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MIGRATION OF THE TALENTED: CAN EUROPE CATCH UP WITH THE U.S.?

LYDIA MECHTENBERG
Universität Hamburg

ROLAND STRAUSZ
Humboldt Universität Berlin

Abstract

We develop a model to analyze migration of highly talented individuals within and into Europe. First, we show that if transferability of human capital is endogenous, i.e., if high migration flows and high human capital transferability are mutually interdependent, Europe might be trapped in a low-migration equilibrium. Second, we show that high mobility *within* a Federation is necessary to attract highly talented immigrants *into* the Federation. We study in how far and in what way the European public policy behind the Bologna and the Lisbon Process can contribute to higher mobility in Europe.

1. Introduction

We develop a model to analyze the determinants and effects of an imperfect transferability of human capital on talented natives and immigrants within a Federation. The model reveals that imperfect human capital transferability within a Federation both induces and is induced by low migration rates of the natives in that Federation. Low migration rates lead to an inferior matching between jobs and workers and makes immigration from third countries into the Federation less attractive, especially for more talented individuals. We use the model to evaluate the European Bologna and Lisbon Process

Lydia Mechtenberg, Universität Hamburg, Von-Melle-Park 5, 20146 Hamburg, Germany (lydia.mechtenberg@wiso.uni-hamburg.de). Roland Strausz, Humboldt Universität Berlin. We thank Michael Burda, Volker Grossmann, Jennifer Hunt, Alexandra Spitz–Oener, and especially Silke Uebelmesser and two anonymous referees for helpful discussions and suggestions. This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk."

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as an effort to increase transferability within Europe. We study in how far these measures can achieve their politically proclaimed goals of reducing mismatches between jobs and skills and attracting highly skilled immigrants in the global competition for international talent.

The paper's contributions are as follows. We first show how imperfect transferability of human capital limits mobility and how it affects the distribution of talents. Attributing the imperfect transferability to divergent education systems and working cultures provides us with a rationale to endogenize it: high migration flows lead to an internationalization of workplaces and, thereby, induce a harmonization of working cultures, so that human capital becomes more transferable across borders. On the other hand, low migration flows result in imperfect transferability of human capital. Hence, we endogenize the degree of transferability as the outcome of a coordination game between potential migrants. Depending on the coordination, we obtain two possible equilibria: an inefficient but risk-dominant equilibrium with low migration and a low degree of transferability and an efficient, Pareto-dominant equilibrium with high migration and a high degree of transferability.

We subsequently present and investigate the idea that the empirically low rates of migration within Europe result from a coordination failure, because individuals coordinate on the risk-dominant but inefficient equilibrium. We then discuss possible approaches to increase the transferability of human capital, starting from this inefficient equilibrium. We first argue that public policy is able to increase transferability directly by harmonizing education systems—a policy measure that is currently implemented cooperatively in most European countries within the framework of the Bologna Process. Second, we show under which conditions such direct targeting of the transferability of human capital will lead to an equilibrium with high migration flows and under which conditions other measures, i.e., a reduction of direct migration costs, are needed to secure the efficient equilibrium. Next, we identify and compute the local welfare effects of these policies.

We further argue that imperfect transferability of human capital within Europe constitutes a handicap in the global competition of talents. We investigate theoretically how imperfect transferability affects migration decisions of non-European young immigrants, e.g., university students, who may choose between immigration into Europe and immigration into the United States. Finally, we identify and compute the local welfare effects of changes in immigration rates.

The remainder of our paper is organized as follows. The next section puts our model and results in relation to the current European political debate on migration and relates them to the economic literature. Section 3 develops the formal model in which we derive our results. In Section 4, we endogenize the transferability of human capital and study how imperfect transferability of human capital affects local migration decisions. Section 5 analyzes the effects of imperfect transferability on global competition for international talents. We relate these results to the Bologona and

Lisbon Process in Section 6. Section 7 concludes. Proofs are collected in the Appendix.

2. Political Context and Related Literature

Before the 2004 EU enlargement, fears about potential detrimental effects of labor migration within Europe were widespread among European politicians in national governments. Despite these concerns, however, labor migration within Europe remained low after enlargement and is still much lower than in regions of comparable size such as the United States.[1]

On the one hand, this is good news to those who initially feared a compression of wages in the receiving countries and a brain drain in the sending countries. On the other hand, however, the potential benefits of a better matching between skills and jobs that are expected from a unified European labor market do not materialize when migration is low. Thus, as long as Europeans are unable or unwilling to move along with the best jobs, Europe's productivity will remain below its potential.[2]

Moreover, not only migration within Europe, but also skilled immigration into Europe is lower than a growing number of politicians and businessmen believe would be good for Europe's economy.[3] Geis, Uebelmesser, and Werding (2011), for instance, show that the United States attracts a considerably higher share of the world's highly skilled labor than European countries like France and Germany, or even the United Kingdom. Boeri (2008) confirms this finding, when he shows that the United States attracts about twice as much immigrants with a tertiary degree than Europe. Moreover, immigrants in the EU score considerably lower in literacy tests than immigrants in New Zealand. Finally, also the distribution of test scores of immigrants in a European country like Germany lies below that of the country's natives; whereas in Canada, immigrants and natives have the same score distribution.

The conjecture suggests itself that these two phenomena—low labor mobility within Europe and low skilled immigration into Europe—are interrelated. If barriers to mobility are still high in Europe, a potential immigrant

[1] For empirical studies that demonstrate the persistently low levels of labor migration within Europe, see Geis, Uebelmesser, and Werding (2011) and Zaiceva and Zimmermann (2008). For an empirical comparative study showing that labor migration is considerably lower in Europe than in the United States, see Peri (2005, 2007).

[2] Fidrmuc (2004) shows for Eastern Europe that the propensity to migrate in reaction to asymmetric regional shocks is low. This indeed suggests (for Eastern Europe) that matching between skills and capital is imperfect. Puhani (2001) shows empirically that it is "extremely unlikely" that labor mobility in Europe works as an adjustment mechanism against asymmetric labor market shocks. Arntz (2005) shows that the unemployed in Germany have a low propensity to migrate in regions with less tight labor markets. By contrast, Borjas, Bronars, and Trejo (1992) show that in the United States internal mobility of the youth is strong and mainly driven by reactions to mismatches between skills and jobs.

[3] See Peri (2005, 2007).

must take into account her low prospects of insuring herself against asymmetric regional shocks on the European labor market. Thus, she might prefer migration into another region, like Canada or the United States, where she knows that she will be able to move along with the best jobs.

Methodologically, our main contributions are, first, to endogenize the transferability of human capital by modeling it as an outcome of a coordination game between potential migrants and, second, to show that even though the equilibrium with low migration is Pareto-dominated, it is risk-dominant and, therefore, likely to be selected.[4] Thus, this paper is the first to bridge the gap between the literature that looks at migration as a coordination game with strategic complementarities in the sense of Cooper (1999) and the literature that investigates the effects of imperfect transferability of human capital. Contributions to the first-mentioned stream of literature are, for instance, Hendricks (2001) and Giannetti (2003), who model complementarities of the productivity of migrants similarly. Hendricks (2001) assumes that an individual's earnings increase in the average level of the productivity of its ethnic group. In the model of Giannetti (2003), an individual's skill premium increases in the average level of productivity of the location where she works.[5]

In comparison to this literature, the strategic complementarities between migrants are different in our framework, because we do not assume a direct effect of any individual migrant on the productivity of the labor force in his destination country.[6] Instead, we model migration as a critical mass game: A sufficiently high flow of high-skilled migration can internationalize the work place in the destination country such that human capital acquired in the source country becomes more transferable across the border.

Our paper is further related to the literature on transferability of human capital. This literature started with Roy (1951) on the self-selection of migrants. Borjas (1994) formalizes Roy's ideas, whereas Borjas *et al*. (1992) find empirical support. Subsequent work is mostly empirical. For instance, Chiswick (1978) finds that schooling has a lower effect on earnings of immigrants and partly interprets this finding as support for imperfect skill-transferability. Duleep and Regets (2002) also find empirical support for the hypothesis of declining transferability of human capital for immigrants in the United States. Thus, imperfect transferability of human capital has become an empirical fact. Yet, despite its empirical importance, little is known

[4] To our knowledge, there are no other fully microfounded models of migration with endogenous skill transferability and equilibrium selection. For instance, Duleep and Regets (1999) endogenize skill transferability, but the model is not fully microfounded and migration is not described as a coordination problem.

[5] See also Stark (2004), who assumes that an individual's productivity increases in the average human capital of the economy.

[6] Mechtenberg and Strausz (2008) provide a theoretical analysis of the Bologna Process in which the talents of student migrants and the quality of higher education in a given country are complementary.

about the determinants of skill-transferability and most work treats it as a black box.[7] With respect to this literature, a contribution of our paper is, therefore, to go beyond a straightforward comparative statics analysis in the degree of skill-transferability and address the actual determinants of imperfect transferability such as differences in working cultures.

3. The Model

Consider a federation that consists of two countries. In each country there are individuals of mass one. The only strategic decision of an individual is a migration decision in the final period $t = 2$, whether to work in their native country or migrate and work in the other country. Because the payoff from the individual's migration decision depends on her talent and on the migration decision of others, the underlying game is a coordination game with strategic complements.

More specifically, each individual obtains in period $t = 1$ a higher education at their home university. We refer to these individuals with a higher education as graduates. The acquired human capital from this education coincides with the graduate's talent $\theta \in [0, 1]$. The two countries are symmetric; they, in particular, do not differ in educational quality or the distribution of talents. We further assume that, in each country, talent θ is uniformly distributed over the interval $[0, 1]$.

Apart from talent, a graduate's productivity y_i depends on the state of the economy in the country where she works. A country has either a normal or a booming economy. If the graduate, i, stays in her country of birth, and if the economy there is normal, her productivity equals her human capital, i.e., $y_i = \theta_i$. By contrast, if the graduate's country of birth has a booming economy, her productivity there is enhanced by a positive regional shock, i.e., $y_i = \theta_i(1 + \pi)$. The parameter $\pi \in (0, 1)$ represents the positive economic shock and more talented graduates benefit proportionally more from a booming economy. The assumption $\pi < 1$ implies that the graduate's benefits from education, θ_i, are more important than the productivity gain $\theta_i\pi < \theta_i$ from favorable economic conditions. In this sense, education is a more important determinant of productivity than a country's economic conditions.

Each graduate decides, in period $t = 2$, in which of the two countries she wants to work. Graduates observe the countries' economic conditions when they make these decisions noncooperatively. Differences in economic conditions, therefore, drive migration incentives. To keep our analysis tractable, we assume that exactly one country has a booming economy, whereas the other country has a normal economy. We denote the booming country by H

[7] See also Thum and Uebelmesser (2000) for an argument why positive transferability of human capital might have a positive effect on the sender country.

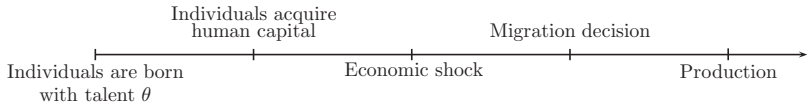

Figure 1: The timeline.

and the other country by L. Before graduates complete their education, it is, however, not known which of the two countries will have the booming economy in period $t = 2$. In particular, we assume that, in $t = 1$, the two countries are equally likely to obtain a booming economy. From the perspective of period $t = 1$, both countries are, therefore, fully symmetric.

If a graduate decides to migrate, she incurs a fixed migration cost $c > 0$. This cost captures the migrant's relocation expenses and other burdens. In addition to the fixed costs c, a migrant also loses a part of her human capital from education. In particular, we assume that a graduate θ_i who migrates from country L to country H has a productivity $\theta_i(\alpha + \pi)$. The *transferability* parameter $\alpha < 1$ captures the idea that an education is more valuable in the country where it was acquired than in a foreign country. This assumption captures the stylized facts reported by a large part of the migration literature. Moreover, it seems especially appropriate in the European context, where part of the education is country-specific and countries differ in languages and working cultures. The transferability parameter α plays a crucial role in our analysis. We endogenize it in Section 4 and argue that it captures, in a reduced form, the main political goals of the Bologna and Lisbon process. Note that when $\alpha + \pi < 1$, the loss of human capital offsets any gain from migrating to a booming economy. For this reason, we restrict attention to $\alpha + \pi > 1$.

We abstract from unemployment among graduates; in each country a firm employs all the graduates on a country's labor market so that they can always realize their full productivity. A graduate appropriates a fixed share γ of her productivity; the remaining part is appropriated as a positive externality by nonacademic natives of the country where the graduate works. Because nonacademics are passive, we do not model them explicitly. Yet, our welfare analysis fully incorporates the positive externality from a graduate on the nonacademics in the country where the graduate works.

To summarize, Figure 1 describes the sequence of events. First, talented individuals are born and their individual talents realized. Second, individuals study in their native country and acquire their human capital from higher education. Third, nature determines which country has the better economy. Fourth, graduates decide whether or not to expend a cost c and lose a share $(1 - \alpha)$ of their higher education to migrate into the neighboring country. Finally, graduates work and the productivity of a given graduate is shared between herself and the nonacademics in the country in which she works. The following table summarizes a graduate's payoffs from the migration

decision depending on whether she originates from a booming country H or a normal country L:

Payoffs	Stay	Migrate
Graduate θ_i from country H	$\gamma\theta_i(1+\pi)$	$\gamma\theta_i\alpha - c$
Graduate θ_i from country L	$\gamma\theta_i$	$\gamma\theta_i(\alpha+\pi) - c$

4. Intrafederal Mobility

We first study the migration decision of the natives in the countries H and L. First consider a graduate with talent θ_i from country H . She obtains a payoff $\gamma\theta_i(1+\pi)$ if she remains in country H and obtains the payoff $\gamma\theta_i\alpha - c$ if she migrates to country L. Hence, a graduate from the high productivity country has no incentive to migrate and, therefore, there is no migration from H to L.

In contrast, a graduate i from country L obtains the payoff $\gamma\theta_i$ if she remains in L, whereas migrating to country H yields her a payoff $\gamma\theta_i(\alpha + \pi) - c$. Hence, a graduate from country L with talent θ_i migrates exactly when[8]

$$\theta_i \geq \hat{\theta}(\alpha) \equiv \min\left\{\frac{c}{\gamma\,[\pi - (1-\alpha)]}, 1\right\}.$$

Let $\bar{\alpha} \equiv 1 - \pi + c/\gamma$ so that $\hat{\theta}(\alpha)$ is smaller than 1 only if $\alpha > \bar{\alpha}$. Then, we obtain the following result:

LEMMA 1: *For $\alpha \leq \bar{\alpha}$, no migration occurs. For $\alpha > \bar{\alpha}$, only graduates with talent $\theta_i \in [\hat{\theta}(\alpha), 1]$ migrate from L into H.*

The comparative statics are intuitive: The flow of migration increases in the bargaining power of the labor force, γ, in the size of the economic shock π, and decreases with the direct costs of migration, c . Because c is independent of talent, it is the highly talented graduates who migrate, whereas the less talented graduates remain in their home country. Moreover, Lemma 1 reveals two effects of the imperfect transferability of human capital $\alpha < 1$. First, there is less migration when human capital is not fully transferable across borders: $\hat{\theta}(1) < \hat{\theta}(\alpha)$. Consequently, the overall surplus generated on the labor market of the federation is lower with $\alpha < 1$ than it would have been with $\alpha = 1$. The reason is that, for $\alpha < 1$, the matching of jobs to graduates is inefficient. Second, low transferability α amplifies the effect that migrants are the highly talented graduates.[9]

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[8] By assumption $\pi + \alpha > 1$ so that the denominator in the expression $\hat{\theta}(\alpha)$ is positive.

[9] As Chiswick (1999) points out, favorable self-selection of migrants occurs in any model in which (1) there are out-of-pocket costs of migration, and (2) earnings (in any country) increase in ability.

4.1. Coordinating Migration

The proportional loss of human capital associated with migration, $(1-\alpha)$, represents an inefficiency from the diversity in national education systems, working cultures, and languages within Europe. The literature hitherto treats this loss as exogenous. By contrast, we view the transferability parameter α as a variable that is endogenous in two ways. First, it depends on the comparability and the universal curriculum of higher education systems. Second and probably more importantly, the parameter depends on the diversity in working cultures and languages spoken on the job. These differences become smaller when the workforce becomes more internationalized. The underlying idea is that firms adapt their working culture to migrants if they come in large numbers. For instance, it may become unnecessary for a migrant to learn the native language of her destination country before realizing her full potential at work, because the firm where she starts working might switch to English as a focal language when its labor force becomes more international.[10]

Due to this effect, mobility and the degree of transferability are interdependent and self-enforcing: The more graduates ignore national borders and move along with the more productive jobs, the more firms and workers find it attractive to harmonize working cultures and switch to a common international language. This then facilitates migration between these countries, because human capital will become more easily transferable across borders. Hence, internationalization increases with migration, which, in its turn, increases with internationalization.

We model the outcome from this self-enforcing process as follows. Let m denote the share of European migrants from the low productivity country L to the high productivity country H. We assume that if m is larger than some cut-off value $\bar{m} \in (0, 1)$, then a harmonization of working cultures and languages in countries 1 and 2 occurs. We take the extreme that, if $m \geq \bar{m}$, diversity between working cultures and languages spoken on the job disappears completely so that human capital becomes fully transferable across borders. Formally,

$$\alpha(m) = \begin{cases} 1 & \text{if } m \geq \bar{m} \\ \alpha_0 & \text{if } m < \bar{m}, \end{cases} \tag{1}$$

where $\alpha_0 < 1$ represents the initial base-level of human capital transferability.

In our application to the European system, α_0 signifies two things. First, a high α_0 stands for low diversity in national working cultures and languages

[10] In many small countries, such as the Netherlands or Denmark, the working language at many firms with a large foreign share of employees is English. However, usually only individuals that already plan to migrate get information about firms that plan to hire internationally. Thus, firms cannot attract more workers from abroad by an *ex ante* commitment to an international working culture, because their decision to commit would not become known to foreigners that do not have any plans to migrate.

spoken on the job. For instance, a German graduate finds it easier to realize the full potential of her acquired human capital in Austria than in France. Second, α_0 represents the degree to which a given national higher education system provides human capital that is transferable into the labor market of the other country. For instance, a diploma as provided from German universities before the implementation of the Bologna Process was unknown to employers in other European countries, and graduates with a diploma have not been appreciated much in European countries other than Germany. Thus, before the Bologna Process, migration of a small number of graduates from Germany to, for instance, England was characterized by a low α_0. Consequently, α_0 rises, when, in line with the Bologna process, Europe harmonizes university degrees. [11]

Consequently, migration becomes a coordination game between graduates. To investigate the outcomes of the coordination game, define

$$\hat{\alpha} \equiv \frac{c}{\gamma\,(1-\bar{m})} + 1 - \pi.$$

The parameter $\hat{\alpha}$ represents the degree of human capital transferability needed to induce a migration flow that is just sufficiently high to trigger an international working culture and perfect transferability of human capital. We have $\hat{\alpha} \in (\overline{\alpha}, 1)$ exactly when $\bar{m} < 1 - c/(\gamma\pi)$. Moreover, let m^* and α^* denote the equilibrium share of migrants and the equilibrium share of postmigration human capital, respectively. Note that α^* is either α_0 or 1, depending on m^*. The following proposition characterizes the equilibrium outcomes (m^*, α^*) of the coordination game.

PROPOSITION 1: *(i) For* $\hat{\alpha} > 1$, *the equilibrium outcome* m^* *is unique. In particular,* $\alpha^* = \alpha_0$, *with* $m^* = 0$ *if* $\alpha_0 \leq \bar{\alpha}$ *and* $m^* = 1 - c/[\gamma(\alpha_0 + \pi - 1)]$ *if* $\alpha_0 > \bar{\alpha}$. *(ii) For* $\hat{\alpha} \leq 1$ *and* $\alpha_0 \leq \bar{\alpha}$, *there exists an equilibrium outcome* $m^* = 1 - c/(\gamma\pi) > \bar{m}$ *and* $\alpha^* = 1$, *and an additional equilibrium outcome* $m^* = 0$ *and* $\alpha^* = \alpha_0$. *(iii) For* $\hat{\alpha} \leq 1$ *and* $\alpha_0 > \bar{\alpha}$, *there exists an equilibrium outcome* $m^* = 1 - c/(\gamma\pi) > \bar{m}$ *and* $\alpha^* = 1$ *and, for* $\alpha_0 < \hat{\alpha}$, *an additional equilibrium outcome* $m^* = 1 - c/[\gamma(\alpha_0 + \pi - 1)]$ *and* $\alpha^* = \alpha_0$.

Figure 2 illustrates the different equilibria and their relation to the transferability variable α^* for the two cases $\hat{\alpha} > 1$ and $\hat{\alpha} \leq 1$. For a thorough understanding of how the intensity of (anticipated) international migration and the transferability of human capital across borders influence each other, it is helpful to investigate in more detail the qualitative differences between the different migration equilibrium outcomes.

First observe that, for $\hat{\alpha} > 1$, even a perfect transferability of human capital does not suffice to induce sufficiently many individuals to migrate, and

[11] In Section 6, we will explicitly address the Bologna Process as a political attempt to increase intra-European migration.

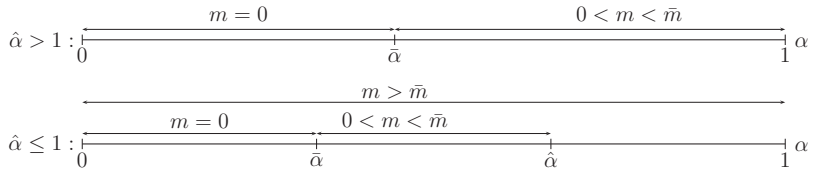

Figure 2: Mobility equilibria.

the working culture in the receiving country would not become internationalized in any equilibrium. Thus, in this case, only a *low-migration equilibrium* exists in which transferability of human capital remains imperfect. This equilibrium can even exhibit a total absence of migration.

For $\hat{\alpha} \leq 1$, however, two equilibria exist that can be ranked according to the Pareto criterion. The *high-migration equilibrium* with $m^* = 1 - c/(\gamma\pi) > \bar{m}$ and $\alpha^* = 1$ is Pareto-dominant, because it allows for migration without any loss of human capital. In the high-migration equilibrium, graduates expect migration to be intensive enough to harmonize working cultures and to raise the transferability of human capital α^* to 1. Accordingly, graduates expect no loss of their human capital from migration into the better economy, thereby collectively rationalizing their expectations.

However, there also exists a *low-migration equilibrium* that is Pareto-inferior. In this equilibrium, graduates anticipate that not enough of their fellow graduates migrate into the better economy and that, therefore, working culture in the country with the better economy will not be international. They, therefore, expect a loss of human capital $(1 - \alpha_0)$ from migration. With such a loss, the less talented graduates prefer to stay in their home country, thereby justifying the initial expectation that not enough graduates migrate.

The multiplicity of equilibria raises questions about whether coordination failure may explain the empirically consistently low rates of migration within Europe as compared to the United States: Is Europe trapped in an inefficient low-migration equilibrium? And what is it that makes coordination on the Pareto-dominant high-migration equilibrium unattainable?

4.2. The Risk-Dominant Equilibrium

The concept of risk dominance in games as developed by Harsanyi and Selten (1988) provides a formal theory why individually rational players coordinate on a Pareto-dominated equilibrium rather than the Pareto-dominant one.[12] The intuitive idea is that players may prefer the Pareto-dominated equilibrium, because it exhibits less risk.

[12] For a relatively recent application and simple exposition of the concept of risk dominance in coordination games see, e.g., Amir and Stepanova (2006).

Observe that in our setup staying in one's home country is less risky than migrating into the better economy. To see this more clearly, consider the parameter constellation $\hat{\alpha} \leq 1$, where the Pareto-dominant high-migration equilibrium and the Pareto-inferior low-migration equilibrium indeed coexist. For this parameter constellation, all individuals $\theta_i > \hat{\theta}(\alpha_0)$ have the strictly dominant strategy to migrate, and all individuals with $\theta_i < \hat{\theta}(1)$ have the strictly dominant strategy to stay. Hence, the coordination problem exists only between the individuals of types $\theta \in \Theta^c \equiv [\hat{\theta}(1), \hat{\theta}(\alpha_0)]$. Each of these individuals in Θ^c has to make the choice whether or not to migrate. In the high-migration equilibrium, the individual θ migrates and his equilibrium payoff is $\gamma\theta(1+\pi) - c$. If the individual migrates, but the high-migration equilibrium does not arise then he receives a strictly lower payoff $\gamma\theta(\alpha_0 + \pi) - c$. Hence, playing the high-migration equilibrium involves a risk if the individual is not completely convinced that this equilibrium actually materializes. In contrast, playing the low-migration equilibrium does not exhibit such risk. In the low migration equilibrium, an individual $\theta_i \in \Theta^c$ does not migrate and his payoff from not migrating is $\gamma\theta_i$ independent of whether the low-migration equilibrium actually emerges. In this sense, playing the low-migration equilibrium is less risky than the high-migration equilibrium.

Harsanyi and Selten (1988) provide a formal theory of risk dominance. It was originally developed for a two-player game with two strict Nash equilibria. We follow this theory as closely as possible, but note that a major complication in applying it to our setup is extending the concept to infinitely many players. Crucial in the formal theory of risk dominance are the deviation losses of a unilateral deviation in the two equilibria. Hence, consider first the deviation losses of some individual $\theta_i \in \Theta^c \equiv [\hat{\theta}(1), \hat{\theta}(\alpha_0)]$. In the high-migration equilibrium, an individual $\theta \in \Theta^c$ migrates and obtains the payoff $\gamma\theta(1+\pi) - c$. If the individual deviates unilaterally from his equilibrium play and does not migrate, he obtains $\gamma\theta$. Hence, following Van Damme (2002), his deviation loss is $d^h(\theta) = \gamma\theta\pi - c$, which for any $\theta \in \Theta^c$ is nonnegative. In contrast, the individual does not migrate in the low-migration equilibrium so that he obtains the payoff $\gamma\theta$. A universal deviation to migrate yields him the lower payoff $\gamma\theta(\alpha_0 + \pi) - c$. Hence, his deviation loss in the low-migration equilibrium is $d^l(\theta) = \gamma\theta(1 - \alpha_0 - \pi) + c$. It follows that type $\theta \in \Theta^c$ is indifferent toward his migration decision if his belief that a high-migration equilibrium is played is

$$d(\theta) \equiv \frac{d^l(\theta)}{d^l(\theta) + d^h(\theta)} = \frac{\gamma\theta(1 - \alpha_0 - \pi) + c}{\gamma\theta(1 - \alpha_0)}.$$

Note that this critical belief is close to 1 for individuals in Θ^c close to $\hat{\theta}(1)$; these individuals must be extremely convinced that a high-migration equilibrium is played to play themselves according to this equilibrium. Following the theory of risk dominance, these individuals find playing the high-migration

equilibrium risky. On the other hand, individuals $\theta \in \Theta^c$ close to $\hat{\theta}(\alpha_0)$ consider the low-migration equilibrium riskier. It follows that the risk ranking of the two equilibria depends on the individual's type $\theta \in \Theta^c$ in a monotone fashion and the individuals do not agree in their ranking.[13] In our setup, however, the behavior of the pivotal type $\overline{\theta} = 1 - \overline{m}$, whose decision in favor of migration is just needed to trigger the high-migration equilibrium, is, in the end, crucial. Note that if the individual of type $\overline{\theta}$ finds the low-migration equilibrium less risky than the high-migration equilibrium, then the type $\tilde{\theta}$ for whom the two equilibria are equally risky, $d(\tilde{\theta}) = 1/2$, must be of a higher type than $\overline{\theta}$. Then, the mass $1 - \tilde{\theta}$ of individuals who associate less risk with the high-migration equilibrium is below the critical mass $\overline{m}$ and insufficient to trigger the high-migration equilibrium. In such a case, the high-migration equilibrium would imply that individuals for whom the low-migration equilibrium is less risky decide nonetheless to migrate—which is against the spirit of the risk-dominance criterion.

Hence, our approach is to risk-rank the equilibria according to the ranking of the pivotal type $\bar{m}$. Consequently, we say the low-migration equilibrium risk dominates the high-migration equilibrium if the crucial belief of type $\overline{\theta}$ exceeds $1/2$, i.e., if $\overline{\theta} < \tilde{\theta}$ so that type $\overline{\theta}$ finds the low-migration equilibrium less risky than the high-migration equilibrium. This leads us to the following result.

PROPOSITION 2: *Suppose $\hat{\alpha} \leq 1$. Then there exists exactly one low- and one high-migration equilibrium. The low-migration equilibrium risk dominates the high-migration equilibrium if and only if*

$$\bar{m} > 1 - \frac{2c}{\gamma(2\pi - (1 - \alpha_0))}.$$

Hence, when $\bar{m}$ is large, the low-migration equilibrium is the less risky one and equilibrium selection based on the idea of risk dominance favors the Pareto-inefficient low-migration equilibrium. This reasoning formalizes the initial intuition that although the high-migration equilibrium is Pareto-dominant, natives in Europe coordinate on the low-migration equilibrium, because staying in one's home country is the less risky strategy.[14]

[13] The critical belief at which one equilibrium risk dominates the other is taken to be $1/2$. In games with two players, the theory usually aggregates the individual risk measures by taking the Nash products and considers the equilibrium associated with the larger Nash product risk-dominant. We cannot extend this notion to our setup by taking some infinite sequence of Nash products, because this yields zero for both equilibria.

[14] The experimental literature confirms the intuition that players tend to coordinate on the risk-dominant rather than the Pareto-dominant equilibrium and especially so when, as in our framework, the number of players is large. For instance, Cooper *et al.* (1990, 1992) present experimental evidence that players fail to coordinate on the Pareto-dominant equilibrium. Similarly, Heinemann, Nagel, and Ockenfels (2004) find that comparative

4.3. Welfare Effect of Migrants

In this subsection, we identify the different welfare effects of raising the transferability of human capital from α_0 to 1. We show that the social welfare of country H and the federation as a whole increases, whereas the effect on the welfare of country L is ambiguous.

First consider the welfare in the booming country H. Because the natives of the booming country do not migrate, each talent $\theta \in [0, 1]$ contributes $\theta(1+\pi)$ to their country's welfare. In addition, country H captures a share $1-\gamma$ from the migrants with talent $\theta \in (\hat{\theta}(\alpha^*), 1]$ from country L. Overall welfare in country H is, therefore,

$$W^H(\alpha^*) = \int_0^1 \theta\,(1+\pi)\,d\theta + \int_{\hat{\theta}(\alpha^*)}^1 (1-\gamma)\,\theta(\alpha^*+\pi)\,d\theta.$$

A low transferability of human capital reduces the accumulated positive externalities produced by migrants on country H. We may use the previous expression to compute the welfare gain from raising the transferability from α_0 to 1,

$$\begin{aligned}\Delta W_m^H &= W^H(1) - W^H(\alpha_0)\\ &= (1-\gamma)\left[\int_{\hat{\theta}(1)}^{\hat{\theta}(\alpha_0)} \theta\,(1+\pi)\,d\theta + \int_{\hat{\theta}(\alpha_0)}^1 \theta\,(1-\alpha_0)\,d\theta\right] > 0. \quad (2)\end{aligned}$$

The sign of expression (2) is unambiguously positive; country H gains when the transferability of human capital becomes perfect. The two integrals in (2) reveal a welfare gain from two different sources. First, imperfect transferability of human capital keeps medium talented migrants born in country L away from the labor market in H; it represents the inefficient matching of graduates and jobs. The first integral in (2) represents the gain in improving this matching when the transferability of human capital becomes perfect. Second, highly talented migrants from country L, who migrate regardless of the migration inefficiency $1-\alpha_0$, are more productive in H without the migration inefficiency. The second integral in (2) expresses this welfare gain.

Next consider the welfare effects on country L. After finishing their education, only the graduates with talents below $\hat{\theta}(\alpha^*)$ remain in L. These immobile graduates contribute their full productivity to country L's welfare. The highly talented graduates $\theta > \hat{\theta}(\alpha^*)$ migrate into country H and only contribute a fraction γ of their productivity to the country's social welfare.

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statics are consistent with the risk-dominant equilibrium. Van Huyck, Battalio, and Beil (1990) show that especially larger groups are more likely to coordinate on the risk-dominant equilibrium. Weber (2006) elaborates on this group-size effect and shows that large groups are less likely to coordinate on the Pareto-dominant equilibrium when they do not "grow" out of small groups that initially play the Pareto-dominant one.

Country L's welfare is, therefore,

$$W_m^L(\alpha^*) = \int_0^{\hat{\theta}(\alpha^*)} \theta \, d\theta + \int_{\hat{\theta}(\alpha^*)}^1 (\gamma\theta(\alpha^* + \pi) - c) \, d\theta. \tag{3}$$

It follows that an increase in the transferability of human capital from α_0 to 1 raises country L's welfare by

$$\begin{aligned} \Delta W_m^L &= W_m^L(1) - W_m^L(\alpha_0) \\ &= -\int_{\hat{\theta}(1)}^{\hat{\theta}(\alpha_0)} (1-\gamma)\theta \, d\theta + \int_{\hat{\theta}(1)}^{\hat{\theta}(\alpha_0)} (\gamma\theta\pi - c) \, d\theta + \int_{\hat{\theta}(\alpha_0)}^1 \gamma\theta(1-\alpha_0) \, d\theta. \end{aligned} \tag{4}$$

Expression (4) shows that an elimination of the inefficiencies in the transferability of human capital has positive and negative effects on country L. Its sign is, therefore, ambiguous. The first integral in the expression demonstrates the negative effect that a higher transferability increases the outflow of graduates from country L. Because the country loses a share $1 - \gamma$ of the productivity of migrants, this impacts country L's welfare negatively. Yet, graduates migrate because it raises their personal welfare and this has a positive effect on country L 's social welfare. The second integral captures the change in personal welfare of graduates who become mobile when the transferability of human capital is 1 rather than α_0. Finally, the third integral captures the change in welfare from those graduates who migrate regardless of the imperfect transferability; their utility is larger with perfect transferability and this benefits country L.

Considering the overall welfare effects confirms the intuition that an elimination of the migration inefficiency raises aggregate welfare of the overall federation,

$$\Delta W^1 = \Delta W_m^H + \Delta W_m^L = \int_{\hat{\theta}(1)}^{\hat{\theta}(\alpha_0)} (\theta\pi - c) \, d\theta + \int_{\hat{\theta}(\alpha_0)}^1 \theta(1-\alpha_0) \, d\theta < 0.$$

The expression is unambiguously positive, because $\theta\pi > \gamma\theta\pi > c$ for all $\theta \in (\hat{\theta}(\alpha_0), \hat{\theta}(1))$. The first integral represents the federation's welfare gain from a better matching of jobs and graduates. The second integral represents the welfare gain from mobile graduates, who, with perfect transferability, do no longer have their human capital diminished.

Given that the two countries are symmetric *ex ante*, they both expect a positive gain from high mobility and, therefore, have a strict incentive in period 1 to eliminate any migration inefficiency.

5. Global Competition for Talent

Empirical observations confirm that not only migration of the highly skilled *within* Europe is low as compared with the United States, but also immigration of highly skilled individuals *into* Europe. Because of shrinking populations and increased globalized competition, European politicians

increasingly speak out in favor of highly skilled immigration. The Bologna and the Lisbon Process are build on this idea and aim at making Europe more attractive for talents from non-European countries.

In this section, we investigate the idea that the low rates of migration within Europe and into Europe are interrelated, because low transferability of human capital deters migration into Europe. The basic reasoning is straightforward: If it is more costly to transfer acquired human capital within Europe than within the United States, then insurance against locally unfavorable economic conditions is more costly in Europe. This translates into a preference for the United States and leads to low rates of migration into Europe.

To study these arguments more carefully, we extend our model to study immigration of students from a third part of the world, e.g., Asia, into two federations, Federation 1 and Federation 2.[15] Federation 1 represents Europe and Federation 2 represents the United States. To focus on the above argument, we assume that Federation 2 is identical to Federation 1 except that in Federation 2, human capital is fully transferable across borders.

In particular, each federation consists of two countries, each with mass 1 of individuals with talent θ uniformly distributed over $[0, 1]$. The individual θ_i first studies at a university in her home country and, thereby, acquires human capital θ_i. After observing economic conditions, she then has to decide where to work and realize her human capital. As in Federation 1, exactly one country in Federation 2 has a positive economic shock $\pi > 0$, whereas the other country in Federation 2 does not. Each country is equally likely to have the booming economy. There is no unemployment among graduates; a firm in each of the two countries enables each graduate to realize her productivity. A graduate appropriates the same share γ of this productivity as in Federation 1, whereas the remaining part accrues to the country where the individual works. When a graduate migrates within Federation 2, she incurs a fixed cost $c > 0$. The only but crucial difference between Federation 1 and 2 is that when a graduate migrates in Federation 2, she does not lose any human capital: $\alpha_1 \leq \alpha_2 \equiv 1$.

Let H_2 denote the country in Federation 2 with the highly productive economy and L_2 the country with the worse economy. Then, a graduate i from H_2 earns $\gamma\theta_i(1 + \pi)$ in her home country H_2 and $\gamma\theta_i - c$ in the other country L_2. Consequently, all natives from H_2 remain in their home country, where their productivity is higher. In contrast, a graduate i from L_2 earns

[15] The model presented in this section is related to the one suggested by Matsuyama (2002) in the sense that players simultaneously choose two different actions that are substitutes, but complementary between subjects. In Matsuyama (2002), there is a parameter space in which only asymmetric equilibria exist. Thus, this type of game can be used to explain diversity (e.g., two different equilibria in two different countries). We, however, already assume an exogenous asymmetry between the United States and Europe, because we stipulate exogenous perfect transferability of human capital in the United States.

$\gamma\theta_i(1+\pi) - c$ in country H_2 and $\gamma\theta_i$ in her home country L_2. Hence, migration into H_2 is beneficial to i if and only if

$$\gamma\theta_i\pi > c.$$

We assume that the cost of migration is low enough, $c < \gamma\pi$, so that there always exist some highly talented individuals from L_2 for whom migration is profitable. In particular, individuals from country L_2 migrate into country H_2 exactly when

$$\theta_i > \hat{\theta}(1) = \frac{c}{\gamma\pi}.$$

Now consider *immigrants* from some third country C. Because we focus on student immigration, we assume that no university is stationed in C. Therefore, individuals in C must obtain their human capital either in Federation 1 or Federation 2. Empirically, a large share of graduates from developing countries who obtained their degree in Europe or the United States remain in the developed part of the world. Accordingly, we assume that immigrants do not return to country C but stay in the federation where they acquired their human capital. Hence, we also abstract from migration between federations.

Immigrants from C differ in two dimensions. First, just like the citizens of the two federations they differ in talent $\theta \in [0, 1]$. Second, immigrants differ in their subjective preferences for a specific federation. In particular, let $\delta \in [-1, 1]$ express the additional utility that an immigrant obtains from migrating to Federation 1 rather than Federation 2. Hence, if $\delta_i > 0$, then a specific immigrant i has, all other things equal, a preference for Federation 1. For $\delta_i < 0$, immigrant i has a preference for Federation 2. We assume that immigrants have an overall mass of μ and their types (θ, δ) are uniformly distributed over the rectangle $[0, 1] \times [-1, 1]$.

5.1. Immigration Decisions

An immigrant who, after selecting Federation 1, happens to end up in the country with the worse economy will migrate if and only if her talent θ exceeds $\hat{\theta}(\alpha_1)$. Thus, an immigrant with $\theta \geq \hat{\theta}(\alpha_1)$ always ends up working in the high productive country, either because she was lucky to pick the booming country from the start or because she, after finishing her education, migrates to the highly productive country. From an *ex ante* perspective, these two possibilities are equally likely and, therefore, the mobile immigrant expects a payoff from immigrating to Federation 1 of

$$V_1^{mi} = \gamma\theta(1+\pi)/2 + (\gamma\theta(\alpha_1+\pi) - c)/2 + \delta_i.$$

By contrast, an immigrant $\theta \leq \hat{\theta}(\alpha_1)$ who has selected Federation 1 finds that migration into the neighboring country is unattractive. This immobile immigrant, therefore, is equally likely to end up working in country L or H.

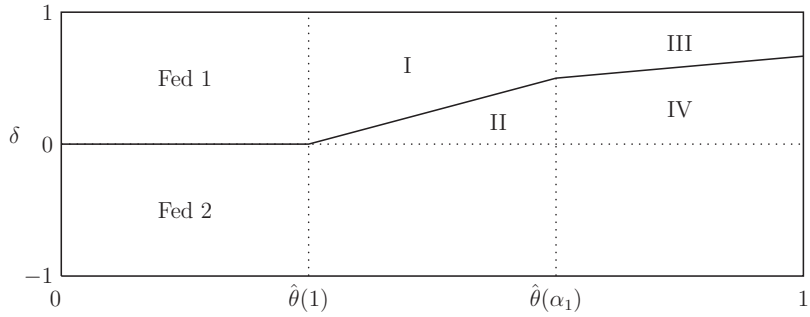

Figure 3: Decision of immigrants.

Hence, an immobile immigrant i expects a payoff from moving to Federation 1 of

$$V_1^{ii} = \gamma\theta(1+\pi)/2 + \gamma\theta/2 + \delta_i.$$

Instead, an immigrant who decides to immigrate to Federation 2 ends up working in the highly productive country whenever her talent exceeds $\hat{\theta}(1)$. Therefore, this mobile immigrant expects a payoff from immigrating into Federation 2 of

$$V_2^{mi} = \gamma\theta(1+\pi)/2 + (\gamma\theta(1+\pi) - c)/2.$$

By contrast, an immigrant with a talent of only $\theta < \hat{\theta}(1)$ remains immobile in Federation 2 and, therefore, expects a payoff from moving to Federation 2 of

$$V_2^{ii} = \gamma\theta(1+\pi)/2 + \gamma\theta/2.$$

Comparing the payoffs for the different types of immigrants, we obtain the following result.

PROPOSITION 3: *An immigrant with characteristics* (θ, δ) *decides to immigrate to Federation 1 if (i)* $\theta \in [0, \hat{\theta}(\alpha_1)]$ *and* $\delta > 0$, *or if (ii)* $\theta \in (\hat{\theta}(1), \hat{\theta}(\alpha_1)]$ *and* $\delta > (\gamma\theta\pi - c)/2$, *or if (iii)* $\theta \in (\hat{\theta}(\alpha_1), 1]$ *and* $\delta > \gamma\theta\,(1-\alpha_1)\,/2$.

Figure 3 illustrates the Proposition's results. Immigrants with $\delta > 0$ have an inherent preference for Federation 1, whereas immigrants with $\delta < 0$ have a preference for Federation 2. The proposition shows that immigrants with low talent $\theta \leq \hat{\theta}(1)$ decide in line with their inherent preferences. The reason is that, independent of the federation they live in, these immigrants are immobile after their graduation. The difference in transferability of human capital between the two federations does not play a role for them.

In contrast, the difference in transferability of human capital affects immigration decisions for immigrants with an intermediate talent

$\theta \in (\hat{\theta}(1), \hat{\theta}(\alpha_1)]$. These immigrants are mobile within Federation 2, but are immobile within Federation 1 where the transferability of human capital is $\alpha_1 < 1$. For these immigrants, Federation 2 has, therefore, an advantage over Federation 1. As illustrated by area II in Figure 3, this advantage may outweigh an inherent preference for Federation 1.

Finally, immigrants with a high talent $\theta \in (\hat{\theta}(\alpha_1), 1]$ are mobile both in Federation 1 and 2, despite a limited transferability of human capital in Federation 1. Because the mobile immigrants lose part of their acquired human capital in Federation 1, these highly talented immigrants also regard the low transferability α_1 as a disadvantage of Federation 1 which skews their preference toward Federation 2. Thus, the more talented they are, the less of them move to Federation 1. Area IV illustrates these types of immigrants.

Hence, Figure 3 confirms our intuitive idea that due to low transferability of human capital within Federation 1, Federation 1 attracts less immigrants than Federation 2. Yet, it also reveals that the loss of graduates affects the composition of talented immigrants in the federation. Federation 1 loses out on the most talented graduates. Interpreting Federation 1 as Europe and Federation 2 as the United States, this result is in accordance with the empirical facts.

5.2. Welfare Effects of Immigrants

Figure 3 is helpful in guiding our computations concerning the welfare effects of an imperfect transferability of human capital. It shows that, depending on the way how transferability inefficiency $\alpha_1 < 1$ affects their mobility decisions, we may distinguish four different types of immigrants.

First, Area I represents the immigrants who decide in favor of Federation 1 despite a low transferability but decide against migrating to country H if they happen to end up in country L. With a perfect transferability of human capital, these immigrants would migrate within the federation and, thereby, raise their productivity by a factor π. Because the federation appropriates a share of $1 - \gamma$ of their productivity, an immigrant in Area I of type θ_i raises the federation's social welfare by

$$\Delta E_I(\theta_i) = (1 - \gamma)\theta_i \pi.$$

The relative proportion of immigrants of type θ_i in Area I is

$$M_I(\theta_i) = \int_{(\gamma\theta_i\pi - c)/2}^{1} 1/4 d\delta = (2 - \gamma\theta_i\pi + c)/8$$

so that the welfare effect of Area I is

$$\Delta W_I = \int_{\hat{\theta}(1)}^{\hat{\theta}(\alpha_1)} M_I(\theta)\Delta E_I(\theta)\, d\theta.$$

Area II represents those immigrants who, due to the reduced transferability, move to Federation 2 rather than Federation 1. With a perfect transferability of human capital, these immigrants move to Federation 1 and all end up working in country H. Consequently, an immigrant in Area II of type θ_i raises the federation's social welfare by

$$\Delta E_{II}(\theta_i) = (1-\gamma)\theta_i(1+\pi).$$

The relative proportion of immigrants of type θ_i in Area II is

$$M_{II}(\theta_i) = \int_0^{(\gamma\theta_i\pi - c)/2} 1/2 d\delta = (\gamma\theta_i\pi - c)/4$$

so that the welfare effect of Area II is

$$\Delta W_{II} = \int_{\hat{\theta}(1)}^{\hat{\theta}(\alpha_1)} M_{II}(\theta)\Delta E_{II}(\theta)\, d\theta.$$

Area III represents those immigrants who decide to move to Federation 1. If these immigrants are unlucky and happen to end up in country L, they, subsequently, migrate to country H. An efficient transferability of human capital, therefore, raises the productivity of these immigrants by a factor $(1-\alpha_1)$. As a result, an immigrant in Area III of type θ_i raises the federation's social welfare by

$$\Delta E_{III}(\theta_i) = (1-\gamma)\theta_i(1-\alpha_1).$$

The relative proportion of immigrants of type θ_i in Area III is

$$M_{III}(\theta_i) = \int_{\gamma\theta_i(1-\alpha_1)/2}^{1} 1/2 d\delta = (2 - \gamma\theta_i(1-\alpha_1))/4,$$

so that the welfare effect of Area III is

$$\Delta W_{III} = \int_{\hat{\theta}(\alpha_1)}^{1} M_{III}(\theta)\Delta E_{III}(\theta)\, d\theta.$$

Area IV represents those immigrants who, due to the migration inefficiency in Federation 1, decide to move to Federation 2. Without the inefficiency, they choose Federation 1 and, either by luck or subsequent migration, end up working in country H. An immigrant in Area IV of type θ_i raises the federation's social welfare by

$$\Delta E_{IV}(\theta_i) = (1-\gamma)\theta_i(1+\pi).$$

The relative proportion of immigrants of type θ_i in Area IV is

$$M_{IV}(\theta_i) = \int_0^{\gamma\theta_i(1-\alpha_1)/2} 1/2 d\delta = \gamma\theta_i(1-\alpha_1)/4,$$

so that the welfare effect of Area IV is

$$\Delta W_{IV} = \int_{\hat{\theta}(\alpha_1)}^{1} M_{IV}(\theta)\,\Delta E_{IV}(\theta)\,d\theta.$$

The overall welfare effects of the additional immigrants who choose Federation 1 if transferability of human capital becomes perfect are

$$\Delta W^1 = \mu(\Delta W_I + \Delta W_{II} + \Delta W_{III} + \Delta W_{IV}) > 0, \tag{5}$$

where μ is the mass of immigrants. It is unambiguously positive, because each individual ΔW is positive.

6. The Bologna and the Lisbon Process

The Bologna and the Lisbon Process are coordinated political attempts to increase mobility in Europe. The declared aims of these measures are to reduce mismatches between jobs and talents and to attract highly talented immigrants. These two aims are meant to boost productivity in Europe and allow Europe to attain its full potential.

In our model, mobility in Federation 1 can be raised by two different approaches, given that the graduates themselves fail to coordinate on the high migration equilibrium. First, transferability of human capital, α_0, could be enhanced. Second, migration costs c could be lowered for migrants.

The Bologna Process is best understood as an attempt to increase transferability of human capital α_0 by reducing the diversity of higher education systems. In a harmonized education system firms are better able to judge the value of a foreign university degree, which increases the quality of matching between jobs and graduates.[16]

The Lisbon Process, on the other hand, should be understood in a wider sense. It encompasses all measures that increase labor mobility and immigration of students and workers whose skills are needed in Europe. Accordingly, the European Commission suggests both policies that make human capital more transferable and policies that reduce other migration costs. For instance, COM (2008, p. 14) reports: "The Commission recommends that Member States develop integration and social inclusion policies for mobile workers and their families, using existing EU measures and tools, e.g., on cultural, linguistic and schooling policies and on anti-discrimination and skills recognition." In the context of our model, the Lisbon Process can therefore be best understood as a bundle of soft policy measures that contribute to both increasing α_0 and decreasing c.

[16] Accordingly, the official Bologna Website 2007–2010 says: "The purpose of recognition is to make it possible for learners to use their qualifications from one education system in another education system (or country) without losing the real value of those qualifications." See http://www.ond.vlaanderen.be/hogeronderwijs/bologna/ActionLines/recognition.htm

However, as can be seen from Figure 2, targeting α_0 makes sense only if $\hat{\alpha} < 1$. This is because only then, the high-migration equilibrium actually exists. Thus, only for $\hat{\alpha} < 1$ the high-migration equilibrium can be made unique by increasing α_0 above $\hat{\alpha}$. If, by contrast, the starting point of policy is a low-migration equilibrium with $\hat{\alpha} > 1$, the only possibility of reaching the high-migration equilibrium is to lower c until $\hat{\alpha} < 1$. Intuitively, if migration costs c outweigh the effect of the positive shock on income, $\gamma\pi$, then it is not sufficient to target the transferability of human capital alone. Instead, one first has to enhance the relative importance of the positive economic shock by lowering direct migration costs.

Hence, a policy of increasing α_0 can have one of two effects. On the one hand, it can contribute to increasing migration in a low migration equilibrium, without being sufficient to establish the high migration equilibrium. This happens as long as, for given c, α_0 remains below $\hat{\alpha}$. By contrast, if the policies implemented in the course of the Bologna and the Lisbon Process are sufficient to establish α_0 above $\hat{\alpha}$, then they will induce the high migration equilibrium.

Finally, an important practical consideration is that the Bologna and the Lisbon Process are both voluntary, cooperative policies. Participating countries must, therefore, each have an individual incentive to implement the respective policies, i.e., each of the countries has to expect an increase in welfare from supporting the Bologna and the Lisbon Process. Our analysis shows that this is guaranteed only *ex ante*, i.e., before the realization of the economic shock. This is so because only the overall *expected* change in welfare from switching to the high migration equilibrium is unambiguously positive for both of the countries.

This observation suggests a stronger support for long-term policies than short-term ones. Hence, reforms targeted at the education system might be easier to implement cooperatively than reforms that affect current labor mobility. In the context of our model, this means that increasing α_0 can be achieved cooperatively, whereas it is more difficult to agree about decreasing c by, for example, directly subsidizing migration.

7. Conclusion

We show that low transferability of human capital thwarts migration of talented graduates within a federation and, conversely, low migration within a federation impedes transferability of human capital. This leads to two types of inefficiencies: First, an inefficient matching of graduates and jobs occurs so that graduates do not attain their full productive potential. Second, low transferability creates a handicap in the global competition for international talents. Interpreting the Lisbon and Bologna Process as means to increase the transferability of human capital, we show how they may help to increase

mobility and make Europe a more attractive destination for especially the more talented individuals.[17]

To focus on the imperfect transferability of human capital, we considered a highly stylized model of migration. In particular, we assumed that all countries and federations are symmetric except for the transferability of human capital. This abstraction allows us to isolate the effects of imperfect transferability. Clearly, countries and federations do not only differ in the transferability of human capital alone but also in many other dimensions. Indeed, popular debate attributes differences between Europe and the United States in the (im)migration rates to higher educational quality and higher wages in the United States. From this perspective, our contribution is to point to a third possible cause: less transferable human capital between the countries within Europe than between the different states in the United States.

In assuming constant marginal productivity, we also abstracted from the question whether immigration could lower wages for native workers. In the context of our application, this abstraction seems less problematic, because highly talented workers, such as innovative researchers, are few and the problem is more one of excess demand than of excess supply. As a result, the crowding-out effects of such workers are low. We also ignored possible costs of switching from one's mother tongue to a common international language when migration becomes intense. Because of our focus on the highly educated, also this assumption is less problematic. Including such cost would, however, lower the welfare gains of natives from immigration of talents. Moreover, we may enrich the model by explicitly modeling the individual decision of migrants whether or not to learn the local language and modeling the individual decision of firms whether or not to switch to a focal language. For instance, Gabszewicz *et al*. (2010) explicitly account for the fact that the benefits of learning the other community's language decrease if many members of that community learn a language that one speaks already. We leave such extensions to further research.[18]

Appendix

Proof of Lemma 1: Follows directly from the body text. ■

Proof of Proposition 1: We first determine the conditions under which the different equilibrium outcomes $m^* \in [0, 1]$ exist:

[17] An obvious third inefficiency is a reduced incentive effect for acquiring the human capital in the first place. We abstracted from this effect, because it is clear that it provides an additional argument in favor of increasing transferability.

[18] We are grateful to an anonymous referee for pointing these issues out.

(i) An equilibrium with $m^* = 0$ and $\alpha^* = \alpha_0$ exists exactly when for $\alpha^* = \alpha_0$, the highest talented graduate $\theta_i = 1$ has no strict incentive to migrate. Thus, $m^* = 0$ and $\alpha^* = \alpha_0$ exactly when $\gamma \geq \gamma(\alpha_0 + \pi) - c$, i.e., if and only if $\alpha_0 \leq \bar{\alpha}$.

(ii) An equilibrium with $m^* \in (0, \bar{m})$ and $\alpha^* = \alpha_0$ exists exactly when the graduate with talent $\theta_i = 1 - m^*$ is, with $\alpha^* = \alpha_0$, indifferent between migrating or not. This is because then, all $\theta > 1 - m^*$ have a strict incentive to migrate and all $\theta < 1 - m^*$ have a strict incentive not to migrate. Indifference of type $\theta = 1 - m^*$ obtains exactly when $\gamma(1 - m^*)$ equals $\gamma(1 - m^*)(\alpha_0 + \pi) - c$, which is equivalent to

$$m^* = 1 - \frac{c}{\gamma(\alpha_0 + \pi - 1)}.$$

Hence, the equilibrium exists exactly when $1 - \frac{c}{\gamma(\alpha_0+\pi-1)}$ is larger than zero and smaller than $\bar{m}$, which is equivalent to $\alpha_0 \in (\bar{\alpha}, \hat{\alpha})$.

(iii) An equilibrium with $m^* \in (\bar{m}, 1)$ and $\alpha^* = 1$ exists exactly when the graduate with talent $\theta_i = 1 - m^*$ is, for $\alpha^* = 1$, indifferent between migrating or not. For $\alpha^* = 1$, indifference of type $\theta = 1 - m^*$ obtains exactly when $\gamma(1 - m^*)$ equals $\gamma(1 - m^*)(1 + \pi) - c$, which is equivalent to $m^* = 1 - c/(\gamma\pi)$). Because $1 - c/(\gamma\pi) > \bar{m}$ is equivalent to $\hat{\alpha} < 1$, this equilibrium exists exactly when $\hat{\alpha} < 1$.

(iv) An equilibrium with $m^* = 1$ exists only if the graduate with talent $\theta_i = 0$ has, with $\alpha^* = 1$, a weak incentive to migrate. But this requires $c \leq 0$, which is a contradiction to the assumptions of the model. Therefore, an equilibrium with $m^* = 1$ does not exist. ■

Proof of Proposition 2: The low-migration equilibrium risk dominates the high-migration equilibrium if $d^l(1 - \bar{m})/(d^l(1 - \bar{m}) + d^h(1 - \bar{m})) > 1/2$. Because by assumption $\alpha + \pi > 1$, straightforward calculations yield the result in the proposition. ■

Proof of Proposition 3: Note that $\hat{\theta}(1) \leq \hat{\theta}(\alpha_1)$ for any $\alpha_1 \in [0, 1]$. We, therefore, have three types of immigrants to consider:

(i) An immigrant with talent $\theta \in [0, \hat{\theta}(1)]$ expects a payoff V_1^{ii} from moving to Federation 1 and V_2^{ii} from moving to Federation 2. She, therefore, decides in favor of Federation 1 exactly when $V_1^{ii} \geq V_2^{ii}$. Thus, she moves into Federation 1 if and only if $\delta \geq 0$.

(ii) An immigrant with talent $\theta \in (\hat{\theta}(1), \hat{\theta}(\alpha_1)]$ expects a payoff V_1^{ii} from moving into Federation 1 and a payoff V_2^{mi} from moving into Federation 2. She, therefore, decides in favor of Federation 1 exactly when $V_1^{ii} \geq V_2^{mi}$, i.e., if and only if $\delta > (\gamma\theta\pi - c)/2$.

(iii) An immigrant with talent $\theta \in (\hat{\theta}(\alpha_1), 1]$ expects a payoff V_1^{mi} from moving to Federation 1 and V_2^{mi} from moving to Federation 2. Thus, she decides in favor of Federation 1 exactly when $V_1^{mi} \geq V_2^{mi}$, i.e., if

and only if $\delta > \gamma\theta\,(1-\alpha_1)\,/2$. This third case is relevant if and only if $\hat{\theta}(\alpha_1) < 1$, that is, if and only if $\alpha_1 > c/\gamma - \pi + 1$. ■

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