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► **To cite this version:**

| Milo Bianchi. Immigration Policy and Self-Selecting Migrants. 2012. halshs-00670037

HAL Id: halshs-00670037

<https://shs.hal.science/halshs-00670037>

Preprint submitted on 14 Feb 2012

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Immigration Policy and Self-Selecting Migrants*

Milo Bianchi[†]

April 2011

Forthcoming in the *Journal of Public Economic Theory*

Abstract

We build a simple model of self-selection into migration and immigration policy determination. We first show that the effect of any immigration policy can be decomposed into a size and a composition effect. We then explore how the optimal policy may change once the latter effect is considered.

Keywords: Immigrant self-selection; immigration policy.

JEL codes: F22, J61, O24.

*Thanks to two anonymous Referees and to Abhijit Banerjee, Jess Benhabib, Guido Friebel, Sergei Izmailov, Anna Maria Mayda, Sten Nyberg, Elena Paltseva, Jörgen Weibull for helpful comments. Thanks to Région Ile-de-France for financial support.

[†]Université Paris Dauphine - Place de Lattre de Tassigny - 75016 - Paris (France).
E-mail: milo.bianchi@dauphine.fr

1 Introduction

It is commonly understood that several effects of immigration in receiving countries depend crucially on immigrants' characteristics.¹ At the same time, the relation between immigration policy and immigrants' skill composition remains largely unexplored. In the economics literature as in policy debates, the demand and supply sides of immigration tend to be considered separately.²

As a first step towards filling this gap, we develop a simple model in which both immigration policy and immigrants' skill composition are determined in equilibrium. Whether an individual with a given skill decides to migrate depends on the immigration policy implemented and at the same time that policy depends on whether high or low skilled individuals are more likely to migrate. We are interested in exploring how the optimal immigration policy changes once it is taken into account that any such policy affects immigrants' skill composition.

It is important to look at both the supply and demand sides in a unified framework because of a well known fact. Migrants are not a random sample of their home country population. Incentives to migrate and resources to pay the migration costs vary with skills. Given immigrants' self-selection, any immigration policy affects not only the size but also the skill composition of the migration flow. Since self-selection determines how different potential migrants respond to a policy change, understanding what drives such selection becomes crucial for optimal policy design.

We develop this argument in a setting with two countries. In the sending country, individuals, called foreigners, are endowed with different skills and wealth, and depending on their endowment they decide whether to work at home or migrate to the receiving country. In the receiving country, individuals, called natives, support an immigration policy that maximizes their equilibrium wages. In particular, high skilled natives aim at increasing the supply of low skilled immigrants, while low skilled natives push for increasing the supply of high skilled immigrants. According to these preferences and to the weight attached to different groups in the population, i.e. low vs. high skilled and immigrants vs. natives, the receiving country government sets the immigration restrictions.

In our main analysis, we focus on immigration restrictions which affect the cost migrants have to pay to enter and work in the receiving country, such as direct fees or bureaucratic requirements that increase the time and money needed to comply. These restrictions are assumed to be the same

¹Confining attention to the economics literature, see Borjas (1994), Friedberg and Hunt (1995), Chiswick, Lee and Miller (2005) on the labor market effects, and Storesletten (2000), Lee and Miller (2000), Chojnicki, Docquier and Ragot (2011) on the effects on public finance.

²Some notable exceptions are mentioned below.

for all immigrants. This allows us to emphasize that even in this case the policy affect immigrants in different ways, thereby determining their self-selection.³ In fact, on the one hand, the restrictions imply that only the richest foreigners can migrate, and these tend to be the high skilled. On the other, the restrictions induce only those with the most to gain to migrate. If returns to skills are higher in the sending country, these migrants tend to be the low skilled. Hence, depending on whether immigration is driven by incentives or wealth constraints, and on whether returns to skills are higher in the sending or in the destination country, restrictions may improve or worsen immigrants' skill composition.

We then decompose the effect of immigration policy in the receiving country as an effect on the size and an effect on the composition of the migration flow. We show that these effects typically work in opposing directions: the size effect, whereby the number of immigrants is varied, while keeping their skill composition fixed, hits hardest those foreigners with a higher propensity to migrate; conversely, the composition effect tends to be stronger on those who migrate less. Moreover, the composition effect may dominate the size effect, especially at lower levels of restrictions: those foreigners with the lowest propensity to migrate may be, in absolute terms, the most sensitive to a policy change. Hence, the composition effect may *reverse* the immigration policy outcomes as predicted by the size effect alone.

We illustrate some implications of this result by considering the optimal policy design by a utilitarian government maximizing natives' total income. In this setting, if immigrants' skill composition was exogenous, the government would not restrict immigration. Open immigration would maximize the benefits arising from skill complementarities between natives and immigrants. However, the fact that restrictions influence immigrants' skills implies that even this utilitarian government may optimally implement positive immigration restrictions. The reason is that restrictions help in inducing the optimal skill mix of immigrants. This observation may provide a rationale for positive immigration restrictions even absent any redistributive concerns or political economy distortions. As we show, what is needed is that immigrants receive a lower weight than natives in the government's welfare function.

We also sketch some implications of our results for the political economy of immigration, and in particular for the determination of natives' preferences concerning immigration policy. The composition effect implies that such preferences may not be fully defined in terms of current immigrants' skill composition. For example, some natives may support a more restrictive policy even though current immigrants are not detrimental to them, since

³Moreover, as we discuss in Section 4, this framework appears useful for analyzing other policy instruments, like quotas, as well as the possibility for the receiving country to impose different immigration restrictions on different types of migrants.

tighter restrictions would change immigrants' skill composition in their favor.

The present paper builds on two broad streams of literature. On the supply side of migration, we model the migration decision as a basic human capital investment (Sjaastad, 1962), in which self-selection may be driven both by cross-country returns to skills (as in Borjas, 1987) and by wealth constraints (as in Lopez and Schiff, 1998, Chiquiar and Hanson, 2005, and Friebel and Guriev, 2006). Unlike most of this literature, the emphasis is in how immigration policies may affect immigrants' self-selection.

Second, we contribute to the literature on the determination of immigration policies.⁴ Apart for stressing the interaction with the supply side, our approach is novel in that we consider migration cost as the policy variable.⁵ This variable seems important as any restriction to immigration entails, at least indirectly, monetary costs. Moreover, the exercise appears useful even if one considers our policy variable literally as a tax on immigrants. Such a tax has recently received attention in policy debates (see Freeman, 2006 and Legrain, 2007), but its effects have received little attention in formal models.⁶

As stressed, the interaction between demand and supply appears under-emphasized in this literature. Two notable exceptions are Bellettini and Ceroni (2007) and Giordani and Ruta (2008). While similar in spirit, both their modeling approaches and their results are different. Bellettini and Ceroni (2007) assume that immigrants are positively self-selected and argue in favor of a high immigration quota: by reducing wages in the receiving country, this would increase immigrant quality and maximize national income. Giordani and Ruta (2008) focus instead on how immigration prejudices can be self-fulfilling: restrictive policies tend to attract low skilled immigrants and these immigrants are a drain on welfare in the receiving country, which in turn sustains anti-immigration attitudes.

The rest of the paper is organized as follows. Section 2 presents the basic model; Section 3 derives the main results. In Section 4, we discuss the robustness of our results to alternative assumptions and propose some avenues for extensions. Section 5 concludes by suggesting some policy implications. Omitted proofs are provided in the Appendix.

⁴See for example Benhabib (1996), who explores how the median voter determines minimal capital requirements for admission and Epstein and Nitzan (2006) and Facchini and Willman (2005), who use a lobbying model to explain the formation of immigration quotas.

⁵See Myers and Papageorgiou (2002) for a comparison of different immigration policies when the sending and receiving countries have homogeneous populations.

⁶From an historical viewpoint, it is also interesting to notice that the first interventions to limit and select immigration flows in the U.S. and Canada acted on costs rather than on quantities (see Timmer and Williamson, 1998 for a detailed account).

2 The model

Consider a world with two countries, a sending and a receiving country. We are interested in the interaction between workers in the sending country, who may decide to migrate, and the receiving country's government, which sets the immigration policy.

2.1 The sending country

The sending country is populated by a continuum n^* of workers, called foreigners. Foreigners are heterogeneous in three respects: skill, migration cost, and initial wealth. Let n_θ^* denote the mass of foreigners with skill θ , where $\theta \in \{H, L\}$.⁷ A foreigner i with skill θ may migrate to the receiving country and earn the endogenous wage w_θ , or he can work in the sending country for an exogenous wage w_θ^* .⁸

If he migrates, each foreigner has to incur a monetary cost γ . This cost has to be paid up-front, and no borrowing is possible, so migration may be limited by wealth constraints. Specifically, foreigners are endowed with some wealth, drawn by a distribution Ω_θ with continuous density ω_θ . When θ is interpreted as an observable skill (like education), it is assumed that the high skilled tend to be wealthier than the low skilled (see Filmer and Pritchett, 1999; and Piketty, 2000).⁹ Formally, this writes

$$\frac{\omega_L}{1 - \Omega_L} \geq \frac{\omega_H}{1 - \Omega_H}, \quad (1)$$

for every $\gamma \in \mathbb{R}_+$.¹⁰ In addition, the migration cost includes an individual-specific psychological cost ε_i , which may reflect individual characteristics like age, family ties, access to networks in the origin and destination country.¹¹

⁷A recent literature emphasizes that the acquisition of skills in the sending country may be affected by immigration policy (e.g. Mountford, 1997; Stark, Helmenstein and Prskawetz, 1997; Vidal, 1998; Beine, Docquier and Rapoport, 2001), and that would provide an additional reason to consider the effect of immigration policy on immigrants' skills. We here take the sending country skill composition as exogenous in order to emphasize that immigration policy induces a composition effect (described in Section 3.3) even for a given pool of foreigners.

⁸While wages in origin countries may be affected by emigration (see Hanson, 2005 and Mishra, 2007), we focus here on the effects in the receiving country.

⁹We notice in Section 3.3.1 how this framework can be applied to selection on unobservable characteristics.

¹⁰Equation (1) assumes conditional stochastic dominance, which is slightly stronger than first order stochastic dominance and weaker than the standard assumption of monotone likelihood ratio (see Krishna, 2002).

¹¹In our formulation, these elements are not systematically correlated with the skill θ . One may instead assume that the low-skilled have higher migration costs, since for example they can hardly give up the support of their community in terms of access to credit (as in Banerjee and Newman, 1998 and Munshi and Rosenzweig, 2009) or unemployment insurance (as in Cuecuecha, 2005). This would be qualitatively similar to our framework, in which wealth constraints are more likely to be binding for the low-skilled.

Specifically, ε_i is assumed to be a random variable following a log-concave cumulative distribution Π with continuous density π .¹² This assumption implies that the ratio

$$\frac{\pi}{\Pi} \text{ is decreasing.} \quad (2)$$

2.2 The receiving country

The receiving country is populated by a continuum n of workers, here called natives, who are heterogeneous in skill $\theta \in \{H, L\}$.¹³ Natives are assumed to have a linear utility function which depends only on equilibrium wages w_θ .¹⁴ These wages are determined in a competitive labor market as

$$w_\theta = \frac{\partial F(N_H, N_L)}{\partial N_\theta}, \quad (3)$$

where $F(N_H, N_L)$ is the receiving country production function and N_θ is the sum of natives and immigrants with skill θ

$$N_\theta = n_\theta + x_\theta. \quad (4)$$

We focus on purely redistributive effects of immigration, whereby immigrants compete with similarly skilled natives and complement natives with different skills. In particular, we simply let the production technology be a constant returns to scale Cobb-Douglas function

$$F(N_H, N_L) = N_H^\alpha N_L^{1-\alpha}, \quad (5)$$

where $\alpha \in (0, 1)$. The receiving country government is interested in regulating the inflows of immigrants as these influence natives' utility. Its goal is to maximize the welfare function

$$W = \mu_H w_H + \mu_L w_L, \quad (6)$$

where μ_θ denotes the weight attached to group θ 's utility. We will mostly consider a utilitarian function with $\mu_\theta = n_\theta$.¹⁵ Immigration policy acts on γ , which is the cost foreigners have to incur to enter and work in the receiving country. This policy is common to all immigrants. As mentioned in the Introduction, and further discussed in Section 4.1, we want to emphasize that even such a policy affects their self-selection. Hence, we write the government's program as

$$\max_{\gamma \in \mathbb{R}_+} \mu_H w_H(\gamma) + \mu_L w_L(\gamma). \quad (7)$$

¹²Log-concavity is satisfied by basically all "named" distribution functions (see Bagnoli and Bergstrom, 2005).

¹³While one may model the interaction between immigration policy and human capital formation in the receiving country, we wish here to make our point in the simplest setting and so take the receiving country skill distribution as given.

¹⁴We discuss more general formulations in Section 4.3.

¹⁵Some extensions and possible ways to endogenize these weights are discussed in Section 4.2.

3 Analysis

We now show that, in order to set the optimal policy, the receiving country government has to predict the effects of such policy on immigrants' skill composition. This in turn requires an understanding of the forces driving the decision to migrate.

3.1 The migration decision

A foreigner i with skill θ prefers to migrate if $w_\theta - (\gamma + \varepsilon_i) \geq w_\theta^*$, so for each skill θ there exists a cut-off value $\varepsilon^\theta \equiv w_\theta - w_\theta^* - \gamma$ such that any individual with skill θ and a cost ε_i lower than ε^θ would like to migrate. In addition, this individual must be sufficiently wealthy to pay the migration cost γ . Thus, the supply of migrants with skill θ is defined by

$$x_\theta = q_\theta n_\theta^*, \quad (8)$$

where q_θ is the fraction of foreigners with skill θ who can afford and who are willing to move, i.e.

$$q_\theta = [1 - \Omega_\theta(\gamma)]\Pi[w_\theta - w_\theta^* - \gamma]. \quad (9)$$

We define immigrants' skill composition as the ratio of high to low skilled migrants, i.e.

$$Q = \frac{q_H}{q_L}, \quad (10)$$

and we say that immigrants are positively self-selected if and only if $Q \geq 1$.

3.2 Optimal immigration restrictions

According to equations (3) and (5), equilibrium wages in the receiving country can be written as

$$w_H = \alpha R^{\alpha-1}, \quad (11)$$

and

$$w_L = (1 - \alpha)R^\alpha, \quad (12)$$

where R is the ratio of high to low skilled workers

$$R = \frac{N_H}{N_L} = \frac{n_H + x_H}{n_L + x_L}. \quad (13)$$

Hence, the receiving country skill distribution and equilibrium wages depend on migration flows, and then on the immigration policy γ .¹⁶ We can write

¹⁶Notice that w_H is uniquely defined by equations (11) since the right hand side of (11) is continuous and decreasing in w_H . Hence, the fixed point problem always has a unique solution. Similarly, w_L and R are uniquely defined by equations (12) and (13), respectively.

the government's program in equation (7) as

$$\max_{\gamma \in \mathbb{R}_+} \mu_H \alpha R^{\alpha-1} + \mu_L (1 - \alpha) R^\alpha. \quad (14)$$

The low skilled benefit from a high R , i.e. a large inflow of high skilled immigrants, and the high skilled benefit from the opposite. Given these preferences, the optimal policy depends on the weights μ_θ . The higher μ_H , the lower the R induced by such a policy.¹⁷

For now, we ignore redistributive concerns or other political economy distortions, and consider a purely utilitarian setting in which each group is valued by its size. In this setting, no immigration restrictions are imposed if immigrants are given the same weight as natives. In fact, if

$$\mu_\theta = N_\theta, \quad (15)$$

then the welfare function W in (6) does not depend on R , i.e. on high vs. low skilled wages, but only on total production. Hence, W is maximized by setting $\gamma = 0$.

A preference for high or for low skilled workers instead arises when immigrants receive a lower weight than natives. In this case, the government sets its policy so as to benefit the group of workers with the lowest proportion of immigrants. Suppose the government cares only about natives, then

$$\mu_\theta = n_\theta, \quad (16)$$

and we have that

$$\frac{dW}{d\gamma} = (1 - \alpha) w_H \left[\frac{n_L x_H - n_H x_L}{n_H + x_H} \right] \frac{dR}{d\gamma}. \quad (17)$$

In this case, the welfare function W is convex in R and it has a minimum at $R = n_H/n_L$. Efficiency gains from immigration are minimized when immigrants have the same skill composition as the native population, i.e. when $x_H/x_L = n_H/n_L$. Since the government maximizes efficiency, i.e. natives' total income, it aims at optimizing the skill ratio R .

As a benchmark for our following analysis, suppose that immigrants' skill composition was exogenous. In that case, setting the immigration policy and achieving the optimal skill ratio would be easy. We would have

$$\frac{dW}{d\gamma} \leq 0,$$

¹⁷This logic can be applied also if one introduces capitalists into our model. Assuming that immigrants bring no capital, returns to capital in the receiving country depend on the complementarity or substitutability between capital and skilled/unskilled labor. If both skilled and unskilled labor are complementary to capital, capitalists would push for open immigration and so the optimal γ would decrease with the weights associated with capitalists' utility. If instead skilled (unskilled) labor is assumed to substitute for capital, capitalists' interests would be aligned with those of skilled (unskilled) workers.

and so imposing no immigration restriction would be optimal. We can show this in the following Proposition.

Proposition 1 *If immigrants' skill composition is taken as given, a utilitarian government imposes no immigration restrictions.*

However, as is clear from (9), immigrants' skill composition does depend on the immigration policy. Hence, solving the government's program in equation (17) requires an understanding of the forces driving the migration flows, which is the issue we now address.

3.2.1 Size and composition effects

In what follows, we provide an intuitive discussion of how R depends on the immigration policy γ ; a more formal derivation can be found in the Appendix (Section 6.2). By totally differentiating R in (13), one can show that

$$\frac{dR}{d\gamma} \geq 0 \text{ if and only if } \frac{\partial x_H}{\partial \gamma} N_L \geq \frac{\partial x_L}{\partial \gamma} N_H, \quad (18)$$

where $\partial x_\theta / \partial \gamma$ are *partial* derivatives (describing the direct effect of immigration policy on immigration flows). The relation in (18) can be decomposed in the product of two forces. If the composition of immigrants were independent of γ , that is $dQ/d\gamma = 0$, then

$$\frac{dR}{d\gamma} \geq 0 \text{ if and only if } \frac{x_H}{x_L} \leq \frac{n_H}{n_L}. \quad (19)$$

If instead $x_H/x_L = n_H/n_L$, then

$$\frac{dR}{d\gamma} \geq 0 \text{ if and only if } \frac{\partial Q}{\partial \gamma} \geq 0. \quad (20)$$

Equation (19) describes a *size effect*, i.e. what happens to the skill ratio R when one varies the number of immigrants, while keeping their skill composition fixed. According to equation (19), increasing the cost increases the ratio R if and only if immigrants are less skilled than natives. As shown in Proposition 1, open immigration would maximize total welfare if immigration restrictions had only a size effect. However, as described by equation (20), any immigration policy also changes the average skill of immigrants. This represents a *composition effect*: higher restrictions increase the skill ratio R if and only if they increase immigrants' skill composition Q . Before turning to the rest of our analysis, in which we investigate what drives such a composition effect and what its implications are for optimal policy design, we state the following Proposition.

Proposition 2 *Immigration policy affects the receiving country's skill ratio by changing the size and the composition of the migration flow, as described respectively by equations (19) and (20).*

3.3 The composition effect

Standard discussions about immigration policies ignore the composition effect. However, such disregard may be misleading: this effect may *reverse* the predictions based on the size effect alone. In fact, as we now show, there are situations in which the tension between the two effects is inescapable, since immigrants' skill composition Q increases in γ if and only if immigrants are more skilled than natives. In addition, the composition effect may be stronger than the size effect.

Self-selection is less likely to be an issue if the skill compositions of the two countries are very different. If for example the sending country has a very poor skill composition, all else being equal, a more restrictive policy is likely to have a larger impact on low skilled foreigners, thereby increasing the ratio R . This effect being clear, we now concentrate on selection issues and so consider the case in which the skill composition between the sending and the receiving country is similar.¹⁸ In particular, we let

$$n_H^* = n_H \text{ and } n_L^* = n_L. \quad (21)$$

The relation between R and γ then depends on how the policy affects the propensity of low and high skilled foreigners to migrate, i.e. on the elasticities of q_H and q_L with respect to γ . Predicting such a relation requires an understanding of the forces behind immigrants' self-selection, as we now consider.

3.3.1 The simplest case: no wealth constraints

To illustrate our argument in the cleanest way, we first ignore wealth constraints. Besides being simple, this way of modeling the migration decision emphasizes cross-country wage differentials, as in the classic self-selection literature. Moreover, this may be the most natural setting if one is interested in selection along non-observable dimensions, which need not be systematically correlated with wealth.

In this case, immigrants' self-selection is driven only by the incentives that foreigners face according to their skills, and immigrants' skill composition in equation (10) can be written simply as

$$Q = \frac{\Pi(w_H - w_H^* - \gamma)}{\Pi(w_L - w_L^* - \gamma)}. \quad (22)$$

Therefore, immigrants are positively self-selected if and only if *absolute* gains from migration increase with skills, i.e. if $(w_H - w_H^*) \geq (w_L - w_L^*)$.¹⁹ This

¹⁸Notice that even in this case, given heterogeneous migration costs ε_i , wages would not be equalized across countries and some foreigners may still prefer to migrate.

¹⁹In their empirical analysis, Grogger and Hanson (2008) emphasize the role of *absolute* vs. *relative* wage differentials in explaining self-selection patterns.

condition can be rearranged in terms of wage differentials in the sending vs. receiving country as

$$\Delta w \geq \Delta w^*, \quad (23)$$

where $\Delta w^* = w_H^* - w_L^*$ and $\Delta w = w_H - w_L$. Accordingly, when condition (23) holds, we say that returns to skills are higher in the receiving country.

Wage differentials also drive the relation between Q and immigration restrictions. In fact, simply differentiating (22), we have

$$\frac{\partial Q}{\partial \gamma} \geq 0 \iff \pi(\varepsilon^L)\Pi(\varepsilon^H) - \pi(\varepsilon^H)\Pi(\varepsilon^L) \geq 0 \iff \Delta w \geq \Delta w^*. \quad (24)$$

Equation (24) describes an *incentive effect*. From equation (2), changing costs has a relatively higher impact on the foreigners with lower gains from migration. When wage dispersion is higher in the receiving country, these foreigners tend to be low skilled. Hence, further restrictions improve immigrants' skill composition if and only if $\Delta w \geq \Delta w^*$, that is if immigrants are *more* skilled than natives. This implies a tension between size and composition effects. The reason for this is intuitive: the size effect by definition hits a group of foreigners proportionally to their propensity to migrate, while the composition effect tends to be stronger on the least represented group.

To see the effects on the receiving country, we notice that the composition effect can be stronger than the size effect. A marginal increase in the cost may decrease (increase) R despite immigrants being less (more) skilled than natives. As we show in the Appendix, this is the case if the ratio $\pi/(1 + \Pi)$ is decreasing, which in turn is more likely to happen when γ is low. As a result, the relation between the skill ratio and immigration restrictions may be non-monotone. We summarize these observations in the following Proposition.

Proposition 3 *When immigrants' self-selection is determined by incentives alone,*

- a) *Immigrants are positively self-selected if and only if $\Delta w \geq \Delta w^*$;*
- b) *Immigration restrictions increase Q if and only if $\Delta w \geq \Delta w^*$;*
- c) *Under condition (21), size and composition effects work in opposing directions;*
- d) *The relation between R and γ may be non-monotone, with the composition effect being stronger for low levels of γ .*

The fact that the composition effect may reverse the policy outcome as predicted by the size effect alone, has a number of surprising implications. First, in this setting, even a utilitarian government may impose positive

immigration restrictions. In fact, as discussed after equation (17), a government with weights $\mu_\theta = n_\theta$ aims at optimizing the skill ratio. If the relation between R and γ is non-monotone, however, this requires setting a positive γ . Restrictions here are not due to distributional concerns, or other departures from pure efficiency, but they are a way to screen immigrants by affecting their self-selection. We can then state the following Corollary.

Corollary 1 *Immigration restrictions may be optimal even for a utilitarian government that cares only about natives' total income.*

A second implication of the composition effect is that some natives may support further immigration restrictions even if immigrants are not detrimental to them. Suppose for example that immigrants are positively self-selected and they improve the receiving country's skill ratio. In this case, low skilled natives may push for a higher γ even if immigration increases their wage, since restrictions would further improve immigrants' skill composition, the receiving country's skill ratio and so low skilled wages. Hence, individual preferences over immigration policy should consider immigrants' self-selection in addition to their skill composition. We summarize this in the following Corollary.

Corollary 2 *When the composition effect prevails, some natives may support further restrictions even if immigrants are not detrimental to them.*

3.3.2 The general case: incentive and wealth effects

We now explore how the previous insights carry through in a setting where potential migrants face wealth constraints, which may also drive self-selection. For our purposes, this implies that it may not be sufficient to know whether immigrants are positively or negatively self-selected, but one needs to know also what drives self-selection. Those with the highest gain from migration, and then the highest willingness to pay for it, are not necessarily the ones with the greatest resources to pay for it.

Besides being a more general formulation of the migration decision, this setting matches better with the empirical evidence on self-selection in terms of observables. As implied by equation (1), wealth constraints are less severe for the high skilled, which pushes towards positive self-selection. As a result, immigrants may be positively self-selected even if returns to skills are higher in the source country and *physical* costs of migration are relatively small.²⁰

In this setting, we first notice that increasing immigration restrictions improves immigrant skill composition Q when

$$\frac{\pi(\varepsilon^L)\Pi(\varepsilon^H) - \pi(\varepsilon^H)\Pi(\varepsilon^L)}{\Pi(\varepsilon^H)\Pi(\varepsilon^L)} + \frac{\omega_L(1 - \Omega_H) - \omega_H(1 - \Omega_L)}{(1 - \Omega_H)(1 - \Omega_L)} \geq 0. \quad (25)$$

²⁰See for example the study of Mexican immigrants to the U.S. by Chiquiar and Hanson (2005).

The first term is the same *incentive effect* described in the previous Section. The second term represents a *wealth effect*. By equation (1), this is always positive: by increasing the cost, one gets richer and more skilled immigrants.

In this setting, size and composition effects have opposite directions whenever the relation between Q and γ is monotone, i.e. either $\Delta w \geq \Delta w^*$ or self-selection is driven only by wealth constraints or only by incentives (the reason being the same as in the previous analysis). As shown in the Appendix, in such cases, the composition effect prevails when the foreigners with the lowest propensity to migrate are, in absolute terms, the most sensitive to a policy change. In turn, this is more likely to be the case when the cost is sufficiently small; hence, as in the previous analysis, the relation between R and γ need not be monotone. We state this more formally in the following Proposition.

Proposition 4 *When immigrants' self-selection is determined both by incentives and by wealth constraints,*

- a) *Immigrants are positively self-selected if $\Delta w \geq \Delta w^*$ or wealth constraints dominate;*
- b) *Immigration restrictions increase Q if $\Delta w \geq \Delta w^*$ or the wealth effect dominates;*
- c) *Size and composition effects may work in opposing directions;*
- d) *The relation between R and γ may be non-monotone, with the composition effect being stronger for low levels of restrictions;*
- e) *Corollaries 1 and 2 still hold.*

4 Discussion and extensions

In this Section, we discuss the role of our main assumptions in the above analysis and propose some extensions of our framework.

4.1 Immigration policy

Taken literally, our model makes some important simplifications about immigration policy. We assume that restrictions affect the migration cost alone, and that they act unconditionally on skills. We now discuss how our insights would be affected by changing these assumptions.

4.1.1 Alternative policy instruments

First, immigration restrictions include several dimensions beside the monetary cost γ . Along these lines, one may view our framework as a starting point from which to complicate the policy space. For example, immigration is typically restricted via quotas. In our setting, however, changing the quota affects immigrants' self-selection in a similar way as changing the cost γ . In fact, the quota affects the probability that, upon submitting an application, a foreigner receives an entry visa. Suppose that making such an application entails a cost (either monetary or in terms of time). A foreigner applies for a visa only if the expected benefits, i.e. the wage differential multiplied by the probability of getting the visa, exceeds the cost. Changing the quota then has a stronger impact on those with lower gains from migration, which is the same incentive effect we described in the above analysis. Unlike in our analysis, the way in which different quotas interact with wealth constraints is less clear.

In addition, immigration typically requires compliance with a significant amount of bureaucracy. Bureaucracy too may affect self-selection: it requires time, whose value may differ according to skills, or money (e.g. for paying for the assistance of specific private agencies). As a simple example, assume that each migrant has to invest some fixed amount of time β in bureaucracy, and this time is worth βw_ϕ^* . Since in this case bureaucracy is more harmful for the high skilled, the conditions for positive self-selection become harder to satisfy. When only incentives matter, positive self-selection requires that $\Delta w > (1 + \beta)\Delta w^*$, i.e. returns to skill in the receiving country are sufficiently high to compensate also for the greater waste of time. With respect to the case of no bureaucracy, then, an increase in restrictions (i.e. both β and γ) is more likely to reduce immigrants' skill composition.

There are several other ways in which the immigration policy space can be enriched. Nonetheless, the general theme stressed throughout this paper appears robust to the particular modeling choice. In order to predict the effects of immigration policy, one needs to account for the (indirect) effect on immigrants' skill composition, as determined by immigrants' self-selection.

4.1.2 Skill-dependent policy

Turning to the second issue, receiving countries may indeed try to impose different restrictions on different types of immigrants. Even under this lens, however, there are several reasons which make the above analysis of some value. First, and perhaps most importantly, this analysis emphasizes that even policies independent of immigrants' skills have a screening power. This is important as, in all receiving countries, many significant aspects of immigration policy tend to be independent of skills. For example, these countries regulate the total number of immigrants, the amount of bureaucracy needed

to get a visa, the way immigrants are treated once in the country (say in terms of access to welfare), and so on. Policy discussions around these issues tend to neglect the indirect effect on the composition of immigrants, and this paper makes precise a sense in which such omission may be misleading.

Second, systems which directly screen immigrants according to their skills may be very complicated to implement and not necessarily very effective. Indeed, in countries where such systems are in place, like Australia and Canada, they do not appear to effectively influence immigrants' skills and long-term success in the receiving country (as argued e.g. in Miller, 1999 on Australia; in Antecol, Cobb-Clark and Trejo, 2003 and Jasso and Rosenzweig, 2008 on Canada and Australia). In other words, direct selection of immigrants appears to be a difficult task since not all the desirable characteristics can be precisely described and verified. Moreover, the assimilation of immigrants depends also on unobservable dimensions, which are by definition not contractible and as such they can be affected only through indirect screening mechanisms.

Last, our analysis would be of use even if one took the extreme view that the receiving country can perfectly well implement a policy conditional on immigrant skill, and so impose different costs on low and on high skilled immigrants. In such an ideal world, our analysis would show the policy dimension along which the skill ratio R is most sensitive. Suppose for example that the government wishes to increase R . This could be done either by increasing the cost for low skilled immigrants γ_L or by decreasing the cost for high skilled immigrants γ_H . The government may be interested in which is the most efficient way to go, i.e. in whether a larger effect on R would be induced by changing γ_L or γ_H . This would require computing

$$\frac{dR}{d\gamma_H} = \left(N_L^2 - \frac{\partial x_H}{\partial w_H} \frac{\partial w_H}{\partial R} N_L + \frac{\partial x_L}{\partial w_L} \frac{\partial w_L}{\partial R} N_H \right)^{-1} \frac{\partial x_H}{\partial \gamma_H} N_L,$$

and

$$\frac{dR}{d\gamma_L} = - \left(N_L^2 - \frac{\partial x_H}{\partial w_H} \frac{\partial w_H}{\partial R} N_L + \frac{\partial x_L}{\partial w_L} \frac{\partial w_L}{\partial R} N_H \right)^{-1} \frac{\partial x_L}{\partial \gamma_L} N_H.$$

From these relations, we see that

$$\left| \frac{dR}{d\gamma_H} \right| \geq \left| \frac{dR}{d\gamma_L} \right| \iff \frac{\partial x_H}{\partial \gamma_H} N_L \geq \frac{\partial x_L}{\partial \gamma_L} N_H. \quad (26)$$

Condition (26) is equivalent to condition (18), from where our analysis started.²¹ In other words, even in this setting, determining the optimal policy may require accounting for the same size and composition effects emphasized above.

²¹To see the equivalence, notice that x_H does not depend directly on γ_L so $\partial x_H / \partial \gamma_H$ in equation (26) equals $\partial x_H / \partial \gamma$ in equation (18). Similarly for x_L .

4.2 Government's preferences

We focused on the case of a utilitarian government which values each group according to its size. We view the weights $\mu_\theta = n_\theta$ as a useful starting point as they allow us to identify how the composition effect changes the optimal policy program. Distributional concerns and political economy considerations may provide additional reasons to impose restrictions. Instead, as shown in Proposition 1, in a setting with $\mu_\theta = n_\theta$ any immigration restriction is driven by the composition effect.

There are however many ways in which our framework can be extended. First, while considering a linear utility function simplifies our analysis, one may introduce a more general form for natives' utility. Each group would then receive a weight which depends on μ_θ and on the group's marginal utility, and this would induce a greater concern for the low skilled (who have higher marginal utility). Second, one could model the process of aggregating natives' preferences in a more structured (and perhaps more realistic) way. For example, one could think of a majoritarian democracy where only the largest group of natives gets positive weight. If these are low skilled, the government would aim at maximizing the skill ratio R . Alternatively, one could introduce lobbying activities whereby each group may bid for protection and try to increase its weight in the government's program. In this case, the government may trade off contributions and social welfare, and aim at some intermediate R . More generally, one could add to our model a stage in which the weights μ_θ are determined. These weights then determine the optimal R and the ensuing optimal immigration cost. In the above analysis, we have taken the weights as given and described how the government would set its policy in order to move towards the optimal skill ratio R . In this sense, the insights developed on size vs. composition effects are robust to the specific way in which the weights μ_θ are determined.

A different line of extension would be to include in the government objective function the direct costs and benefits of implementing a given immigration policy. In our main analysis, we have not considered the potential revenues associated with immigration costs (as instead emphasized by proponents of entry taxes, see the references in the Introduction). As detailed in Section 4.1, our policy γ need not be interpreted as an entry tax: a significant share of migration costs depends on immigration restrictions without being pocketed by the receiving country government (e.g. immigrants' expenses for legal and consulting services needed to comply with bureaucracy). At the same time, we have not considered any cost of implementing the immigration policy (as instead stressed e.g. in Beine, Docquier and Özden, 2009). In order to emphasize these costs and benefits, the government objective function in (6) can be rewritten as

$$W = \mu_H w_H(\gamma) + \mu_L w_L(\gamma) + T(\gamma) - C(\gamma),$$

where $T(\gamma) = \gamma(x_H(\gamma) + x_L(\gamma))$ are the revenues and $C(\gamma)$ are the costs associated with implementing the policy γ . Denote γ^* the cost which maximizes labor market benefits $\mu_H w_H(\gamma) + \mu_L w_L(\gamma)$ we have considered so far, and γ^{**} the cost which maximizes net revenues $T(\gamma) - C(\gamma)$ (assuming the problem has a unique solution).²² The government would then typically choose a cost between γ^* and γ^{**} . That is, in this world, the government would have to balance the effects of the implementation of immigration policy on fiscal balances with its effects on natives' wages. Still, in order to estimate the latter, it would have to take into account the composition effect we stressed in our main analysis.²³

4.3 Natives' preferences

In the above analysis, natives' skills determine preferences over immigration policy through standard labor market competition between immigrants and natives. Labor market interactions have received the greatest attention in the economics literature on the effects of immigration in receiving countries (see e.g. Borjas, 1994 and Bauer and Zimmermann, 2002 for surveys). Nonetheless, the evidence is certainly controversial. Some studies find a rather small effect on natives' wages (Friedberg and Hunt, 1995 and Card, 2005), while others (e.g. Borjas, 2003) report that immigrants compete with similarly skilled natives and significantly lower their equilibrium wages (see also Ottaviano and Peri, 2008 for a recent review of these estimates). The same labor market effect has also been proposed as an explanation of natives' attitudes towards immigration policy (see Scheve and Slaughter, 2001 and Mayda, 2006). In countries where immigrants are less skilled than natives, more educated individuals tend to support more liberal immigration policies, and this correlation disappears once one considers people outside the labor force.

More generally, our focus on the effects on R may be useful to analyze several other issues which we have left aside. For example, natives' preferences on immigration may be driven also by public finance and political economy issues. From a fiscal viewpoint, one may argue that high skilled immigrants are always preferred since they pay higher taxes and receive fewer welfare benefits. Hence, high skilled natives would trade-off the reduction in wages with the fiscal benefit of accepting high skilled immigrants.²⁴ On political economy issues, if immigrants gain political power in the receiving

²²Of course, the optimal γ^* need not be equal to the one derived in a setting with no taxes, as these may change the returns to skills in the receiving country.

²³I acknowledge useful suggestions by one of the referees in shaping this discussion.

²⁴Suppose that the government collects tw_θ and distributes the revenues with a lump sum transfer to every worker. Now high skilled utility is a convex combination with weight t of the wage w_H , which depends negatively on R , and the transfers, which depend positively on R . The effects of these concerns on individual preferences over immigration are documented in Hanson, Scheve and Slaughter (2007) and Facchini and Mayda (2009).

country, then natives may trade-off the effect on their wages with the effect on the political equilibrium (as in Ortega, 2005). Depending on these trade-offs, natives would determine their preferred skill ratio R and push for any policy which moves towards such R . But again, our results on how R varies with γ do not depend on the specific way in which such a preferred R is determined.

5 Conclusion

In this paper, we have developed a simple framework for analyzing the interaction between immigrants' self-selection and the determination of immigration policy. We have shown that any immigration policy affects the composition of the migration flow and have explored some implications of this effect for optimal policy design. We have carried out our analysis in a setting intended to be the simplest for conveying our insights on the composition effect. This clearly leaves many avenues open to future research, some of which have been mentioned in Sections 2 and 4. Another interesting extension would be to consider a dynamic model in which current migration flows depend also on past flows, through migration networks or family reunification. In such a model, current immigration policy affects future migration flows and so the optimal policy design should also consider the relation between the characteristics of initial and subsequent immigrants.²⁵

We wish to conclude by suggesting some possible policy implications of our results. As mentioned in the Introduction, the effects of immigration largely depend on immigrants' composition, and as such receiving countries may have a great interest in improving their ability to screen. In this respect, our results show that, given immigrants' self-selection, any policy has some indirect screening power. Given that size and composition effects tend to work in opposing directions, this may significantly complicate the optimal policy design. On the other hand, such screening power may be viewed as an additional dimension to exploit. Since the effectiveness of direct screening mechanisms appears limited, immigration policies may consider influencing self-selection ex-ante rather than imposing restrictions ex-post. As we have shown, this in turn requires understanding the forces shaping the decision to migrate. By affecting the way different potential migrants respond to policy changes, immigrants' self-selection is then key also for receiving countries. Nothing is terribly surprising in this statement. There is a large and fundamental literature studying how different types of agents respond differently to changes in prices.²⁶ For some reason, the literature on immigration policy

²⁵See e.g. Carrington, Detragiache and Vishwanath (1996), Beine, Docquier and Özden (2009), McKenzie and Rapoport (2010) for theoretical and empirical contributions on the role of past immigration in shaping the size and composition of current migration flows.

²⁶These agents being borrowers dealing with interest rates, workers with wages or poli-

has generally overlooked this issue, and, from this perspective, this paper may be a step towards filling the gap.

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6 Omitted Proofs

6.1 Proof of Proposition 1

If the composition of immigrants is independent of γ , it must be that

$$\frac{\partial x_H}{\partial \gamma} x_L = 0,$$

that is

$$\frac{\partial x_H}{\partial \gamma} x_L = \frac{\partial x_L}{\partial \gamma} x_H. \tag{27}$$

Hence, by (27),

$$\frac{\partial R}{\partial \gamma} = \frac{\frac{\partial x_H}{\partial \gamma}(n_L + x_L) - \frac{\partial x_L}{\partial \gamma}(n_H + x_H)}{(n_L + x_L)^2} = \frac{\frac{\partial x_H}{\partial \gamma}n_L - \frac{\partial x_L}{\partial \gamma}n_H}{(n_L + x_L)^2},$$

and so again by (27), recalling that $\partial x_\theta / \partial \gamma < 0$,

$$\frac{\partial R}{\partial \gamma} \geq 0 \iff n_H x_L - n_L x_H \geq 0.$$

Hence, by equation (17), $dW/d\gamma$ has the same sign as $(n_L x_H - n_H x_L)(n_H x_L - n_L x_H)$, which is negative. That is, W decreases in γ and so open immigration is optimal when the composition of immigrants is independent of γ .

6.2 Proof of Proposition 2

Totally differentiating equation (13) and rearranging terms, we have that

$$\frac{dR}{d\gamma} \left(N_L^2 - \frac{\partial x_H}{\partial w_H} \frac{\partial w_H}{\partial R} N_L + \frac{\partial x_L}{\partial w_L} \frac{\partial w_L}{\partial R} N_H \right) = \frac{\partial x_H}{\partial \gamma} N_L - \frac{\partial x_L}{\partial \gamma} N_H.$$

Since $\partial w_H / \partial R < 0$ and $\partial w_L / \partial R > 0$, the term in parentheses is positive, so

$$\frac{dR}{d\gamma} \geq 0 \text{ if and only if } \frac{\partial x_H}{\partial \gamma} N_L \geq \frac{\partial x_L}{\partial \gamma} N_H,$$

which is equation (18) in the main text. Multiplying both sides of equation (18) by $x_L x_H$, we see that the ratio R increases in γ if and only if

$$\frac{x_H}{n_H + x_H} \cdot \frac{\partial x_H}{\partial \gamma} x_L \geq \frac{x_L}{n_L + x_L} \cdot \frac{\partial x_L}{\partial \gamma} x_H. \quad (28)$$

Equation (28) can be decomposed into a size and a composition effect, as described respectively by equations (19) and (20) in the main text.

6.3 Proof of Proposition 3

When immigrants' self-selection is determined by incentives alone, immigrants' skill composition in equation (10) can be written simply as

$$Q = \frac{\Pi(w_H - w_H^* - \gamma)}{\Pi(w_L - w_L^* - \gamma)}.$$

Hence,

$$Q \geq 1 \iff w_H - w_H^* \geq w_L - w_L^*,$$

that is point (a) in the Proposition. As mentioned in the text, point (b) follows by simply differentiating (22) and using assumption (2). Turning to

point (c), notice that substituting (21) into equation (19), we can write the size effect as

$$\frac{dR}{d\gamma} \geq 0 \Leftrightarrow q_H \leq q_L,$$

while by assumption (2) the composition effect in (20) writes as

$$\frac{dR}{d\gamma} \geq 0 \Leftrightarrow q_H \geq q_L.$$

Hence under (21) size and composition effects work in opposing directions. To see point (d), rewrite condition (18) as

$$\frac{\partial q_H}{\partial \gamma} n_H^* n_L - \frac{\partial q_L}{\partial \gamma} n_L^* n_H + \frac{\partial q_H}{\partial \gamma} q_L n_H^* n_L^* - \frac{\partial q_L}{\partial \gamma} q_H n_L^* n_H^* \geq 0, \quad (29)$$

which under (21) writes as

$$\frac{\partial q_H}{\partial \gamma} - \frac{\partial q_L}{\partial \gamma} + \frac{\partial q_H}{\partial \gamma} q_L - \frac{\partial q_L}{\partial \gamma} q_H \geq 0. \quad (30)$$

Hence, if the ratio $\pi/(1 + \Pi)$ is decreasing, that is

$$\frac{\partial q_H}{\partial \gamma} - \frac{\partial q_L}{\partial \gamma} + \frac{\partial q_H}{\partial \gamma} q_L - \frac{\partial q_L}{\partial \gamma} q_H \geq 0 \Leftrightarrow q_H \leq q_L,$$

then the composition effect dominates. Further restrictions increase R if and only if they improve Q , which in our case requires $\Delta w \geq \Delta w^*$. The ratio $\pi/(1 + \Pi)$ is decreasing if for example the psychological cost of migration ε_i is uniformly distributed over some interval $[a, b]$. Hence, for $\varepsilon^\theta \in [a, b]$, $\pi(\varepsilon^L) = \pi(\varepsilon^H)$ and, substituting into equation (30), we see that

$$\frac{\partial R}{\partial \gamma} \geq 0 \Leftrightarrow \Pi(\varepsilon^H) - \Pi(\varepsilon^L) \geq 0 \Leftrightarrow \Delta w \geq \Delta w^*. \quad (31)$$

From equation (31), restrictions increase the skill ratio R if and only if immigrants are *more* skilled than natives. Hence, as long as both thresholds ε^L and ε^H lie within the interval $[a, b]$, the composition effect prevails. When instead one of the thresholds ε^L and ε^H lies outside the interval $[a, b]$, the sign of the derivative is reversed, i.e. the size effect prevails. This also shows the possibly non-monotone effect of γ on R . If the cost becomes so high that no high skilled foreigner has any incentive to move, the composition effect disappears. Such cost is implicitly defined by

$$\bar{\gamma} = w_H(\bar{\gamma}) - w_H^* - a,$$

where $\bar{\gamma}$ always exists since w_H is bounded so $\gamma > w_H - w_H^* - a$ for γ sufficiently large. Hence, in this example, the composition effect is stronger for $\gamma \leq \bar{\gamma}$, while the size effect dominates afterwards. As a result, the relation between R and γ is U-shaped, with a minimum at $\gamma = \bar{\gamma}$.

6.4 Proof of Proposition 4

The logic follows the proof of Proposition 3 by noticing that now selection is driven both by incentives and wealth constraints, where the latter always push towards positive self-selection due to assumption (1). Hence, as stated in (a), if $\Delta w \geq \Delta w^*$ then immigrants are positively self-selected because both of incentive and wealth effects. (If instead $\Delta w < \Delta w^*$, the effect is ambiguous. As $\gamma \rightarrow 0$, incentives dominate so the relation tends to be negative. As γ increases, the shape of Q depends on the strength of the two effects: when $\Pi(\varepsilon^H)$ goes to zero faster than $(1 - \Omega_L)$, Q tends to zero as γ increases; when the opposite occurs, there exists a cost beyond which the wealth effect takes over, so the relation is U-shaped.) If $\Delta w \geq \Delta w^*$ or the wealth constraint dominates, then the relation between Q and γ is monotone, and the analysis in Proposition 3 goes through (points b and c). In this case, given equation (21), a *sufficient* condition for the composition effect to prevail is that, as mentioned in the text, the foreigners with the lowest propensity to migrate are, in absolute terms, the most sensitive to a policy change, that is

$$x_H \geq x_L \text{ if and only if } \frac{\partial q_H}{\partial \gamma} \geq \frac{\partial q_L}{\partial \gamma}. \quad (32)$$

In fact, condition (25) holds if and only if $x_H \geq x_L$, that is,

$$\frac{\partial q_H}{\partial \gamma} q_L \geq \frac{\partial q_L}{\partial \gamma} q_H \Leftrightarrow x_H \geq x_L. \quad (33)$$

Together with condition (32), (33) implies condition (30), that is R increases with γ despite immigrants being more skilled than natives. That is, the composition effect prevails (point d). Similarly to the previous analysis, the composition effect may prevail only when the cost is sufficiently small, so that the population of migrants who respond to policy changes is sufficiently heterogeneous. If the cost is so high that only one group of foreigners migrates, being the richest or the most motivated, then by definition there is no composition effect. Given this possible non-monotonicity in the effect of γ on R , the discussion after Proposition 3 still holds and so Corollaries 1 and 2 follow.