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Why Don't Labor and Capital Flow Between Young and Old Countries?

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Abstract

In this paper we investigate the twofold effect of demographics on international factor flows in a model with endogenous policy constraints on both foreign direct investment and migration. Factor price differences between industrialized and developing countries create economic incentives for migration to developed countries and for capital flows to less developed countries. However, political barriers to immigration in developed countries and expropriation risks in developing countries impede labor and capital flows. Using a political economy approach that takes into account different generations' conflicting attitudes towards immigration and expropriation, we explore how these policy restrictions interact. We find that, in the presence of mobility constraints, larger demographic differences between countries need not result in an increase of factor flows.

JEL classification: D78, F21, F22, J10
Keywords: Demographic Change, Political Economy, Migration, Foreign Direct Investment

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1 Introduction

Virtually all industrialized countries and many developing countries are facing a decline in birth rates and an increase in life expectancy. However, demographic structures differ widely between industrialized and developing countries: in general, birth rates are much smaller in rich industrialized countries than in the developing world. Industrialized countries are thus characterized by a larger proportion of old relative to young individuals. Since individuals accumulate capital throughout their working life, developed countries dispose of relatively large stocks of productive capital per worker. This leads to high wages but low capital returns in comparison to developing countries. Consequently, large efficiency gains from international capital and labor movements seem possible.

The importance of demographic structures for international migration and foreign direct investment (FDI) has aroused international interest. Factor movements are discussed not only as a means to realize efficiency gains but also as a driver for economic growth in developing countries and to secure pension systems in industrialized countries. While the United Nations' report on replacement migration calculates the size of labor movements necessary to offset population aging in various low-fertility countries (see UNPD 2001), INGENUE (2001) model and Brooks (2003) simulate the effects of demographic trends on international capital flows under the assumption that capital is perfectly mobile while labor is not. Brooks (2003) predicts that the US and the EU will be large capital exporters until their baby boomers retire around 2020.

However, political constraints to factor flows exist both in developing and developed countries. Developing countries with a favorable demographic structure to inward investment often do not offer the institutional framework for international investors to fully reap efficiency gains. Governments of industrialized countries in turn tend to be sensitive to native resentments toward the admission of immigrants. Observed international factor flows are indeed far too low to equalize the returns to capital and labor. Brooks (2003) notes that capital flows would be considerably lower than predicted by his model if institutional risk was taken into account. Concerning labor, Facchini and Mayda (2008) make restrictive immigration policies responsible for the low level of international flows. To understand the determinants of factor flows we thus have to assess the political economy of mobility constraints. The political processes from which mobility constraints result are influenced by heterogeneous interests within a country's population. Since different attitudes of labor and capital owners are (basically) in line with different attitudes of young and old individuals, mobility constraints are directly

influenced by the demographic structures of populations. Demographic diversity thus has a twofold impact, on economic incentives for factor flows and on attitudes toward factor flows. While it unambiguously creates economic incentives for factor flows, its impact on the outcome of the political process requires detailed consideration.

Research on the impediments to international capital and labor flows is well established, but the simultaneous consideration of migration and investment policies has so far been neglected. This is a gap in the literature which we aim to fill with our paper. Accounting for both kinds of policies jointly does not simply imply that both migration and FDI are limited. Instead, the volume of factor flows is determined by the interplay of policies. In our model, the larger the share of capital invested in the developing country, the less immigrants are admitted to the industrialized country. Meanwhile, higher emigration from the developing country secures capital investments there.

To capture the demographic effects on international factor flows, we consider a one-period setting with sequential decisions in two open economies, each populated by two generations. While the majority is young in the developing country, the reverse is true for the industrialized country. We assume policies to be determined by the respective median voter's preferences. The government's policy decision in the industrialized country is how many immigrants to admit, while in the developing country, imported capital can either be expropriated or not. Our model explains several stylized facts in a straightforward way. First, in our model equilibrium labor and capital flows are indeed restricted by policies. Second, among poor countries, more developed countries have a higher propensity to expropriate. Third, immigration preferences are driven by economic as well as non-economic motives. Furthermore, the existent demographic diversity does not necessarily induce factor flows. Admitting immigrants is more attractive for the industrialized country's old median voter the younger the developing country's population. However, then, expropriation preferences of the young median voter are higher. The age structure in the industrialized country only affects expropriation preferences in the developing country via emigration. Although immigration preferences in the industrialized country may increase with the share of old, this need not be the case. Finally, we discuss the impact of the timing of individual and policy decisions on the volume of factor flows.

We set up the economic model in section 3. Section 4 analyzes equilibrium policies, given simultaneity of the investment and migration policy decisions. In section 5 we examine the impact of changes in parameters on the equilibrium, while section 6 extends our analysis to the case in which investment takes place after the migration policy decision. Section 7 concludes.

2 Related Literature

Our analysis draws on two strands of literature. The first one deals with the impediments to capital flows from rich to poor countries. Contrary to Lucas (1990), Alfaro et al. (2008) find that bad institutional quality does play a major role in explaining the low level of capital investment in poor countries. Several authors deal explicitly with expropriation risk of FDI. Eaton and Gersovitz (1984), for example, argue that the mere existence of expropriation risk distorts FDI flows even if expropriation does not occur. Cole and English (1991) and Thomas and Worrall (1994) model dynamic games between international investors and a host-country government under the assumption that investors can punish the host country for expropriation by withholding future investment. The authors find that in order to avoid expropriation, FDI must not exceed a critical threshold. Additionally, Harms (2002) shows in a theoretical model that a taxation of foreign capital is more likely if the host country is poor. However, other than taxation, expropriation entails an additional cost, which grows with the technological deficit of developing countries. Jodice (1980) finds a curvilinear effect of development on expropriation risk, implying that the risk of expropriation is largest in intermediately developed countries. He conjectures that while very rich countries waive expropriation in favor of more subtle ways to seize foreign investors' revenues, very poor countries do not expropriate as they hinge on the technological advantage of foreign firms.

The second strand of literature we build on deals with endogenous immigration policy. In the static models by Benhabib (1996) and Mazza and van Winden (1996), individuals support admitting immigrants if these are different from themselves. Preferences may be reversed if immigrants receive political rights. This is also an important prediction of the dynamic models of Dolmas and Huffman (2004) and Ortega (2005). In our model, old capital owners' immigration preferences are limited, even though immigrants do not have any political rights. This is because migration entails a non-economic disutility and because it raises the capital intensity and thus lowers returns on the part of capital invested in the developing country, although it raises capital returns in the industrialized country. As we do, Sand and Razin (2009) analyze the impact of aging on immigration and also on redistribution policy. In their model the median voter's identity may change not only due to native population aging but also due to the immigration of individuals who have more children than natives. This may restrain the old's preference for admitting immigrants. We focus on the effect of marginal changes in the population share of both generations. In contrast to Sand and Razin, we therefore assume that the median voter in the industrialized country is

always old.

3 The Economic Model

We consider an industrialized country and a developing country, both populated by young and old individuals. The young individuals may potentially supply their labor in either country, while the old individuals are out of the labor force. The old individuals in the industrialized country own a given amount of capital. Meanwhile, the old in the developing country do not own any productive capital, only an endowment e^* which they can consume, as in Cole and English (1991). The size of the total population is normalized to one in both countries:

$$N^y + N^o = 1 \qquad \text{and} \qquad N^{y*} + N^{o*} = 1 \,,$$

where the asterisk denotes the developing country's variables. We assume that the old are in the majority in the industrialized country, while the opposite holds for the developing country, that is $N^o > 0.5$ and $N^{o*} < 0.5$.

In both countries a homogeneous good is produced with a Cobb-Douglas production function:

$$Y = AK^{\alpha}L^{1-\alpha} \quad \text{and} \quad Y^* = \tilde{A}(K^*)^{\alpha}(L^*)^{1-\alpha} \,.$$

The size of the capital stock owned by the old generation in the industrialized country is $\bar{k} \cdot N^o$. The assumption that the developing country's old own only a non-productive endowment is plausible since financial institutions are rudimentary in many developing countries, and savings often take the form of tangible assets. Production in the developing country thus hinges on capital inflows from the industrialized country ($K^* = \bar{k} \cdot N^o - K$). We assume that foreign direct investment is administered by a mutual fund, which coordinates the single investment decisions.

The young in both countries exogenously supply one unit of labor. We set the depreciation rate to zero for simplicity.[1] We assume that total factor productivity (TFP) in the industrialized country A exceeds TFP in the developing country. This results from a less favorable business climate, for instance due to an inferior infrastructure, in the developing country. However, capital flows from the industrialized country are accompanied by technological expertise. Therefore, TFP $\tilde{A}$ exceeds the level A^* the developing country

[1]Note that this simplification does not drive our results. In the limiting case with full depreciation, the net utility gain from expropriation is independent of the level of FDI.

would achieve without the foreign expertise:

$$\tilde{A} = \frac{1}{\theta} A^* \quad \text{with} \quad 0 < \theta < 1 \; .$$

The foreign investors' productivity thus not only hinges on the initial conditions they find in the developing country (such as the state of the infrastructure and know-how, the regulatory burden etc.), but also on their know-how and their capacity to cope with these conditions. Defining M as labor migration from the developing to the industrialized country, factor prices are given by

$$\begin{aligned} w &= (1-\alpha) A \left(\frac{K}{N^y + M} \right)^{\alpha} \quad , \quad r = \alpha A \left(\frac{K}{N^y + M} \right)^{\alpha - 1} , \\ w^* &= (1-\alpha) \tilde{A} \left(\frac{K^*}{N^{y*} - M} \right)^{\alpha} \quad \text{and} \quad r^* = \alpha \tilde{A} \left(\frac{K^*}{N^{y*} - M} \right)^{\alpha - 1} \end{aligned} \tag{1}$$

in the industrialized and the developing country respectively. Note that assuming a more general CES production function would allow a wider range of possible factor price elasticities with respect to migration and FDI.[2]

Each country's government sets policy to maximize the respective median voter's utility. The policy decision in the developing country concerns the expropriation of foreign capital. Expropriation refers to the seizure of the capital stock, and, for simplicity, it is assumed to be always total. If there were no costs of expropriation, the developing country would be subject to a classical time-inconsistency problem and would always expropriate. Consequently, no capital would flow there. However, expropriation usually comes at some cost. As foreign investors lose control over invested capital after expropriation, it is sensible to assume them to withdraw their expertise, as in Eaton and Gersovitz (1984) as well as Harms and an de Meulen (2009).[3] The seized capital stock is still used for production, but TFP drops to A^* in the developing country, thereby lowering output and the young's wages. The old do not incur any cost from expropriation. We assume that the benefit from expropriation (the gross return to capital) is distributed equally among the developing country's old and those young who have not emigrated. Each inhabitant of the developing country thus receives a transfer t with

$$t = \frac{T}{1 - M} = \frac{(1 + \theta r^*) K^*}{1 - M} \; . \tag{2}$$

[2]There is a large empirical literature on the effects of migration on wages, starting with Card (1990). The size of factor price effects is contingent on the substitutability between different factors of production and between immigrants and natives, see for instance Ottaviano and Peri (2008).

[3]In a setting with a longer time horizon, one could also argue that expropriation reduces future capital inflows, see Cole and English (1991) and Thomas and Worrall (1994).

The government of the industrialized country decides on the number of admitted immigrants. Immigration to the industrialized country affects its citizens' welfare in two ways. First, it alters factor prices. The young generation clearly suffers since wages decline. The old generation benefits from increasing capital returns on the part of capital invested at home k and suffers from decreasing returns on that part invested in the foreign developing country k^*. Be aware that k and k^* do not denote the capital intensities in production (K/L and K^*/L^*) but rather the capital used in home and foreign production per investor (K/N^o and K^*/N^o). Second, we assume that immigration causes a disutility d to all of the industrialized country's citizens, proportional to the number of immigrants M.[4] This disutility parameter captures potential welfare effects of immigration not accounted for in individual incomes in a tractable way. For instance, natives may resent an increased heterogeneity of social norms and customs, as in Hillman (2002), or immigration may reduce the utility derived from public goods, as in Alesina and La Ferrara (2005). Individuals' utility is linear in consumption:

$$U^i = c^i - d \cdot M \quad \text{and} \quad U^{i*} = c^{i*} \,, \qquad i = y, o \,,$$

with

$$\begin{aligned} c^y &= w \,, \\ c^o &= k(1+r) + k^*(1+r^*) \,, \end{aligned}$$

and

$$c^{y*} = \begin{cases} w & \text{in case of emigration} \\ w^* & \text{in case of non-expropriation} \\ \theta w^* + t & \text{in case of expropriation} \,, \end{cases}$$

$$c^{o*} = \begin{cases} e^* & \text{in case of non-expropriation} \\ e^* + t & \text{in case of expropriation} \,. \end{cases}$$

We assume a sequence of events as illustrated in figure 1. First, the industrialized country's old allocate their capital to both countries and at the same time, the industrialized country's government determines maximum immigration. Second, the developing country's young migrate before third, the developing country's government decides whether to expropriate the foreign capital stock. Fourth, production and consumption take place. We solve the model by backward induction, that is, we start with the expropriation decision.

[4] We could also use the more general functional form d^γ. Since the choice of γ does not have any qualitative effect on our results we set γ equal to one. With $\gamma = 1$, the disutility caused by immigration increases linearly with the population share of immigrants.

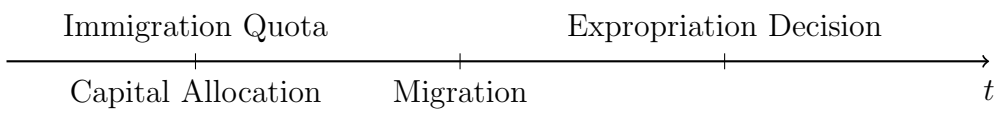


Figure 1: Sequence of Events

This sequence of events is chosen for the following reasons. Expropriation of the capital stock can only take place after capital has been installed. We assume the expropriation decision to be taken right before production starts, that is, after capital investment and labor migration. With respect to capital allocation and migration policy, we begin by assuming simultaneity. One could also argue that the implementation of migration policy decisions requires a longer lead time than the allocation of capital.[5] We therefore extend our model to this sequential timing in section 6.

4 Equilibrium Policy

We now come to the determination of equilibrium migration and FDI. We solve for the four equations determining the volume of individually optimal and politically determined factor flows, starting with the expropriation decision, which takes place in stage three. While we model four decisions, we show that factor flows are always restricted by the two policy decisions: FDI is restricted to the volume where the developing country abstains from expropriation, and migration takes on the level the industrialized country's old median voter prefers. Note that high emigration from the developing country may change the identity of the median voter there from a young to an old individual.

Non-Expropriation Constraint

When deciding whether to expropriate in the third stage, the developing country's government faces given levels of capital imports K^* and migration M. We define the *non-expropriation constraint* K^{*max} as the level of FDI for which the median voter in the developing country is indifferent between expropriation and non-expropriation. If the median voter is old (because of high emigration, that is $M > N^{y*} - N^{o*}$), any foreign capital is always

[5] Assuming that the investment decision takes place before the migration policy decision instead of simultaneity would yield exactly the same results, given that investors are atomistic and behave symmetrically in equilibrium.

expropriated. We call the threshold value of migration for which there remain as many old as young individuals in the developing country M^{crit}, with $M^{crit} = N^{y*} - N^{o*}$. If $M < M^{crit}$, the median voter in the developing country is young. The young who have not emigrated benefit from the transfer like the old, but additionally suffer from a reduced wage rate due to a drop in TFP. A young median voter weakly prefers non-expropriation if the transfer does not compensate for the wage loss:

$$(1-\theta)w^* \geq t \ .$$

Using (2), this can be written as

$$(1-\theta)w^* \geq \frac{K^*}{1-M} + \frac{K^* \cdot \theta r^*}{1-M} \ . \tag{3}$$

An inflow of capital has three effects on expropriation preferences, a wage effect $(1-\theta)w^*$, a return effect $K^* \cdot \theta r^*/(1-M)$ and an effect on the seizable capital stock $K^*/(1-M)$. Subtracting the return effect on both sides and inserting (1) yields

$$\left[\frac{\frac{1-\theta}{\theta}A^*(1-\alpha) - \alpha A^*(N^{y*}-M)/(1-M)}{(N^{y*}-M)^{\alpha}}\right](K^*)^{\alpha} \geq \frac{K^*}{1-M} \ .$$

Note that the sign of the term in squared brackets on the left hand side is independent of the level of FDI, K^*. A necessary condition for positive FDI for all M between 0 and N^{y*} is that the wage effect exceeds the return effect, which is fulfilled for sufficiently low θ:

$$\theta \leq \frac{1-\alpha}{(1-\alpha)+\alpha N^{y*}} \ .$$

This means that expropriation has to be costly.[6] Solving for K^* yields

$$K^* \leq (A^*)^{\frac{1}{1-\alpha}} \left[\frac{\frac{1-\theta}{\theta}(1-\alpha)(1-M) - \alpha(N^{y*}-M)}{(N^{y*}-M)^{\alpha}}\right]^{\frac{1}{1-\alpha}} \ .$$

Consequently, we can write the upper bound for capital imports, the *non-expropriation constraint*, as

$$K^{*max} = \begin{cases} 0 & \text{if } M > M^{crit} \\ (A^*)^{\frac{1}{1-\alpha}} \left[\frac{\frac{1-\theta}{\theta}(1-\alpha)(1-M) - \alpha(N^{y*}-M)}{(N^{y*}-M)^{\alpha}}\right]^{\frac{1}{1-\alpha}} & \text{if } M \leq M^{crit} \ , \end{cases} \tag{4}$$

[6] Note that relaxing our assumption of no depreciation would decrease expropriation preferences due to a lower distributable capital stock. Given that the wage effect is larger than the return effect, expropriation would never take place in the limiting case with a depreciation rate of 100%.

for the case of an old and a young median voter respectively.

We can calculate the derivative of the young median voters' *non-expropriation constraint* with respect to emigration as

$$\frac{dK^{*max}}{dM} = \left(\frac{K^{*max}}{N^{y*} - M}\right)^{\alpha} \left[\frac{1-\theta}{\theta} A^* \left(\frac{\alpha(1-M)}{N^{y*} - M} - 1\right) + \alpha A^*\right] . \quad (5)$$

The sign of this derivative is ambiguous. A positive effect of emigration on the critical level of FDI is sufficient for a unique equilibrium to exist in the case of a young median voter in the developing country (see proposition 1). Therefore, we assume the necessary and sufficient condition for $dK^{*max}/dM > 0$ for all M between 0 and N^{y*} given by

$$\theta > \frac{N^{y*} - \alpha}{(1+\alpha)N^{y*} - \alpha} ,$$

to be fulfilled. Emigration has three effects on the *non-expropriation constraint*. First, wages increase and so does the wage effect from expropriation. Second, capital returns and the return effect decrease. Both of these effects lower expropriation preferences. Third, the number or recipients of a possible transfer decreases, making expropriation more attractive for the median voter. The parameter θ has two opposite effects on the derivative dK^{*max}/dM. Even though the marginal effect on the wage loss becomes smaller if θ increases, FDI to be distributed in case of expropriation decreases, as (4) shows.

In summary, expropriation has to be costly for non-expropriation compatible FDI to be larger than zero. However, the level of FDI compatible with non-expropriation only increases in emigration if expropriation costs are not too high, i.e. if θ is not too low. We have thus derived the *non-expropriation constraint*, resulting from the expropriation decision in the last stage, and its properties.[7]

Emigration Constraint

In the preceding stage, the developing country's young take their migration decision for a given level of FDI and for a given immigration policy in the industrialized country. In the absence of any immigration restrictions they

[7]Note that less elastic reactions of factor prices to factor supplies would translate into less elastic costs and benefits of expropriation in equation (3), implying a larger risk of expropriation. The effect of a growing seizable capital stock dominates the wage and return effects. Furthermore, weak reactions of factor prices may imply that expropriation preferences increase with emigration, since the number of transfer recipients declines.

would migrate until utility and thus wages in both countries are equal. This yields an *emigration constraint*:

$$M^{opt} = \frac{(\theta A/A^*)^{1/\alpha}(\bar{k}N^o - K^*)N^{y*} - K^*N^y}{(\theta A/A^*)^{1/\alpha}(\bar{k}N^o - K^*) + K^*} \ . \tag{6}$$

It is declining in the level of FDI since FDI reduces wage differences between both countries:

$$\frac{dM^{opt}}{dK^*} = -\frac{(\theta A/A^*)^{1/\alpha}(\bar{k}N^o - K^*)(N^y + N^{y*})}{\left[(\theta A/A^*)^{1/\alpha}(\bar{k}N^o - K^*) + K^*\right]^2} \qquad < 0 \ .$$

However, potential migrants have to obey the limit on immigration set by the industrialized country's government, the *immigration policy constraint* M^{max}, which we derive in the next subsection. While the potential migrants know the level of FDI, this is not the case for the industrialized country's government which decides on immigration policy. In our model the immigration restriction imposed by the industrialized country turns out to be binding, as we show below.

Immigration Policy Constraint

Immigration policy is determined by the preferences of the industrialized country's median voter, who is an old individual. Immigration policy is set simultaneously to the investors' allocation of capital. Immigration from the developing country raises the capital return on the part of capital invested in the industrialized country and decreases the capital return on the part invested in the developing country. Be aware that foreign capital returns only accrue to the industrialized country's investors if $K^* \leq K^{*max}$. For any volume of FDI exceeding the non-expropriation compatible level, the impact of migration on foreign capital returns is therefore not taken into account. However, we only consider the former case, since it is only optimal for investors to invest in the foreign country as long as returns are not expropriated (see below). Maximizing the old's indirect utility function assuming non-expropriation yields the following first-order condition for every value of K^* between zero and $\bar{k}N^o$:

$$k\frac{dr}{dM} + k^*\frac{dr^*}{dM} = d \ , \tag{7}$$

with

$$\frac{dr}{dM} = \frac{1-\alpha}{N^y + M}r \quad \text{and} \quad \frac{dr^*}{dM} = -\frac{1-\alpha}{N^{y*} - M}r^* \ ,$$

and d denoting the non-monetary disutility related to a marginal increase in immigration. Equation (7) illustrates that immigrants are admitted as long as the marginal gain from immigration, $k(dr/dM)$, outweighs the marginal cost, $-k^*(dr^*/dM) + d$.[8] The first-order condition can also be written as

$$\frac{\alpha(w - w^*)}{1 - N^y} = d \; . \tag{8}$$

For unrestricted migration the wage rates in both countries are equal, and the left-hand side is zero. This is a solution for the *immigration policy constraint* only if $d = 0$, i.e. there are no costs of integrating immigrants. Intuitively, M^{max} must be smaller than unrestricted migration for any d exceeding zero. Hence, we can abstract from the *emigration constraint* as equilibrium migration is always determined by the industrialized country's policy.

For $K^* = 0$, we can show that

$$M^{max} = \bar{k} \left(\frac{(1-\alpha)\alpha A}{d} \right)^{1/\alpha} (N^o)^{(\alpha-1)/\alpha} - N^y \; . \tag{9}$$

With investment only taking place at home, the industrialized country's old favor admitting an infinite number of immigrants if there are no integration costs. The marginal return gain of additional immigration increases with the amount of capital each investor owns and also with the total capital stock and therefore with N^o. Additionally, a larger number of old agents is tantamount to a smaller domestic labor force, reinforcing the marginal gain of immigration.

For any $K^* > 0$, we cannot solve explicitly for M^{max}. However, using the implicit function theorem, we can show that the derivative of the industrialized median voter's preferred level of migration to FDI is

$$\frac{dM^{max}}{dK^*} = -\frac{\frac{r}{N^y+M} + \frac{r^*}{N^{y*}-M}}{\frac{K}{N^y+M} \cdot \frac{r}{N^y+M} + \frac{K^*}{N^{y*}-M} \cdot \frac{r^*}{N^{y*}-M}} \quad < 0 \; . \tag{10}$$

With larger capital exports, investors place a higher weight on foreign capital returns. These become large for low levels of migration. Therefore, chosen immigration is a declining function of FDI. At the same time with the immigration policy decision, the industrialized country's old allocate their capital endowment. The investors have to take the political expropriation decision of the developing country into account.

[8] Note that less elastic factor prices would imply that both marginal gains and costs decrease. M^{max} is then likely to be lower if the bulk of capital is invested at home.

Investment Constraint

In the absence of expropriation risk, the industrialized country's investors would export the share of capital necessary to equalize capital returns in both countries. We call the level of capital exports in the absence of expropriation risk K^{*opt}, the *investment constraint*, with

$$K^{*opt} = \frac{(A/\tilde{A})^{\frac{1}{\alpha-1}}\bar{k} \cdot N^o(N^{y*} - M)}{(N^y + M) + (A/\tilde{A})^{\frac{1}{\alpha-1}}(N^{y*} - M)} \,. \tag{11}$$

Obviously, the difference in capital returns and thus the optimal level of capital exports is lower the higher the immigration level, such that K^{*opt} is a declining function of M. It is straightforward to understand that no FDI exceeding the non-expropriation compatible level is an optimal choice. This is because in case of expropriation, investors only receive a positive return on the part of capital invested at home. Consequently, utility can be increased by investing a larger fraction of capital at home and reducing FDI. If the non-expropriation compatible level of FDI is not sufficient to equalize returns, it does not pay to further reduce FDI, foregoing high capital returns in the developing country. Therefore, actual FDI is given by the minimum of K^{*opt} and K^{*max}. The assumption that investors' capital is administered by a mutual fund solves the coordination problem between investors of ensuring that the sum of capital flows to the developing country does not exceed the level compatible with the *non-expropriation constraint*.

If the median voter in the developing country is old the *non-expropriation constraint* $K*max$ equals zero and thus always binds. However, in case of a young median voter the individually optimal level of capital exports, K^{*opt}, is not necessarily higher than the policy-induced level K^{*max} since in the interval $M < M^{crit}$ the former is a decreasing and the latter an increasing function of migration. However, we make the assumption that at the critical migration level M^{crit}, the young-median-voter's *non-expropriation constraint* binds, i.e. $K^{*max}(M^{crit}) < K^{*opt}(M^{crit})$. Then the *non-expropriation constraint* also binds for $M < M^{crit}$. Our equilibrium is thus characterized by the two equations (4) and (7).

Equilibrium

In a benchmark situation without political constraints, production would only take place in the country with the higher TFP, which is the industrialized country. Investors take into account that migration reacts to the capital allocation to equalize wages in both countries. Returns on capital are maximized if no FDI takes place, as then the entire workforce of the developing

country emigrates to the industrialized country. This rather extreme outcome is due to the fact that we have not assumed any costs of migrating. In the presence of migration costs, different combinations of migration and FDI are possible, contingent on the relationship of TFP differences and migration costs.

Conversely, our political economy model can be summarized as a game between the industrialized country's investors and the industrialized country's government, subject to the *non-expropriation constraint*. $K^{*max}(M)$ is the investors' best response to the government's choice of immigration M. Hence, in equilibrium (K^*, M) combinations are located on the *non-expropriation constraint* where expropriation does not occur. Given no expropriation, the government's best response to any choice of FDI is given by the *immigration policy constraint* $M^{max}|_{K^*}$. The intersection of best responses then determines a Nash equilibrium. As we show below an additional equilibrium – not given by the intersection of these two policy functions – may exist with $M < M^{crit}$. Figure 2 shows the two policy equations and the equations for individually optimal migration and FDI in the absence of political constraints for $\alpha = 0.35$, $A = 1$, $A^* = 0.6$, $\theta = 0.75$, $N^y = 0.44$, $N^{y*} = 0.57$ and $d = 0.18$.

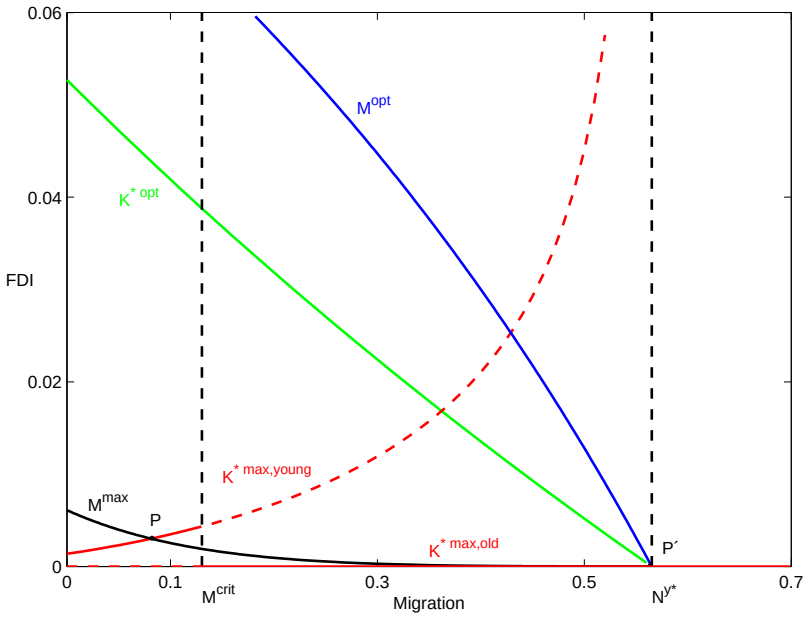


Figure 2: Migration and FDI in Equilibrium

In choosing our benchmark parameters we adhere to common assumptions in the literature. According to Börsch-Supan et al. (2003), the production share of capital is usually set between 0.3 and 0.4, so our benchmark is $\alpha = 0.35$. We normalize TFP in the industrialized country A to 1, since what matters for our analysis is the relative size of A, $\tilde{A}$ and A^*. According to Dreher et al. (2007), developing countries' average TFP relative to the US is 0.53 if only official output is considered and 0.84 if the shadow economy is also taken into account. We set the developing country's TFP to $A^* = 0.6$ and the industrialized country's investors' TFP in the developing country to the intermediate value $\tilde{A} = 0.8$, which yields $\theta = 0.75$. In order to determine the relative sizes of the young and old generations, we look at the United Nations' Population Division's statistics on children per woman.[9] For the period of 2000-2005, total fertility in the world's more developed regions was about 1.6, while it was 2.6 for the world's less developed regions excluding the least developed regions. With the total population normalized to one in both countries, the resulting sizes of the young generations are $N^y = 0.44$ and $N^{y*} = 0.57$. We choose the level of the capital stock per investor to be $\bar{k} = 0.16$, implying an autarky capital intensity of about 0.2 in the industrialized country. The disutility parameter d is, of course, rather arbitrary since we have not explicitly modeled immigration-related costs. We define a critical immigration cost d^{crit}, which solves the *immigration policy constraint* (7) for $M = M^{crit}$ and $K^* = K^{*max}(M^{crit})$. Given that all other parameters are set to their benchmark values, $d^{crit} = 0.14$.

For $d > d^{crit}$, figure 2 illustrates two equilibria, an old-median-voter equilibrium labeled P and a young-median-voter equilibrium labeled P'. If both equilibria exist, we have to compare the industrialized country's old's indirect utility in order to determine which equilibrium is more plausible.[10] Proposition 1 states the conditions for the existence of these two equilibria.

Proposition 1 *Given that $d \geq d^{crit}$, a young-median-voter equilibrium exists, as $dK^{*max}/dM > 0$. It is located at the intersection of $K^{*max}|_{M \leq M^{crit}}$ and M^{max}. Additionally, there is an old-median-voter equilibrium at $(K^* = 0, M^{max}|_{K^*=0})$ if $M^{max}|_{K^*=0} > M^{crit}$.*[11]

Proof: Recall that the policy functions always determine the equilibrium. Since with $d \geq d^{crit}$, the developing country's young median voter's *non-expropriation constraint* and the *immigration policy constraint* intersect at

[9] UNPD (2006)

[10] Although both equilibria may be realized, the one which generates higher utility for both players can be seen as a focal point.

[11] This is fulfilled for sufficiently small d, i.e. $d < \frac{(1-\alpha)\alpha A \bar{k}^\alpha}{(2N^{y*}+N^y-1)^\alpha \cdot (1-N^y)^{1-\alpha}}$

$M \leq M^{crit}$, this is the young-median-voter equilibrium. It is unique if $M^{max}(K^* = 0) \leq M^{crit}$. Then, the industrialized country never admits more than M^{crit} migrants and the median voter's identity in the developing country never changes. Conversely, if $M^{max}(K^* = 0) > M^{crit}$, the intersection point of the *immigration policy constraint* with the old median voter's *non-expropriation constraint*, $(K^* = 0, M^{max}|_{K^*=0})$, is also an equilibrium.

Note that if migration does not cause any cost ($d = 0$), the industrialized country's median voter would like to admit an infinite number of immigrants. Nevertheless, N^{y*} is the upper bound for immigration. We find that the industrialized country's old always prefer the young-median-voter equilibrium, labeled P' in figure 2. Starting from any point on the *immigration policy constraint*, utility decreases as we move marginally along the curve, increasing migration and decreasing FDI: the resulting utility change is approximately given by

$$dU^o = \frac{\partial U^o}{\partial M} dM + \frac{\partial U^o}{\partial K^*} dK^* \qquad < 0 \ ,$$

where $dM > 0$ and $dK^* < 0$ (see figure 2). Using the envelope theorem, $\partial U^o / \partial M = 0$, while $\partial U^o / \partial K^* > 0$ since $r^* > r$. Along M^{max} points with more FDI and less migration are thus clearly preferred. If the industrialized country's inhabitants are sufficiently averse to immigration, the majority in the developing country is never reversed by labor flows. However, it is not possible to exclude an old-median-voter equilibrium theoretically. For the sake of completeness, we briefly discuss the case where $d < d^{crit}$. For any $d < d^{crit}$, the *immigration policy constraint* and the *non-expropriation constraint* intersect at some migration level larger than M^{crit}. Figure 3 shows the case $d < d^{crit}$ (for $d = 0.12$).

Proposition 2 *Given that $d < d^{crit}$, an old-median-voter equilibrium exists. Additionally, there may be a young-median-voter equilibrium which is characterized by $(M^{crit}, K^{*max}(M^{crit}))$.*

Proof: As argued in the proof of proposition 1, $(M^{max}|_{K^*=0}, K^* = 0)$ is the only possible equilibrium if migration exceeds its critical level. We cannot theoretically exclude the existence of an additional equilibrium for migration lower or equal to its critical level. Given $M \leq M^{crit}$ investors prefer a level of FDI lower or equal to K^{*max} as otherwise expropriation occurs. Within this area of possible equilibria, the highest utility is clearly achieved at $(M^{crit}, K^{*max}(M^{crit}))$, the point closest to utility maximizing K^{*opt} and M^{max}. While the investors would like to export more, the median voter favors admitting more immigrants. However, increasing FDI and admitting

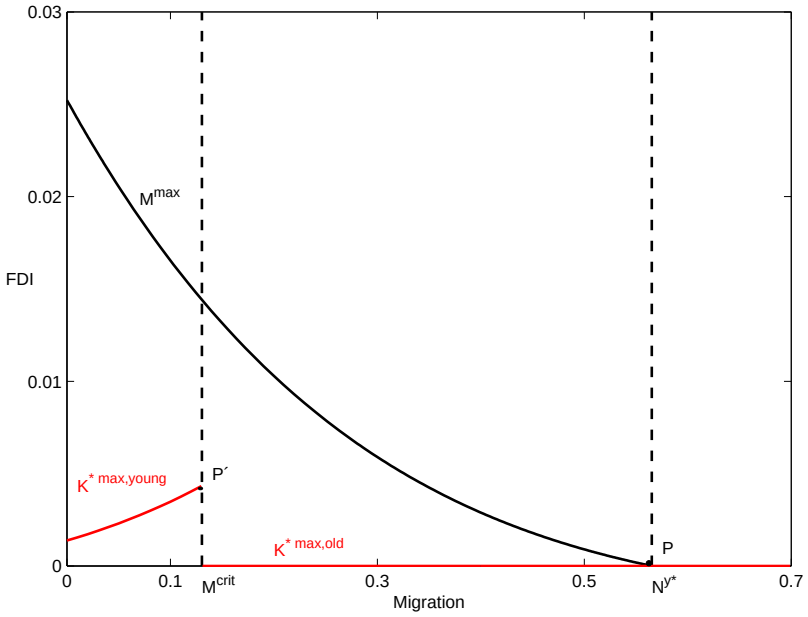


Figure 3: Equilibrium for $d < d^{crit}$

more immigrants would both lead to expropriation. In summary, neither the investors nor the industrialized country's median voter have an incentive to deviate from point $(M^{crit}, K^{*max}(M^{crit}))$.

We cannot rank these two equilibria without further restricting the model parameters: if $M > M^{crit}$ the old generation in the industrialized country benefits from the high return to capital at home. However, investors forgo proceeds in the developing country. If this opportunity cost is high (due to a high K^{*max})) and the difference between $M^{max}|_{K^*=0}$ and M^{crit} is low, the young-median-voter equilibrium is preferred to the old-median-voter equilibrium.

5 Comparative Statics

We now come to the effects of marginal changes in the model parameters on the young-median-voter equilibrium. Changes in the *immigration policy constraint* also apply to the old-median-voter equilibrium, while the old median voter's *non-expropriation constraint* always restricts FDI to zero. In the

absence of political mobility constraints, larger demographic diversity would clearly boost both capital and labor movements. Now, the level of factor flows is determined by policy.

A larger share of the old generation in the industrialized country's population implies a larger capital stock $\bar{k}N^o$. As N^o does not have any impact on expropriation preferences, FDI would only increase if migration rose. However, a larger share of old does not unambiguously boost migration. On the one hand, with an exogenous capital endowment per investor $\bar{k}$ and given FDI $K^* = K^{*max}$, the share of $\bar{k}$ invested at home must increase. Investors consequently place a higher weight on domestic capital returns, preferring higher migration. On the other hand, the impact of immigration on domestic capital returns is also altered. This change in the derivative is given by

$$\frac{\partial^2 r}{\partial M \partial N^o} = \frac{1-\alpha}{(N^y+M)^2} r + \frac{1-\alpha}{N^y+M}\frac{\partial r}{\partial N^o}$$

$$\text{with} \qquad \frac{\partial r}{\partial N^o} = -\frac{1-\alpha}{N^y+M} r \left[1 + \frac{\bar{k}(N^y+M)}{\bar{k}N^o - K^*}\right] \qquad < 0 \, .$$

Intuitively, the marginal effect of migration on the capital return in the industrialized country may be weakened by a larger share of old because the capital return itself is lowered not only by a decrease in the labor force but also by an increase in the capital stock. In summary, it is possible that a higher fraction of old in the industrialized country implies higher migration and thereby higher FDI, but this must not be the case. Using, again, the implicit function theorem, the derivative of M^{max} with respect to N^o can be shown to be

$$\frac{dM^{max}}{dN^o} = \frac{\frac{k^*}{N^o}\left[\frac{r}{N^y+M} + \frac{r^*}{N^{y*}-M}\right] + k\frac{1-\alpha}{N^y+M}\left[\frac{r}{N^y+M} + \frac{\partial r}{\partial N^o}\right]}{k\frac{\alpha}{N^y+M}\frac{r}{N^y+M} + k^*\frac{\alpha}{N^{y*}-M}\frac{r^*}{N^{y*}-M}} \, .$$

For our benchmark parameter values, a marginal increase in N^o would reduce factor flows. However, a substantial increase of the share of the old generation to 0.71 would enhance them, see figure 4(a). Nevertheless, factor flows are still restrained by policy.

Demographic diversity may also be caused by a high share of the young generation in the developing country. A larger N^{y*} affects the wage and return effects of FDI in the same way as lower emigration since both are equivalent to a larger labor force L^*. Wages decrease while capital returns increase, making expropriation more worthwhile for a given level of migration:

$$\frac{\partial K^{*max}}{\partial N^{y*}} = -\alpha A^* \left(\frac{K^{*max}}{N^{y*}-M}\right)^{\alpha} \left[1 + \frac{1-\theta}{\theta}\frac{1-M}{N^{y*}-M}\right] \qquad < 0 \, .$$

Conversely, the direct effect of a larger L^* on immigration policy is unambiguously positive. While the international allocation of capital is unaffected, a larger labor force in the developing country reduces the negative marginal effect of emigration on the capital return there. The derivative is

$$\frac{\partial M^{max}}{\partial N^{y*}} = \frac{k^* \frac{\alpha(1-\alpha)}{N^{y*}-M} \frac{r^*}{N^{y*}-M}}{k \frac{\alpha}{N^y+M} \frac{r}{N^y+M} + k^* \frac{\alpha}{N^{y*}-M} \frac{r^*}{N^{y*}-M}} \quad > 0 \; .$$

Note that expropriation preferences in the developing country are weaker the more young workers emigrate, counteracting the direct negative effect of N^{y*} on FDI. On the contrary, the indirect effect on migration via lower FDI reinforces the direct effect. We can compute the total effects from

$$\begin{aligned} \frac{dM^{max}}{dN^{y*}} &= \frac{\partial M^{max}}{\partial N^{y*}} + \frac{dM^{max}}{dK^*} \cdot \frac{\partial K^{*max}}{\partial N^{y*}} \quad > 0 \qquad \text{and} \\ \frac{dK^{*max}}{dN^{y*}} &= \frac{\partial K^{*max}}{\partial N^{y*}} + \frac{dK^{*max}}{dM^{max}} \cdot \frac{\partial M^{max}}{\partial N^{y*}} \quad < 0 \; , \end{aligned}$$

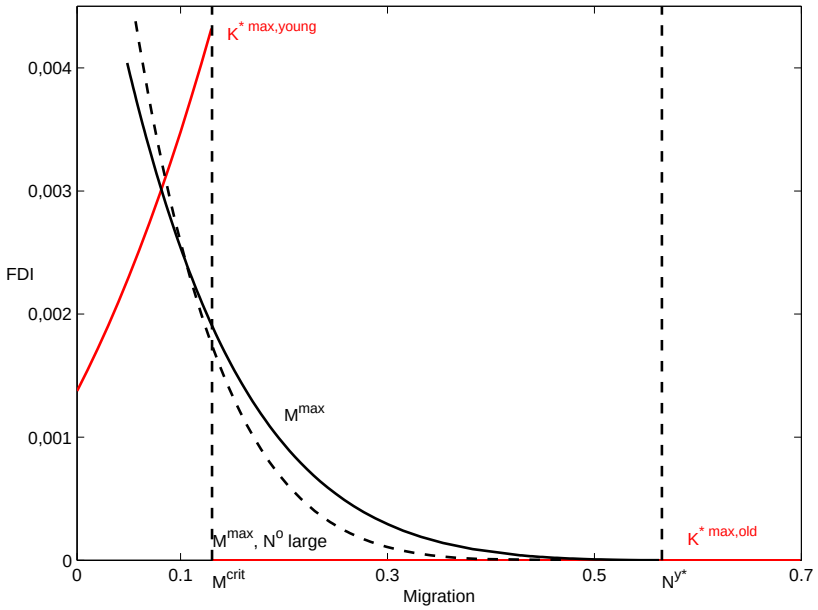
using (5) and (10). While the total effect of a larger N^{y*} on migration is obviously positive, the direct negative effect on FDI can easily be shown to dominate the positive migration-induced indirect effect, yielding a lower non-expropriation compatible level of FDI, see figure 4(b), where the new share of the young generation is set to 0.62.

Demographic structures do not only differ between industrialized and developing regions but also within seemingly homogeneous groups of countries. We have argued that the extent of international demographic diversity has no univocally enhancing effect on factor flows in a situation with politically induced mobility barriers. Analogously, there is a wide technological spread within less developed regions. Hence, we now investigate how factor movements are determined by the extent of technological diversity or of differences in productivity. In the absence of mobility constraints a developing country would attract more FDI and also more labor the higher TFP $\tilde{A}$. While we use TFP in the industrialized country as a numeraire, the investors' productivity in the developing country $\tilde{A}$ is determined by the initial conditions in the developing country A^* as well as by investors' capacity to cope with these conditions θ, as we pointed out in section 3.

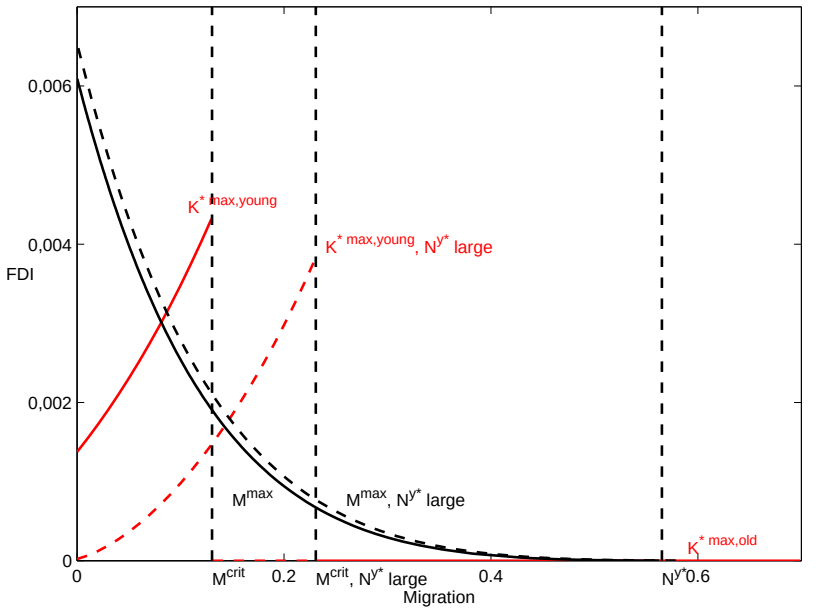
The *non-expropriation constraint* is relaxed as the developing country becomes more productive:

$$\frac{dK^{*max}}{dA^*} = \frac{1}{1-\alpha} \frac{1}{A^*} K^{*max} \quad > 0 \; .$$

The wage and return effect of FDI both increase by the same factor. Since the capital stock effect of FDI is not affected by A^*, the costs of expropriation



(a) Effects of a larger N^o



(b) Effects of a larger N^{y*}

Figure 4: Effects of N^o and N^{y*}

increase by more than the benefits. Recall that the wage effect is larger than the return effect for any positive level of K^{*max}. The relaxation of the *non-expropriation constraint* hinges on the wage loss increasing with A^*, which holds because the productivity gap $\tilde{A} - A^* = [(1-\theta)/\theta]\, A^*$ increases with A^*. However, the direct effect on migration is negative:

$$\frac{\partial M^{max}}{\partial A^*} = -\frac{k^* \frac{\alpha}{A^*} \frac{1-\alpha}{N^{y*}-M} r^*}{k \frac{\alpha}{N^y+M} \frac{r}{N^y+M} + k^* \frac{\alpha}{N^{y*}-M} \frac{r^*}{N^{y*}-M}} \quad < 0 \; .$$

The marginal effect of migration on the capital return in the developing country is enhanced by a larger A^* because the capital return itself is higher. The indirect effect on migration via FDI is also negative, such that migration unambiguously declines. On the contrary, the positive direct effect on FDI is counteracted by declining migration. As a result the sign of the effect of A^* on K^{*max} is actually ambiguous. The total effects are given by:

$$\begin{aligned} \frac{dM^{max}}{dA^*} &= \frac{\partial M^{max}}{\partial A^*} + \frac{dM^{max}}{dK^*} \cdot \frac{\partial K^{*max}}{\partial A^*} \quad &< 0 \qquad \text{and} \\ \frac{dK^{*max}}{dA^*} &= \frac{\partial K^{*max}}{\partial A^*} + \frac{dK^{*max}}{dM^{max}} \cdot \frac{\partial M^{max}}{\partial A^*} \quad &\lessgtr 0 \; . \end{aligned}$$

For our benchmark parameter values an increase of A^* leads to reduced FDI flows. Our model thus replicates a result from the empirical literature on the determinants of expropriation: the effect of a country's gross domestic product on expropriation risk is curvilinear, see Jodice (1980) and Li (2009) among others. Expropriation rarely occurs in rich developed countries, which use more subtle ways of appropriation foreign returns. Meanwhile, the least developed countries lack the technological know-how necessary to compensate the productivity and wage increments FDI involves.

A low θ implies a large difference between $\tilde{A}$ and A^*. If θ increases, $\tilde{A}$ converges to A^* and less FDI is feasible: the wage income absent expropriation decreases, while seized capital returns and wage earnings in case of expropriation do not change. An increment in θ thus attenuates the wage effect but leaves the return effect unchanged. Expropriation is less costly since the productivity gap $\tilde{A} - A^* = [(1-\theta)/\theta]\, A^*$ is smaller. The derivative of K^{*max} with respect to θ is given by

$$\frac{\partial K^{*max}}{\partial \theta} = -\frac{1-M}{(\theta)^2} \left(\frac{K^{*max}}{N^{y*}-M} \right)^{\alpha} \quad < 0 \; .$$

While investments in the developing country become less secure if θ increases, this only holds for a given level of migration. However, since $\tilde{A}$ decreases

with θ, the marginal capital return loss from developing-country emigration is reduced. Consequently, there is a positive direct effect of θ on migration:

$$\frac{\partial M^{max}}{\partial \theta} = \frac{k^* \frac{1}{\theta} \frac{1-\alpha}{N^{y*}-M} r^*}{k \frac{\alpha}{N^y+M} \frac{r}{N^y+M} + k^* \frac{\alpha}{N^{y*}-M} \frac{r^*}{N^{y*}-M}} \quad > 0 \ .$$

This positive effect on migration counteracts the increased risk of expropriation. Thus, while the total effect on migration is unambiguously positive, the non-expropriation compatible level of FDI may increase or decrease:

$$\begin{aligned} \frac{dM^{max}}{d\theta} &= \frac{\partial M^{max}}{\partial \theta} + \frac{dM^{max}}{dK^*} \cdot \frac{\partial K^{*max}}{\partial \theta} \quad > 0 \qquad \text{and} \\ \frac{dK^{*max}}{d\theta} &= \frac{\partial K^{*max}}{\partial \theta} + \frac{dK^{*max}}{dM^{max}} \cdot \frac{\partial M^{max}}{\partial \theta} \quad \lessgtr 0 \ . \end{aligned}$$

Using again simulations based on our benchmark parameter values we find that increasing θ leads to a reduction of FDI.

The political economy of factor movements is not only determined by the model parameters A^* and θ but by d as well. The parameter d raises the cost of immigration the respective median voter bears. Naturally, the higher individuals' disutility from integrating immigrants, the more restrictive is immigration policy.A policy which lowers this immigration related disutility would not only spur the integration of immigrants but also protect industrialized countries' FDI flows. Remember that this only holds as long as the young are in the majority in the developing country.

6 Extension: Equilibrium Policy in a Sequential Setting

We now investigate the sensitivity of the model results to the timing of the capital allocation and migration policy decisions. As we argued above, it is quite plausible to assume that the implementation of migration policy decisions takes longer than the allocation of capital. Therefore, we now elaborate on the young-median-voter equilibrium with the immigration policy decision taking place before the capital allocation decision. The old-median-voter equilibrium is not contingent on the timing of decisions. Since a migration level above M^{crit} always corresponds to zero FDI, the optimal immigration level is still given by equation (9).

In this setting, the government in the industrialized country anticipates how investors react to the immigration policy decision, given by $K^* = \min\{K^{*opt}(M), K^{*max}(M)\}$, still assuming that capital is administered by a

mutual fund. Recall that we made the assumption that at the critical immigration level M^{crit}, and thus for all levels of migration, the *non-expropriation constraint* binds. Consequently, the median voter's decision problem can be written as

$$\begin{aligned}
&\underset{M}{\text{Max}} \quad \frac{\bar{k}N^o - K^{*max}(M)}{N^o}(1+r) + \frac{K^{*max}(M)}{N^o}(1+r^*) - d \cdot M \ , \\
&\text{where} \quad r = \alpha A \left(\frac{\bar{k}N^o - K^{*max}(M)}{N^y + M} \right)^{\alpha - 1} \quad \text{and} \\
&r^* = \alpha \cdot \frac{1}{\theta} A^* \left(\frac{K^{*max}(M)}{N^{y*} - M} \right)^{\alpha - 1} \ .
\end{aligned}$$

The first-order condition for a maximum reduces to

$$\frac{\alpha}{N^o} \left[(r^* - r) \frac{\partial K^{*max}}{\partial M} + (w - w^*) \right] = d \ . \tag{12}$$

Comparing equation (12) to equation (8), it is easy to verify that migration is now higher given that $r^* > r$. The difference is that the median voter can now loosen the *non-expropriation constraint* by choosing a higher level of migration. The industrialized country's old favor increasing FDI if $r^* > r$, implying that FDI is restricted by the *non-expropriation constraint*. In summary, this sequence of decisions results in higher levels of both migration and FDI.

7 Conclusion

This contribution has explicitly accounted for endogenous policies determined by immigration and expropriation preferences. The novel feature of our approach is the modeling of the interplay of policies in limiting factor flows. We have set up a one-period model of two countries with heterogeneous agents, young and old. Accounting for demographic diversity, we have assumed an old median voter in the industrialized country but a young median voter in the developing country.

In equilibrium, factor flows are politically restricted, leaving room for efficiency gains from removing mobility barriers. For instance, if the immigration-related disutility that natives incur can be lowered, both migration and FDI increase. This clearly enhances efficiency. This result is subject to one caveat, as there is the possibility that emigration changes the median voter's identity in the developing country. Then FDI drops to zero, as the expropriation of foreign capital is certain. We therefore conclude that even though migration

protects an aging country's stock of FDI, the aging country does not benefit from completely depriving host countries of their labor force.

While larger demographic diversity would boost factor flows in the absence of mobility constraints, it has an ambiguous effect in our setting. A large share of the old generation in the industrialized country implies that a large share of capital has to be invested at home. Capital returns achieved at home thus receive a higher weight, enhancing immigration preferences. However, it is possible that the positive effect of migration on these capital returns is now weaker. If migration does increase, this also has an indirect positive effect on FDI. A large share of the young generation in the developing country has an unambiguously negative effect on FDI and an unambiguously positive effect on migration. It is equivalent to a large labor force, implying low wages, and low wage losses in case of expropriation, and high capital returns to be distributed in case of expropriation. The positive effect on migration stems from the fact that high capital returns also lead to a reduced negative marginal effect of emigration. Enhanced migration attenuates the negative effect on FDI.

The model may further be extended in various directions. First, we could allow for economic mobility barriers. If moving is costly for the migrants, our results do not change, unless the (political) demand for migrants would exceed individually optimal migration. Second, a wider range of elasticities could be allowed for in production. With weaker factor price effects, factor flows would be further restricted, and migration might not ease expropriation risk. Third, since in industrialized countries much of the debate concerning migration and capital investment is related to the sustainability of pension systems, it would be promising to introduce a pension system to the model.

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