. has implemented a different treatment for the access of Canadians and Mexicans to the U.S. labor market. Whereas the TN status has been easily granted to Canadians at the U.S. border without quotas, it has been offered under tougher conditions to Mexican nationals who are subject to control procedures and to quotas. So, the present discussion also relates to the U.S. and Canadian decision to adopt a common uncontrolled migration of their nationals within NAFTA agreement and to the U.S. and Mexican decision to remove the present controls and quotas on Mexicans. The present discussion also relates to the extension of the TN status to other professional occupations and other countries. The discussion also extends to the U.S. H1B or to the U.S. employment-based green cards, etc.

We give each country two options: either to adopt the free movement of worker migration policy or to control migration. Yet, when a country chooses the second option, it is unable to alter the welfare of its natives working in the other country while it puts no weight on the immigrants residing in its own jurisdiction. Hence, the Nash equilibrium of the non-cooperative game in which each country independently controls the inflow of workers within its borders is a situation where no migration takes place. The second option therefore reduces to the absence of migration.

In order for the policy of free movement of workers to be adopted both countries must comply to the policy. For the sake of exposition, citizenship is initially evenly distributed across countries so that each country has $\bar{L}/2$ citizens. We shall assume that when a country does not adopt the policy of free movement of workers or when it breaches the agreement about the free movement of workers, both countries stop delivering work permits to non citizen workers. In such a case, the spatial distribution of workers is forced back to the initial distribution $(\bar{L}/2, \bar{L}/2)$. For simplicity, we assume that once the agreement about the policy of free movement of workers is breached, it is breached for ever though this last assumption can be relaxed without qualitatively altering the results.

Under the policy of free movement of workers, individuals are free to relocate at no cost in any country. Because individuals move freely, they get the same intertemporal utility in the next period irrespectively of the location they choose in the current period. So, their current location decision depends only on the current state s and labor spatial distribution $\hat{L}_s$. As a result, in equilibrium, agents locate so that their are indifferent between locations: $u_s(L_s) = u_s^*(L_s) \iff C_s(L_s) = C_s^*(L_s)$. *The long run equilibrium coincides with the short run equilibrium given by* (3)

in the previous section.[8] As we now deal only with the free movement outcome $\hat{L}_s$ and the initial allocation $\bar{L}/2$ we drop the "hat" and refer to the equilibrium allocation as L_s.

A policy of free movement of workers is *sustainable* if and only if each country's government evaluates that this policy is beneficial to its citizens at each date and every possible state. That is, a country will breach the policy if it ever finds it in its own interest to do so. As citizens are homogeneous each government compares the intertemporal utility of a representative citizen under free labor mobility with his/her intertemporal utility in the absence of the policy. Consider some state $r \in \mathscr{S}$. Free movement of workers implies a contemporaneous gain/loss relative to the alternative at any date t of $u_r(L_r) - u_r(\bar{L}/2)$. As we have seen in the previous section, a country will incur a contemporaneous loss if it becomes more productive ($\alpha_r > \alpha_r^*$) and must host an uncontrolled flow of immigrants. Free movement of worker will be adopted by countries if contemporaneous losses are offset by future benefits. Future benefits will only arise if there are some future states $q \in \mathscr{S}$ where the country has productivity turndowns ($\alpha_q < \alpha_q^*$). Since the equilibrium allocation of labor is history independent, the expected future benefits at any date t is equal to $\mathrm{E}_s[u_s(L_s) - u_s(\bar{L}/2)]$. The free migration policy will therefore only be sustainable if

$$u_r(L_r) - u_r(\bar{L}/2) + \frac{\delta}{1-\delta}\mathrm{E}_s[u_s(L_s) - u_s(\bar{L}/2)] \geq 0 \quad \forall r \in \mathscr{S}. \tag{4}$$

We refer to these conditions as *participation* or *self-enforcement* constraints. Condition (4) is the most stringent for the state(s) with the highest contemporaneous loss $\overline{s} \in \arg\max_r \{u_r(\bar{L}/2) - u_r(L_r)\}$. Similarly the equivalent of Condition (4) for the foreign country is more stringent in the state(s) $\overline{s}^* \in \arg\max_r \{u_r^*(\bar{L}/2) - u_r^*(L_r)\}$. Rewriting Condition (4), we can state that the policy of free movement of workers is sustainable if and only if

$$\begin{aligned} u_{\overline{s}}(L_{\overline{s}}) - u_{\overline{s}}(\bar{L}/2) + \frac{\delta}{1-\delta}\mathrm{E}_s[u_s(L_s) - u_s(\bar{L}/2)] \geq 0 \\ u^*_{\overline{s}^*}(L_{\overline{s}}) - u^*_{\overline{s}^*}(\bar{L}/2) + \frac{\delta}{1-\delta}\mathrm{E}_s[u^*_s(L_s) - u^*_s(\bar{L}/2)] \geq 0 \end{aligned} \tag{5}$$

[8] Note that this property is valid only under free movement of workers. It is not valid under policies that control migrations because future utility levels then differ across countries.

These conditions leads to the following conclusions. First, sustainability is possible only if there exist positive future expected gains. This implies that countries should expect to incur negative productivity shocks in the future. Second, because $\delta/(1-\delta)$ is an increasing function $[0,1] \to \mathscr{R}^+$, policies promoting free movement of workers are sustainable if discount factors are large enough. This is a result reminiscent of the Folk Theorem in repeated games (Friedman 1971). Finally, by Condition (5), sustainability is less likely if the probability of going to the states $\overline{s}$ and $\overline{s}^*$ are higher.

The next subsection discusses sustainability when the benefit of free movement of workers stems only from labor market flexibility. The following subsection introduces risk aversion.

4.1. Sustainability and labor market flexibility

To highlight the benefit of labor market flexibility, we first ignore any insurance motives by supposing workers are risk neutral: $u_s(L_s) = C_s(L_s)$. Also, to get insight about the impact of trade and congestion factors on the adoption of policies of free movement of workers, we simplify the model. Here we focus on a simple shock structure that permits analytical investigation. We assume that countries face a two-state anti-correlated shocks where $S = 2$, $\alpha_1 = \alpha_2^* = \alpha > 1$ and $\alpha_2 = \alpha_1^* = 1/\alpha < 0$ with $p_1 = p_2 = 1/2$. Hence the domestic country incurs a high productivity shock in state 1 and a low productivity shock in state 2. The opposite occurs for the foreign country. Countries have no common shocks so that there exists a clear benefit to pool the labor markets.

Under free movement of workers, the equilibrium conditions imply equal consumption in both states, $C_s(L_s) = C_s^*(L_s)$, $s \in \{1,2\}$, whereas the symmetry of productivity shocks imposes symmetric employment and consumption levels across states: $L_1 = L_2^*$ $(= \bar{L} - L_2)$ and $C_1(L_1) = C_2^*(L_2)$. Therefore, consumption is identical in any country and state of nature: $C_1(L_1) = C_2(L_2) = C_1^*(L_1) = C_2^*(L_2)$. From equation (3) we have

$$L_1 = \frac{\rho^2}{1+\rho^2}\bar{L} \quad \text{and} \quad L_2 = \bar{L} - L_1 = \frac{1}{1+\rho^2}\bar{L} \quad \text{where} \quad \rho = \alpha^{\frac{1-\gamma}{1-\beta(1-\gamma)}}.$$

A planner maximizing the ex-ante welfare, maximizes state-wise or ex post welfare, so chooses L to maximize

$$W(L) = \omega(L)C(L) + (1-\omega(L))C^*(L).$$

The optimal distribution of labor in the present dynamic setting corresponds to the utilitarian optimal distribution of workers discussed in Proposition 1. As a result, free movement of workers leads to excess agglomeration in the high productivity country when $\beta \neq 0$ and $\gamma \notin \{0,1\}$.

The domestic country has the most stringent participation constraint (5) in state 1 whereas the foreign country has the exactly the same most stringent participation constraint (5) in state 2. Given symmetry the two conditions (5) are identical and simplify to

$$G(\alpha,\beta,\gamma) \leq \frac{\delta}{2-\delta}. \tag{6}$$

where the function

$$G(\alpha,\beta,\gamma) \equiv \frac{C_1(\bar{L}/2) - C_1(L_1)}{C_2(L_2) - C_2(\bar{L}/2)}.$$

measures the *relative cost of adopting (the policy of) free movement of workers*. The sustainability of free movement of workers is related to the value of relative cost of adopting the free movement of workers, $G(\alpha,\beta,\gamma)$. The function G balances the short run cost of accepting migrants in the good state (state 1 for the home country, state 2 for the foreign country) to the short run benefit of the migration option in the bad state (state 2 for the home country, state 1 for the foreign country). It is possible that $G > 1$ so that the costs of accepting migration in the good state exceed the benefits of allowing migration in the bad state. Because $\delta/(2-\delta)$ is an increasing function ranging in the interval $[0,1]$, the policy of free movement of workers is not sustainable when $G > 1$. When $G < 1$ the policy of free movement of workers is more likely to be sustainable when the relative cost of adopting the policy of free movement of workers falls. That is, when the short run cost of accepting migrants falls or when the benefit of the migration option increases.

To consider the value of the function G it is instructive to begin with the discussion of the cases where γ and β are set to their extreme values. First, consider that all goods are traded ($\gamma = 1$). Then, the relative cost of adopting free movement of workers can be shown that $G(\alpha,\beta,1) = 1$. Because the terms of trade fully absorb productivity differences, there is no incentive for workers to relocate and the labor force remains evenly distributed. Trade is a perfect substitute for labor mobility. Free movement of workers has therefore no value and is not a sustainable policy for any discount factors.

Second, suppose that no goods are traded ($\gamma = 0$). Then, the relative cost of adopting free movement of workers, $G(\alpha,\beta,0)$, is smaller than one: free movement of workers is therefore a sustainable policy provided that workers and governments are sufficiently patient (high δ). In the absence of trade, production efficiency can only be restored through relocation of the labor force. To see this, let us first check the case of immobile labor. Per capita consumption is given by the domestic and foreign individual productivities so that $C_1(\bar{L}/2) = \alpha\,(\bar{L}/2)^{\beta-1}$ and $C_2(\bar{L}/2) = \alpha^{-1}\,(\bar{L}/2)^{\beta-1}$. Workers' consumption is again larger in the domestic high productivity country. Under the policy of free movement of workers, workers move toward the high productivity country so that $L_1^*/L_1 = (1+\alpha^{2(\beta-1)}) < 1$ and consumption is $C_1(L_1) = \alpha L_1^{\beta-1}$. The short run cost of accepting migration is equal to $\alpha\,(\bar{L}/2)^{\beta-1} - \alpha L_1^{\beta-1}$ whereas the benefit of the migration option is equal to $\alpha L_1^{\beta-1} - \alpha^{-1}\,(\bar{L}/2)^{\beta-1}$. It can be shown that this short run cost is smaller than the benefit for the migration option. Therefore, free movement of workers is a sustainable policy if the discount factor δ is high enough. Furthermore it is easily checked that as local factor congestion vanishes ($\beta \to 1$) the short run cost falls to zero while the net benefits remain positive so that $G(\alpha,\beta,0)$ tends to zero. As a result, free movement of workers is likely to be sustainable when no goods are traded and congestion is weak enough.

Third, consider the case where firms face very strong decreasing returns to scale or local factor congestion ($\beta \to 0$). Then, also in this case the relative cost of adopting free movement of workers, $\lim_{\beta\to 0} G(\alpha,\beta,\gamma) = 1$. Free movement of workers is therefore not a sustainable # policy. In this case, the economy resembles a situation where each country randomly gets a crop of size α or α^{-1} and trades a share of its crop to get an equal consumption of $A + A^{-1}$ where $A = \alpha^{1-\gamma}$. In the absence of migration consumption is $2A$ in the high productivity country and $2A^{-1}$ in the low productivity country. Thus the short run cost of accepting migrants is $2A - (A + A^{-1}) = A - A^{-1}$ whilst the short term benefit is $(A + A^{-1}) - 2A^{-1} = A - A^{-1}$. Since the short run cost equals the short term benefit, impatient, risk-neutral workers in the high productivity country will never accept incurring this short run cost for a possible benefit of an equal amount in the future. The last two cases highlights the fact that free movement of workers may not be an enforceable policy simply because of the delays between costs and benefits. As seen before, those cases indeed do not lead to excess agglomeration of workers.

Finally, suppose that there exists no local factor congestion but some trade occurs ($\beta = 1$, $\gamma > 0$). In this case it can be shown that $G(\alpha) = (\alpha^{1-\gamma} - 1)/(1 - \alpha^{\gamma-1}) \in$

$(1,\alpha]$ and G monotonically decreases from α to 1 as γ rises from 0 to 1. As a result, free movement of workers is not a sustainable policy. This can be seen as follows. In the absence of labor mobility, the domestic and foreign individual consumption is given by the high and low productivities so that $C_1(\bar{L}/2) = \alpha^{1-\gamma}$ and $C_2(\bar{L}/2) = \alpha^{\gamma-1}$. Workers' consumption is of course larger in the high productivity country so that workers have incentives to move to the high productivity country under free movement of workers. Nevertheless, because there exists a demand for the good produced in the low productivity country ($\gamma > 0$), there still exists a demand for labor in that country and workers never fully agglomerate in the high productivity country. In equilibrium, labor allocates according to $L/L^* = \alpha^{2(1-\gamma)/\gamma}$ and workers' consumption is given by $C_1(L_1) = \alpha^{1-\gamma}(L/L^*)^{-\gamma/2} = 1$. Comparing this to consumption in the absence of migration, we observe that the short run cost of accepting migrants is then equal to $\alpha^{1-\gamma} - 1$ whereas the benefit of the migration option is equal to $1 - \alpha^{\gamma-1}$. Because $\alpha^{1-\gamma} + \alpha^{\gamma-1} > 2$ provided $\alpha > 1$, this short run cost is larger than the benefit. Thus the high productivity country never finds it profitable to accept migrants in exchange of the promise to trigger migration outflow in a future bad state of nature. This is a remarkable result given the common claim that migration is irrelevant in a world with constant returns to scale because workers move with both their demand and production capabilities. However, we have shown in the previous section that there exist excess agglomeration of workers in the high productivity country even under constant returns to scale. This effect increases both the short run cost and benefit of migration. Yet, because of the presence of inefficiencies, it increases the short run cost of migration more than its benefit and hence makes the sustainability of a policy of free movement of labor more difficult

PROPOSITION 2: *Suppose that individuals are risk neutral and that countries face a two-state anti-correlated shocks. Free movement of workers is never a sustainable policy in an economy with only tradeable goods ($\gamma = 1$) or with either very low or very high congestion costs ($\beta \in \{0,1\}$). In an economy where no goods are tradeable ($\gamma = 0$), free movement of workers becomes a sustainable policy if and only if individuals are sufficiently patient (high δ).*

The four cases that are formally discussed above suggest that free movement of workers is less likely to be a sustainable policy in economies with large trade and high congestion of local factors. Figure 2 depicts for all congestion and trade parameters (β,γ) the locus of the equality $G(2,\beta,\gamma) = \delta/(2-\delta)$ where $\delta/(2-\delta) = 0.25$, 0.50,0.75 and 1. These values respectively corresponds to critical discount factors $\delta = 0.40$, 0.66, 0.85 and 1. The area (a) corresponds to

the situation where $G(2,\beta,\gamma) > 1$ and the areas (b) and (c) to the situation where $G(2,\beta,\gamma) < 1$. The relative cost of adopting free movement of workers $G(2,\beta,\gamma)$ becomes larger as we move to the North-West of the figure. As a result, free movement of workers is more likely to become a sustainable policy in economies with smaller local factor congestion and lower trade.

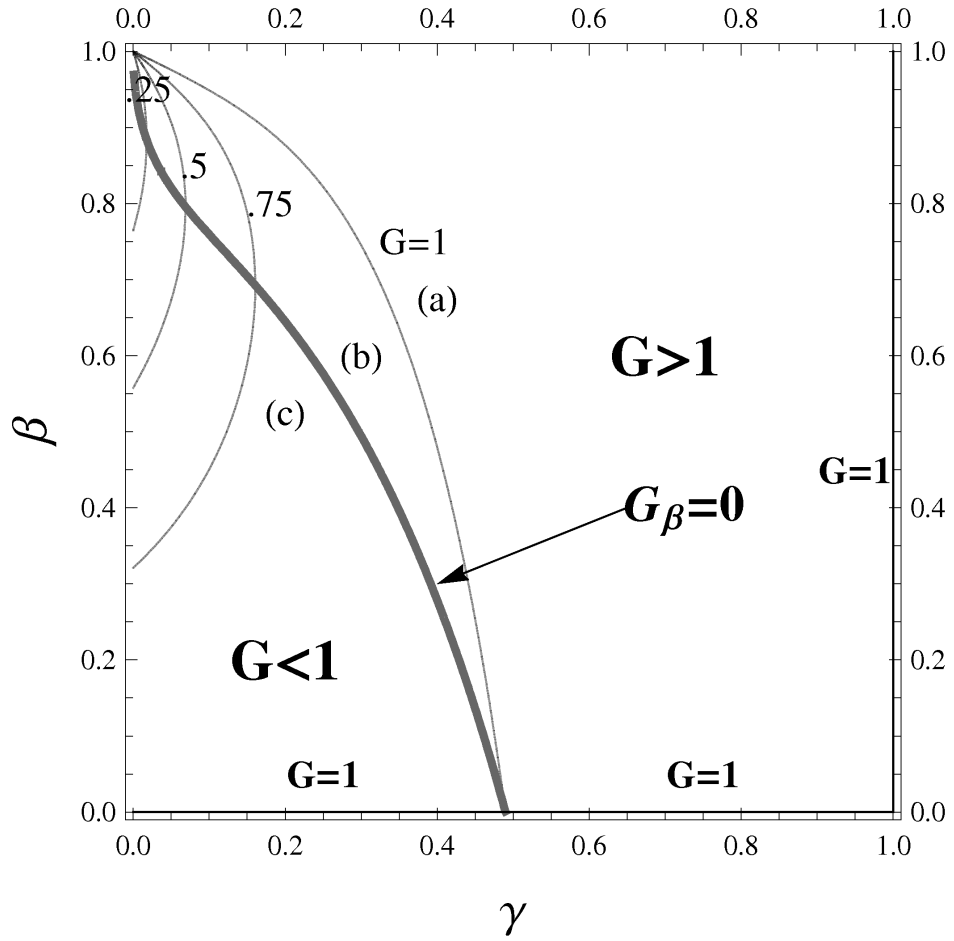

FIGURE 2: RELATIVE COST OF ADOPTING THE FREE LABOR MOBILITY POLICY - $G(2,\beta,\gamma)$.

Finally, Figure 2 also shows that the relative cost of adopting free movement of workers G increases as more goods are traded (larger γ). Because trade is a substitute for migration, free movement of workers is less useful when trade is large. On the other hand, the relative cost of adopting free movement of workers, $G(2,\beta,\gamma)$, is not monotone with respect to the intensity of congestion

parameter β. Indeed, as we move downward in Figure 2 (β falls), $G(2,\beta,\gamma)$ firstly decreases when the parameters (β,γ) lie in the area (b) but it increases when those parameters lie in the area (c). In the figure, areas (b) and (c) are separated by a thick curve which corresponds to the locus where the partial derivative $G_\beta = \partial G(2,\beta,\gamma)/\partial\beta = 0$. Thus this locus shows for a given γ the value of β for which free movement of workers can be supported for the lowest discount factor. Whereas lower congestion or decreasing returns to scale implies that domestic workers' productivity and wages are less affected by immigration, it also implies that migration is not reduced enough by any upward pressure on wages in the low productivity country. Excess migration occurs and can be so inefficient that the domestic country does not find it profitable to opt for free movement of workers. In this case, the short run cost of accepting an excessive inflow of migrants in good states of nature does not outweigh the benefit of the migration option in bad states of nature.

We summarize our result in the following proposition. Let the set $\Gamma(\alpha,\beta,\gamma) = \{(\alpha,\beta,\gamma) : G(\alpha,\beta,\gamma) < 1\}$. From the above discussion about the case $\gamma = 0$, we know that this set is non empty.

PROPOSITION 3: *Suppose that individuals are risk neutral and that countries face a two-state anti-correlated shocks. Consider a free labor mobility policy such that work permits are granted on the condition of employment. Then, we get the following:*
(i) The free labor mobility policy is not sustainable if $(\alpha,\beta,\gamma) \notin \Gamma(\alpha,\beta,\gamma) \neq \emptyset$. *Otherwise there exists a discount factor* $\underline{\delta} \in (0,1)$ *such that free migration policies are sustainable if* $\delta \geq \underline{\delta}$.
(ii) The free labor mobility policy is more likely to be sustainable as more goods are traded. It also is more likely to be sustainable for smaller (resp. larger) local factor congestion if the latter is not too large (resp. small).

In this subsection, we have analyzed the sustainability of free movement of workers under the assumption of risk neutrality. Countries benefit from a more efficient spatial distribution of workers in each state of nature. When individuals are risk averse, free movement of workers may also provide insurance to individuals because it allows them to smooth incomes and consumptions by providing incentives for workers to relocate. We develop this idea in the following subsection.

4.2. Sustainability, insurance and labor flexibility

When individuals are risk averse, the free movement of workers allows countries to smooth income fluctuation by pooling the risk of productivity shocks.

This property becomes significant as soon as shocks are not perfectly positively correlated.

It is firstly interesting to study the case where individuals are infinitely risk averse. In this case, for any set of states, individuals take into account only the payoff in the worst state of nature they can reach, say state $\underline{s}$. It is then clear that the free movement of workers always improves consumption in the worst state relative to the no mobility option. Thus, from condition (4), it can be seen that the expected future gain is always positive so that there must be a large enough discount factor above which free movement of workers becomes a sustainable policy.

The impact of risk aversion on the adopting free movement of workers can be made more precise in the above context of the two-state anti-correlated shocks. Under risk aversion, *the relative cost of adopting (the policy of) free movement of workers* becomes

$$G(\alpha,\beta,\gamma) \equiv \frac{u_1(\bar{L}/2) - u_1(L_1)}{u_2(L_2) - u_2(\bar{L}/2)}.$$

where $u_s(L_s)$ denotes the contemporaneous utility $U[C_s(L_s)]$.

Let us here review some polar cases. First, when all goods are traded ($\gamma = 1$), we know that the terms of trade fully absorb any productivity differentials. Individuals therefore reach a constant utility and the function $G(\alpha)$ is still equal to one.[9] As before, free movement of workers is not useful and therefore it is not sustainable. Second, when congestion is very strong ($\beta \to 0$), the model works as if the world supplied a fixed amount of output that was asymmetrically divided across the countries. Although free movement of workers offers no efficiency gain in labor markets, it allows countries to reach an allocation of output closer (but not equal) to an even distribution of output. Free movement of workers provides an (imperfect) insurance contract. As individuals becomes more risk averse the expected benefit of the policy, $E_s u_s(L_s) - E_s u_s(\bar{L}/2)$, increases compared to its short term cost, $u_{\bar{s}}(\bar{L}/2) - u_{\bar{s}}(L_{\bar{s}})$. Therefore, the relative cost of adopting free movement of workers, $G(\alpha)$, is smaller than one and *there must exist discount factors for which free movement of workers is a sustainable policy*. Third, when there is no congestion and some tradeable goods ($\beta = 1$, $\gamma > 0$), the relative cost of adopting free movement of workers is equal to $G(\alpha) = \left[U(\alpha^{1-\gamma}) - U(1)\right] / \left[U(1) - U(\alpha^{\gamma-1})\right]$ which is smaller than one if and only if $U(\alpha^{1-\gamma}) + U(\alpha^{\gamma-1}) < 2U(1)$. It can be shown that this is always true for any utility function which has a coefficient of rel-

[9] We drop the notational dependence of G on β and γ in what follows.

ative risk aversion greater than or equal one for all relevant levels of consumption. As a consequence, *when coefficient relative risk aversion is larger than one, there always exist discount factors* $\delta \in (0,1)$ *for which free movement of workers is a sustainable policy*.

We summarize these results in the following proposition:

PROPOSITION 4: *Suppose that individuals are risk averse and that countries face a two-state anti-correlated shocks. Free movement of workers is never a sustainable policy in an economy with only tradeable goods (*$\gamma = 1$*). In an economy with either very low or very high congestion costs (*$\beta \in \{0,1\}$*). free movement of workers becomes a sustainable policy if and only if individuals are sufficiently patient (high* δ*).*

Risk aversion has positive impact on the adoption of free movement of workers because free migration equalizes consumption across countries and reduces the consumption variability across states of the worlds. Risk aversion can also have important impact on the adoption of free movement of workers. To illustrate this, we have plotted the sets of parameters (β,γ) for which the relative cost of adopting the free movement of workers, $G(\alpha) = 0.5$ (dashed lines) and $G(\alpha) = 1$ (solid lines). The curves are drawn for constant relative risk aversion (CRRA) preferences with relative risk aversion coefficient ρ varying from 0 to 3. It is worth noting that for any relative risk aversion coefficient larger than one, the relative cost of adopting free movement of workers, $G(\alpha)$, is smaller than one everywhere except at the North and East borders of the figure. *Therefore, for a constant relative risk aversion coefficient larger than one and for almost all parameters of the model* (β,γ), *there always exists a discount factor for which free movement of workers is a sustainable policy*. Although we have seen that the terms of trade eliminate the potential efficiency gains from a flexible relocation of workers, they do not eliminate the potential insurance gain caused by free movement of workers. The decision of adopting free movement of workers has a natural insurance element that should not be under-assessed.

To sum up, we have shown that free movement of workers is a sustainable policy for small enough discount factors, for small enough trade levels and for intermediate local factor congestion. Risk aversion is an important element in the decision to sustain free movements of workers.

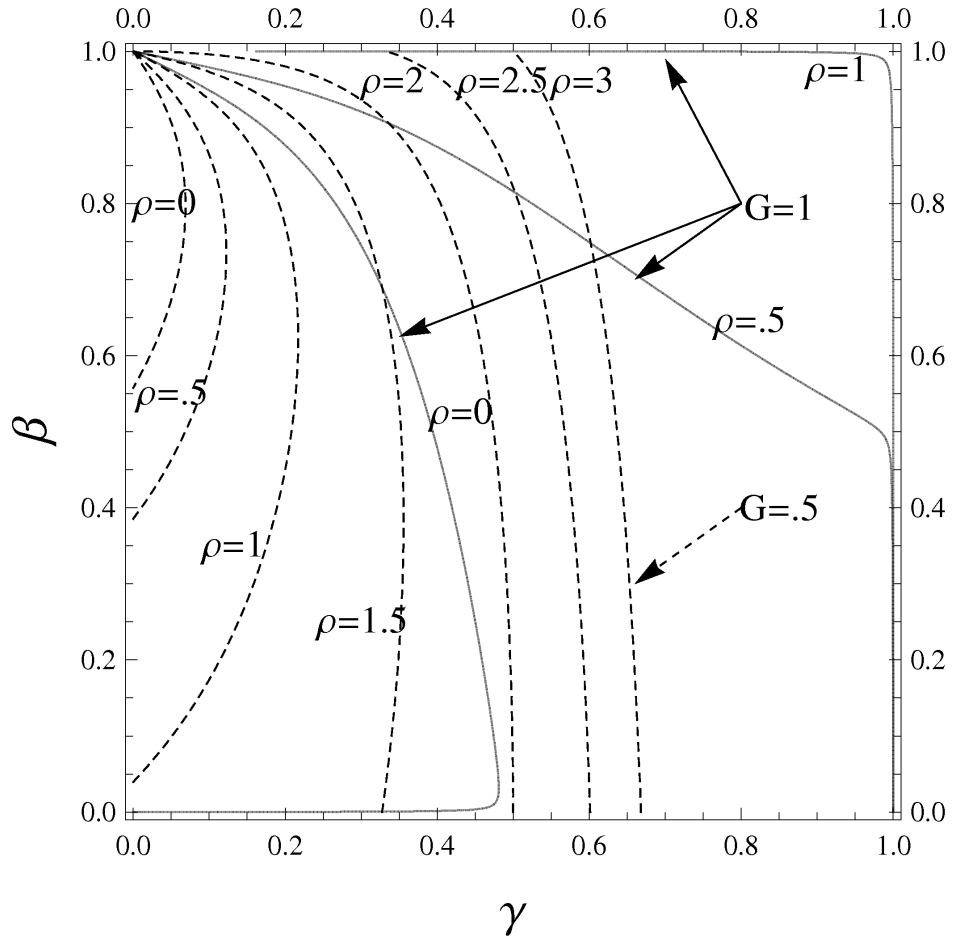

FIGURE 3: COST OF ADOPTING THE FREE LABOR MOBILITY POLICY UNDER RISK AVERSION.

5. FULL RIGHT MIGRATION POLICY

We now return to the distinction between non-permanent and permanent work program and between rights for work permits and citizenship. In particular we now study another form of labor mobility where individuals are automatically granted citizenship in the host country.

The policy of free movement of workers analyzed above is based on the distinction between work permits and citizenship. Because guest workers have permanent work permit and have no local citizenship, they are not included in the local government's objective. In this section we relax this distinction and assume that immigrants receive the citizenship and associated rights to participate in the local

labor market in a permanent way. This assumption tackles the situations where economic shocks last longer than the civil integration (e.g. naturalization) of immigrants into the host country. Indeed, in many countries, a long enough residence in a country allows migrants to acquire citizenship and therefore to get a permanent right to participate in the local labor market. Similarly, the descendants of non citizen migrants are often granted or allowed to ask the citizenship of their parents' host country, a right that open them the right to participate in the local labor market.

Two examples for this setting can be found in the E.U. and the U.S. Under the Treaty of Lisbon, E.U. citizens are allowed to get permanent work permit and resident cards in any E.U. member state where they find work while they keep their initial nationality and most of their political rights in the native country. In E.U. countries, individuals may acquire the local nationality after a certain amount of time and the local nationality can be asked for the descendants born on the local territories. Similarly, the U.S. immigration services grant to foreign workers green cards that offer permanent residence and access to labor market. As as step forward, the green cards that give the opportunity to apply for U.S. citizenship after a certain amount of years. Descendants born in the U.S. automatically acquire the U.S. citizenship. Therefore it is of interest to study the adoption of migration policy in which immigrants get the same rights as local citizens and in which governments are concerned by the welfare of both native and (naturalized) immigrant workers.

In this section we study the adoption of a *full right migration policy* by which, at the beginning of each time period, immigrants get the full rights to citizenship and labor participation in the country where they locate. Those rights include the political rights so that the welfare of both native and immigrants becomes the concerns of each government. In particular we focus on the case where those rights are acquired at the time of entry into the host country and where those rights are exclusive in the sense that migrants loose their former citizenship and rights associated with their former nation.[10] We finally keep the assumption that once the agreement about the policy is breached, it is breached for ever. The full right migration policy includes two main differences with the policy of free movement of workers. On the one hand, when a country breaches from the full right migration policy, it is indeed unwilling to reduce its work force because migrants are now part of its political constituency. On the other hand, because the number of nationals vary with shocks and related immigration flows, the initial

[10] In practice, such political rights may take some time to be acquired and may sometimes be cumulated over several countries. However, we assume away such situations for the simplicity of the argument.

distribution of nationals generally differs from the distributions of nationals in subsequent time periods. As result, we must distinguish the acceptability and the sustainability of the full right migration policy: acceptability relates to the decision to adopt the policy with the initial population distribution whereas sustainability relates to the decision to continue (or not to breach) the policy given the population distribution in subsequent time periods. We show that a full right migration policy is less likely to adopted than the policy of free movement of workers.

Sustainability We first focus on sustainability of the full right migration policy by assuming that the policy is already agreed. If the domestic country breaches the agreement, it can restrict the delivering of work permits only to its citizens. Hence, domestic labor market conditions are given by the number of domestic citizens who have established residence in that country during the previous time period and who have been granted citizenship and labor participation rights. If we denote by r and $q \in S$ the states of nature in the current and previous time periods and by $u_s(L_s)$ the instantaneous utility $U[C_s(L_s)]$, the full right migration policy is sustainable for the domestic country if and only

$$u_r(L_r) + \frac{\delta}{1-\delta} E_s u_s(L_s) \geq u_r(L_q) + \frac{\delta}{1-\delta} E_s u_s(L_q) \quad \forall r, q \in S \tag{7}$$

where L_r and L_q are the short run equilibrium numbers of workers given by (3). This condition is explained as it follows. The right hand side of this condition represents the domestic citizens' intertemporal utility when their government breaches the policy agreement and keeps its L_q citizens.[11] The left hand side of this condition represents the domestic citizens' intertemporal utility under the policy. Because the citizens are allowed to move freely, they get the same intertemporal utility in the next period irrespectively of the location they choose in the current period; their current location decision thus depends only on the current state r and labor spatial distribution L_r. As a result, the long run equilibrium coincides with the short run equilibrium where $u_s(L_s) = u_s^*(L_s)$. In the beginning of the current time period, the domestic government represents only L_q citizens. Because of the possibility of relocation, those citizens get an intertemporal utility equal to $u_r(L_r) + \frac{\delta}{1-\delta} E_s u_s(L_s)$.

Because the domestic instantaneous utilities decrease with a larger domestic labor force, it is clear that Condition (7) is the most stringent for $\overline{q} \equiv \arg\min_s L_s$

[11] In the previous analysis $L_q = \bar{L}/2$ for each state q.

and $\bar{r} \equiv \arg\max_r [u_r(L_{\bar{q}}) - u_r(L_r)]$. The domestic country's incentive to breach is the strongest (1) when it just recovers from the strongest negative shock and has kept only a small large share of its initial population and (2) when the short run utility gain of restricting access to labor market in the current time period is the most important. In contrast to the policy of free movement of workers, this puts a restriction on the set of shocks that make the full right migration policy sustainable.

To get more insight we establish the following necessary condition. Let us take the expectation of both sides of Condition (7) with respect to states r ($E_r(\cdot)$). Then Condition (7) implies that $E_s u_s(L_s) \geq E_s u_s(L_q)$. Therefore, the full right migration policy is sustainable only if there exists no state of nature $q \in S$ such the latter inequality is not satisfied. Given our definition of $\bar{q}$, this means that the full right migration policy is sustainable only if

$$E_s u_s(L_s) \geq E_s u_s(L_{\bar{q}})$$

This puts an downward bound on the size of countries' possible economic depression and migration flows: the full right migration policy cannot be sustainable if the labor distribution becomes too unevenly distributed in the domestic country's worst state of nature $\bar{q}$. This country may indeed take advantage of its small population share when its economy returns to good fortune.

It is also interesting to apply this necessary condition to the case of the two-state anti-correlated shock that we have analyzed earlier ($\alpha_1 = \alpha_2^* = \alpha > 1$, $\alpha_2 = \alpha_1^* = 1/\alpha < 0$ and $p_1 = p_2 = 1/2$). The necessary condition simplifies to $u_2(L_2) \geq u_1(L_2)$, which contradicts the property of the shock symmetry, $u_2(L_2) = u_1(L_1)$, and the fact that $u_1(L_1) < u_1(L_2)$ because $L_1 > L_2$. We summarize this discussion in the following proposition.

PROPOSITION 5: *Consider a full right migration policy such that immigrants get citizenship in the host country.*
(i) This policy is sustainable if and only Condition (7) holds for $q = \bar{q} \equiv \arg\min_s L_s$ and $r = \bar{r} \equiv \arg\max_s [u_r(L_{\bar{q}}) - u_r(L_r)]$.
(ii) The policy is never sustainable if $E_s u_s(L_s) \leq E_s u_s(L_{\bar{q}})$.
(iii) The policy is never sustainable in the case of a two-state anti-correlated shock.

Adoption The present discussion focused on the sustainability of the full right migration policy by assuming that the policy was already agreed. We now analyze the issue of the *adoption* of the policy in the initial time period where population distributions are not the result of free labor movements. In line with the previous

section, we suppose that the spatial distribution is initially given by $(\bar{L}/2, \bar{L}/2)$. Let the state in the initial time period be denoted by r_0. So, the full right migration policy is adopted in the initial time period if and only if Condition (7) holds and if the following *adoption condition*

$$u_{r_0}(L_{r_0}) + \frac{\delta}{1-\delta} E_s u_s(L_s) \geq u_r(\bar{L}/2) + \frac{\delta}{1-\delta} E_s u_s(\bar{L}/2) \tag{8}$$

holds. The adoption condition is obvious the counter part of Condition (4) where r is replaced by r_0. It compares the intertemporal utility of a representative citizen under free labor mobility with his/her intertemporal utility when its government blocks the population to its initial distribution. Because $\bar{L}/2 \geq L_{\bar{q}}$, the right hand side of this condition is smaller than the right hand side of Condition (7). Because this is true for any r_0, the adoption condition is implied by Condition (7). Therefore, if Condition (7) holds and countries are initially evenly distributed, the domestic country adopts the full right migration policy for any initial state of nature. By the same token we have proven that Condition (7) is stronger than Condition (4). This means that a policy of free movement of workers is always sustainable if the full right migration policy is adopted.

We summarize our discussion in the following proposition.

PROPOSITION 6: *Consider a full right migration policy such that immigrants get citizenship in the host country. Then, a full right migration policy will be both adopted and sustainable under the conditions of Proposition* 5 *if the population is initially distributed, The full right migration policy is less likely to be adopted than the policy of free movement of workers.*

The main message of this discussion is that a full right migration policy is less likely to be sustainable and adopted than the policy of free movement of workers. The reason lies in the fall-back positions of the two countries when they face (strong) productivity changes. When the domestic country had a low productivity and suddenly faces a strong rise in its productivity, it has the option to breach the full right migration policy and restrict the benefit of the productivity rise to its local citizen only. As a result, the other country is unable to offer to its citizens the option to migrate in the former country, a situation that is particularly critical when it faces a sudden negative productivity shock at the same time. The harm to this country is more important in the case of a full right migration policy compared to a free labor migration policy because the country is unable to restrict work participation to the $\bar{L}/2$ workers of the initial time period. Hence, the fall-back position of

countries with respect to citizenship and rights to local labor market participation is an important element of sustainability and adoption of labor mobility policies.

6. EXTENSIONS

We here investigate the effect of productivity differentials and unemployment on the adoption of policies of free movement of workers.

6.1. Country asymmetries

The above discussion suggests that there exist good economic rationales to permit labor flows between countries when the latter face non correlated productivity shocks. Yet, it is readily observed that free labor flows are neither organized nor permitted between many countries of the world. This is particularly true for labor flows between developing and developed countries. In this section we present a simple argument to offer an explanation based on the productivity differences for the paucity of common policies promoting free movement of workers between developing and developed countries. We show that large productivity differences make labor mobility policies less likely to be sustainable. For the sake of conciseness, we focus on the policy of free movement of workers. By Proposition 5 (iv), the full right migration policy will not be adopted if free movement of workers is not a sustainable policy.

To make the argument simple, suppose that agents have an instantaneous utility given by the CRRA utility function, $U(C) = C^{1-\rho}/(1-\rho)$, $\rho \geq 0$ and $\rho \neq 1$. Suppose further the domestic productivity is now given by $\widetilde{\alpha}_s \equiv \theta \alpha_s$ whereas the foreign productivity remains equal to α_s^*, $s \in \mathscr{S}$. The parameter θ ($\theta \geq 1$) measures the domestic productivity advantage. Then, the equilibrium distribution of labor under free labor mobility is given by

$$\frac{\widetilde{L}_s}{\widetilde{L}_s^*} = \left(\frac{\widetilde{\alpha}_s}{\alpha_s^*}\right)^{\frac{1-\gamma}{1-\beta(1-\gamma)}} = \left(\frac{\theta\alpha_s}{\alpha_s^*}\right)^{\frac{1-\gamma}{1-\beta(1-\gamma)}} = \frac{L_s}{L_s^*}\left(\theta^{\frac{1-\gamma}{1-\beta(1-\gamma)}}\right)$$

where the tilde $\widetilde{\ }$ denotes the new variables under country asymmetry. One can compute that $d\widetilde{L}_s/d\theta > 0$ so that $\widetilde{L}_s > L_s, \forall s \in \mathscr{S}$. As a result, a higher productivity advantage yields a stronger incentive to agglomerate in the domestic country. This is true for any state of nature. Also, it can be checked that employment levels are ranked in the same order as in the case where $\theta = 1$. So, $L_s > L_r \iff \widetilde{L}_s > \widetilde{L}_r$,

$r \neq s$. Because of CCRA preferences for risk, the instantaneous utility is equal to

$$\widetilde{u}_s(\widetilde{L}_s) = U\left[(\theta\alpha_s)^{1-\gamma/2}(\alpha_s^*)^{\gamma/2}\left(\widetilde{L}_s\right)^{\beta(1-\gamma/2)-1}\left(\widetilde{L}_s^*\right)^{\beta\gamma/2}\right] = u_s(\widetilde{L}_s)\left(\theta^{(1-\gamma/2)(1-\rho)}\right).$$

Following the same argument as for Condition (4), we can state that free movement of workers is a sustainable policy for the domestic country if and only if

$$\frac{\delta}{1-\delta} \geq \frac{\widetilde{u}_{\overline{s}}(\overline{L}/2) - \widetilde{u}_{\overline{s}}(\widetilde{L}_{\overline{s}})}{E_s\widetilde{u}_s(\widetilde{L}_s) - E_s\widetilde{u}(\bar{L}/2)}$$

which is equivalent to

$$\frac{\delta}{1-\delta} \geq \frac{u_{\overline{s}}(\bar{L}/2) - u_{\overline{s}}(\widetilde{L}_{\overline{s}})}{E_s u_s(\widetilde{L}_s) - E_s u_s(\bar{L}/2)} \tag{9}$$

Condition (9) is the same as Condition (4) except that the variables of domestic employment L_s have been replaced by $\widetilde{L}_s$. The critical state $\overline{s}$ is the same as before. Indeed, one can check that $\overline{s}$, defined as $\arg\max_r \left\{\widetilde{u}_r(\bar{L}/2) - \widetilde{u}_r(\widetilde{L}_r)\right\}$, is equal to $\arg\max_r \left\{u_r(\overline{L}/2) - u_r(\widetilde{L}_r)\right\}$ and equivalently to $\arg\max_r \{u_r(\bar{L}/2) - u_r(L_r)\}$ since $\widetilde{L}_r > L_r$, $\forall r \in \mathscr{S}$. Because instantaneous utilities $u_r(L_r)$ falls in L_r, the employment levels $\widetilde{L}_s$ increase and the domestic country's instantaneous utility drops in any state of nature as country asymmetries rise (larger θ). As a result, the numerator of the right hand side of Condition (9) increases whereas its denominator decreases, which yields the increase of this ratio. The critical discount factor for which Condition (9) binds is then smaller than the critical factor $\underline{\delta}$ for which Condition (4) binds. Free movement of workers is therefore less likely to be a sustainable policy when country asymmetries become more important.

PROPOSITION 7: *Suppose that individuals have CRRA preferences for risk and that the domestic country's productivity increases relative to the foreign country such that θ rises with $\widetilde{\alpha}_s \equiv \theta\alpha_s$ ($\theta \geq 1$). Then, the free labor mobility policy is less likely to be sustainable as the domestic country's advantage θ rises.*

This proposition gives grounds to the idea that developed countries are unlikely to accept uncontrolled inflows of immigrants from developing countries. Although there exist gains from a more efficient distribution of labor and from a possible insurance mechanism, the high productivity country does not accept a policy of free movement of workers because such policy would trigger a large and permanent

spatial redistribution of workers into its borders. Such a redistribution of workers increases the congestion of local factors and reduces the domestic residents' wage and consumption. One can get a very clear idea about this effect by setting a large enough country advantage θ. In this case, the domestic number of workers under free movement of workers, $\widetilde{L}_s$, is larger than the number of citizens, $\bar{L}/2$, for any state of nature. The domestic instantaneous utility levels are smaller with the policy than without it; the policy is unacceptable for the domestic country.

The present discussion is not unrelated to the discussion about the full right migration policy. The latter policy is not sustainable when a country inherits from the previous time period a population that is small compared to the population that would be desired by the social planner. Here, the advantaged country also inherits from the initial time period a population ($\bar{L}/2$) that is small compared to the social planner's current choice of population. As a result, both policies offer no improvement to the country with the (temporary or permanent) advantage.

6.2. Unemployment

The reluctance to opt for free movement of workers is often based on a claim about local labor market problems. In particular, many countries have found it difficult to allow uncontrolled (in)flows of workers in times of high unemployment. Boeri and Brücker (2005) presents evidence of of hardening of migration condition within the E.U., in particular from rich countries with large unemployment levels like France and Belgium. We here show that the existence unemployment stemming from labor market rigidities is not a rationale against the adoption of free movement of workers.

Unemployment generally stems from some form of downward nominal wage rigidities. For the sake of simplicity, let us suppose that the domestic and foreign wages (w, w^*) must lie above some exogenous minimum wage $\underline{w}$. Let the tuple (L, L^*) denote the domestic and foreign populations and let the tuple (l, l^*) denote the numbers of worked hours or employed workers; the tuple $(L-l, L^*-l^*)$ can be interpreted as either under-employment or unemployment. In the latter case, we make the simplifying assumption that governments follow a Rawlsian welfare objective and implement lump sum redistribution to the unemployed so that employed and unemployed workers residing in a same country get the same utility. The analysis of the short run equilibrium is the same as in Section 3 except that (L, L^*) must be replaced by (l, l^*). The wage ratio equality (1) now gives the employment ratio: $l/l^* = w^*/w$. This states that worked hours follow local costs

of labor. The domestic instantaneous utility is now given by

$$\begin{aligned} U(C) &= U\left[\alpha^{1-\gamma/2}(\alpha^*)^{\gamma/2}(l)^{\beta(1-\gamma/2)}(l^*)^{\beta\gamma/2}L^{-1}\right] \\ &= U\left[\alpha^{1-\gamma/2}(\alpha^*)^{\gamma/2}(w^*/w)^{\beta\gamma/2}l^{\beta}L^{-1}\right]. \end{aligned}$$

A symmetric expression holds for the foreign country.

Suppose now that the domestic country faces a good productivity shock relative to the foreign country: $\alpha > \alpha^*$. Then, if labor is immobile and if the minimum wage $\underline{w}$ is high enough, downward wage rigidities imply that the foreign country faces unemployment ($w^* = \underline{w}$ and $l^* < L^*$) whereas the domestic country has full employment ($w \geq \underline{w}$ and $l = L$). The instantaneous utilities are given by

$$\begin{aligned} U(C) &= U\left[\alpha^{1-\gamma/2}(\alpha^*)^{\gamma/2}(\underline{w}/w)^{\beta\gamma/2}L^{\beta-1}\right] \quad \text{and} \\ U(C^*) &= U\left[(\alpha^*)^{1-\gamma/2}(\alpha)^{\gamma/2}(w/\underline{w})^{\beta\gamma/2}(l^*/L^*)^{\beta}(L^*)^{\beta-1}\right]. \end{aligned}$$

By contrast, when labor is allowed to move across countries, foreign workers are enticed to agglomerate into the domestic country as long as $C/C^* > 1$; that is, if $(\alpha/\alpha^*)^{1-\gamma}(\underline{w}/w)^{\beta\gamma}(l^*/L^*)^{-\beta}(L/L^*)^{\beta-1} > 1$. So, L increases whereas L^* decreases to l^*. At this point, the foreign country reaches full employment; the labor distribution reaches the short run equilibrium distribution (3) that is obtained in Section 3. Therefore, free movement of workers eliminates unemployment. Free movement of workers implies a better use of productive resources in terms of both time and spatial allocation of work. Workers then get the same instantaneous utility levels $u_s(L_s)$ as those defined in Section 3.

Let us now define the instantaneous utilities as $\overline{u}_s(L/2)$ when countries do not adopt or breach the policy of free movement of workers. Note that labor market rigidities implies that $\overline{u}_s(L_s) < u_s(L_s)$ for all L_s,$s \in \mathscr{S}$. Following the same argument as for Condition (4), we can state that free movement of workers is a sustainable policy for the domestic country if and only if

$$\frac{\delta}{1-\delta} \geq \frac{\overline{u}_s(\bar{L}/2) - u_s(L_s)}{E_s u_s(L_s) - E_s \overline{u}_s(\bar{L}/2)}$$

Since $\overline{u}_s(L_s) < u_s(L_s)$, the right hand side in this condition is smaller than in Condition (4). The free movement of workers is therefore more likely to be a sustainable policy when countries face wages rigidities.

PROPOSITION 8: *The free labor mobility policy is more likely to be sustainable when countries face downward wages rigidities and unemployment.*

7. CONCLUSION

In this paper we have studied the factors that help countries mutually agree common migration policies. For the countries to agree on a common migration policy, short run costs must outweigh long term benefits. Under free migration policies, countries facing good productivity shocks incur short run costs as they allow foreign workers to participate in their local labor markets and domestic wages fall. By contrast, countries facing bad productivity shocks benefit from free migration policies because they can invite their citizens to work temporarily or permanently in more prosperous countries. When productivity varies through time, free migration policies therefore bring long run benefits in terms of labor market flexibility and income risk sharing.

We distinguished between two main policies. Under the policy of free movement of workers, migrants are guest workers who receive non-permanent work and residence permits. This policy corresponds to third-country association agreements or usual guest worker programs. Under the full right migration policy, migrants receive permanent work and residence permits as well as local political rights. This policy applies to immigration policies that implements the naturalization of the migrant or his/her descendants. In this paper, we have demonstrated that the latter policy is less likely to be sustainable. This is because each country anticipates the problem that may arise when its productivity falls from a high level. In this case, a country can indeed be stuck with too a large (recently naturalized) population and may give strong incentives to other countries to block a reverse migration flow by breaching the free migration agreement.

We finally considered the economic factors that contribute to the mutual agreement to adopt a free migration policy. Focusing on free movement of workers, we showed that free migration policies create negative externalities on local workers when countries produce both tradeable and non tradeable goods. This externality yields excess agglomeration in the most productive country, which is exacerbated when congestion factors diminish i.e. when firm have weaker decreasing returns to scale. The presence of this externality reduces both countries' incentives to adopt a common policy for the free movement of workers. Also, we showed that free movement of workers is never a sustainable policy in an economy with only tradeable goods or with either very low or very high congestion factors. In general, free migration policies become sustainable only if the share of tradeable goods

is not too large and congestion factors are neither too high nor to small. In fact, some congestion factors can help. This reverses the conventional wisdom that congestion costs tend to reduce the political acceptability of migration.

Our analysis has been extended to the case of permanent productivity differences and gives grounds to the idea that developed countries are unlikely to accept uncontrolled inflows of immigrants from developing countries. The analysis has also been extended to a simple case with unemployment generated by wage rigidities. In this case, unemployment may not be an appropriate rationale against the adoption of free movement of workers. The analysis can also be extended in several other directions. For instance, it will be interesting to investigate the acceptability of free migration policies in the case of heterogenous workers, public finance issues, controlled migration, etc. Those issues are left for further research.

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APPENDIX A

We proceed in four steps.First, because profits are redistributed locally we have that national income Y is equal to the value of domestic production $P_X X + P_Z Z$ where P_i is the price of good in sector i. Second we calculate labor demand from the condition that the value of the marginal product equals the wage rate, $P_i F_i'(L_i) = w$, or equivalently, $P_i \alpha\beta L_i^{\beta-1} = w$. This implies that the value of production in each sector is proportional to the wage bill: $P_i F(L_i) = \beta^{-1} w L_i$. The national income in wage units is then equal to $Y = \beta^{-1} wL$. Third, given the Cobb-Douglas preference individuals spend a share $\gamma/2$ of their income on each of the tradeable goods and a share $1-\gamma$ on the local non-tradeable good. So, the goods market clearing condition in the non-tradeable sector gives $\beta^{-1} wL_Z = (1-\gamma)Y$ and hence $L_Z = (1-\gamma)L$ since $Y = \beta^{-1} wL$. Then using the labor market clearing condition in the domestic market we have that $L_X = \gamma L$. We can further use these conditions to compute the price of tradeable and non-tradeable goods in wage units as $P_X = (\alpha\beta)^{-1} (\gamma L)^{1-\beta} w$ and $P_Z = (\alpha\beta)^{-1} [(1-\gamma) L]^{1-\beta} w$. Finally, we consider the market clearing conditions for the tradeable good sectors in the domestic and foreign countries. With the Cobb-Douglas preference the value of production is equal to the consumers' expenditure shares: $P_X F_X(L_X) = (\gamma/2)(Y + Y^*)$ and $P_X^* F_X^*(L_X^*) = (\gamma/2)(Y^* + Y)$. Therefore, the value of production of the tradeable good is the same in both countries: $P_X F_X(L_X) = P_X^* F_X^*(L_X^*)$. Because the value of production in each sector is proportional to the wage bill (with proportion β) the wage bills in each country in the tradeable sectors must be equal: $wL_i = w^* L_i^*$. This then further applies to the non-tradeable sector and hence the equilibrium ratio of wages is $w/w^* = L^*/L$.

APPENDIX B

The planner maximizes world per-capita welfare $W(L) = \omega(L) C(L) + (1-\omega(L)) C^*(L)$ where $\omega(L) = L/\bar{L}$. It is easy to check that

$$C'(L) = \left(\beta\left(1-\frac{\gamma}{2}\right) - 1\right)\frac{C(L)}{L} - \frac{\beta\gamma}{2}\frac{C^*(L)}{\bar{L}-L}$$

with a similar expression for $C^{*\prime}(L)$. It then follows that

$$W'(L) = \frac{\beta C(L)}{\bar{L}}\left[\left(1-\frac{\gamma}{2}-\frac{\gamma}{2}\left(\frac{L}{L^*}\right)\right)-\frac{C^*(L)}{C(L)}\left(1-\frac{\gamma}{2}-\frac{\gamma}{2}\left(\frac{L^*}{L}\right)\right)\right].$$

The planner's optimal labor allocation $\tilde{L}$ solves $W'(\tilde{L}) = 0$ and is given by

$$\frac{C^*(\tilde{L})}{C(\tilde{L})} = \frac{\left(1-(\gamma/2)-(\gamma/2)(\tilde{L}/\tilde{L}^*)\right)}{\left(1-(\gamma/2)-(\gamma/2)(\tilde{L}^*/\tilde{L})\right)}.$$

Under free movement of workers, we have $C(\hat{L}) = C^*(\hat{L})$ so that

$$W'(\hat{L}) = \frac{\beta C(\hat{L})}{\bar{L}}\frac{\gamma}{2}\left[\frac{\hat{L}^*}{\hat{L}}-\frac{\hat{L}}{\hat{L}^*}\right].$$

Likewise we can check whether the social planner prefers to allocate more labor to the more productive country. Since at $L = \bar{L}/2$, $C^*(\bar{L}/2)/C(\bar{L}/2) = (\alpha^*/\alpha)^{(1-\gamma)}$ we have

$$W'(\bar{L}/2) = \frac{\beta C(\bar{L}/2)}{\bar{L}}(1-\gamma)\left[1-\frac{C^*(\bar{L}/2)}{C(\bar{L}/2)}\right] = \frac{\beta C(\bar{L}/2)}{\bar{L}}(1-\gamma)\left[1-\left(\frac{\alpha^*}{\alpha}\right)^{(1-\gamma)}\right].$$