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ORIGINAL PAPER

The social preferences of the native inhabitants, and the decision how many asylum seekers to admit

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Abstract We consider a tax-funded policy of admitting and integrating asylum seekers in a country in which the incomes of the native inhabitants are differentiated; for the sake of simplicity, we assume that there are just two groups of native inhabitants: high-income natives and low-income natives. As a consequence of their social preferences, the latter experience disutility caused by relative deprivation. Because integrating the asylum seekers into the mainstream labor force and thereby into the income distribution of the native population "from below" reduces the relative deprivation of the low-income natives, admitting and integrating asylum seekers can be socially beneficial. We derive the optimal number of asylum seekers by maximizing the natives' social welfare function that incorporates these considerations. We find that as long as the cost of admission and integration is not exceptionally high, this number is strictly positive. We then address the issue of how to distribute a given number of asylum seekers among several receiving countries. We find that, rather than allocating the asylum seekers in proportion to the population of each country, aggregate welfare will be maximized through an allocation that is increasing in the within-country difference between the incomes of the high-income natives and the low-income natives. Additionally, we formulate conditions under which admission of the optimal number of asylum seekers is socially preferable to a direct transfer of income from high-income natives to low-income natives.

Keywords: Admission and integration of asylum seekers; Social preferences; Relative deprivation; Tax-funded integration policy; Maximization of social welfare

JEL Classification: D60; F02; F22; I31; J61; J68

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"[On June 27, 2018] Ireland became one of the last countries in the European Union to grant employment rights to asylum seekers . . . leaving Lithuania as the only EU country to prevent asylum seekers from working." Reuters, June 27, 2018.[1]

"According to Eurostat, the EU's statistical office, the only metric consistently correlated with European happiness is relative income." *The Economist*, February 27, 2016.

"On September 23rd a group of five EU interior ministers agreed to a temporary . . . mechanism for rotating the ports to which asylum seekers are transported after being plucked from the water . . . . Much will now depend on how the draft agreement works in practice. It remains to be decided how many countries will take part, [and] how many asylum-seekers each will accept." *The Economist*, September 24, 2019.

1. Introduction

The question of how many asylum seekers a country should admit has rarely before featured so prominently in European public debate as in recent years. Day in, day out, officials, politicians, opinion leaders, and others float ideas on capping the number of people to be admitted into their country. The issue is not a passing one, and has featured prominently in European public debate and policy formation in every one of the past six years, especially when 2.5 million asylum seekers arrived in Europe in 2015-2016. As an example, consider the year 2016. The proposal to set daily quotas for the number of refugees to be allowed to enter Germany, made in January 2016 by Julia Kloeckner, at that time Deputy Federal Chair of the Christian Democratic Union party in Germany, is one such example.[2] Statements in February 2016 by the then French Prime Minister Manuel Valls that his country will accept 30,000 migrants over the next two years, and by the then Chancellor Werner Faymann that Austria will cap the number of asylum seeker applications at 80 per day, are two other examples.[3] The decision of the majority of British voters to leave the European Union in the referendum held on June 23, 2016 has been widely attributed to the campaign by "Brexiters" against freedom of movement within the EU.[4] More openly, Matteo Salvini, Italy's Interior Minister, is reported to "want to suspend asylum procedures completely until the E.U. agrees on fair distribution of refugees, an issue that has deadlocked leaders in Brussels for years." (*Time* magazine, September 24, 2018).

In this paper we tackle the issue of how many asylum seekers to admit from a particular perspective. The formula that we propose does not provide, nor is it

[1] https://www.reuters.com/article/us-ireland-asylum/ireland-to-allow-asylum-seekers-to-work-for-first-time-idUSKBN1JN2AX

[2] https://apnews.com/1286a5ba83ec40ec9826c008bc954153

[3] http://www.theguardian.com/world/2016/feb/19/refugee-crisis-austria-daily-migrant-limit-eu-3bn-turkey-plan

[4] http://www.bbc.com/news/uk-politics-eu-referendum-36574526

intended to deliver, a "golden rule" for admission; rather, it highlights a specific aspect that hitherto has not been considered in the design of admission policies, and it demonstrates how a factor that affects the optimal number of asylum seekers that a country can / should admit and integrate can be assessed through an explicit maximization of a social welfare function. In addition, as shown in detail below, our proposed formulation identifies an incongruity between two advocated policies when the maximization of the social welfare of the natives is the objective. This incongruity arises because taking steps to integrate the asylum seekers - which brings them into the mainstream workforce - is incompatible with allocating them between countries in proportion to the size of the populations of the countries: integrating the asylum seekers into the mainstream bears on the wellbeing of the natives, and if the allocation of asylum seekers is carried out without considering this effect, then the objective of maximizing the natives' welfare is not served. Here we present briefly the setting that we consider, and the assumptions that we make. Later on, we present evidence in support of several of our key assumptions.

The native inhabitants of a country, henceforth the natives, have social preferences. They consist of two homogeneous groups: the incomes of members of one group are higher than the incomes of members of the other group. (We hasten to add that the assumption of having two homogeneous groups of natives is not essential and is made in order to render it easier to derive the paper's main claims. A more general income distribution would yield the same insights.) As a consequence of their social preferences and their lower income, the low-income natives experience disutility caused by relative deprivation. We consider what happens when we let low-skill asylum seekers into the country. In order to pay the costs of admitting and integrating the asylum seekers, the natives are taxed. Following their admission and integration, the asylum seekers join the income distribution of the native population "from below," namely the incomes of the asylum seekers are lower than the incomes of the low-income natives.[5,6] From the maximization of the natives' social welfare function that incorporates these considerations we obtain the optimal share of asylum seekers in the population as a unique, strictly positive

[5] In recent years, the speed and extent of the admission and integration of asylum seekers in several European countries appear not to have been left much to the asylum seekers to choose. Policies have been put in place to ensure this. The EU leader in compelling asylum seekers to integrate is the Netherlands, which in 1998 introduced the *Newcomer Integration Act* requiring asylum seekers and migrants to participate in language and social orientation courses or risk being fined or having their welfare benefits reduced. Currently, Austria, Denmark, France, Germany, Luxembourg, and Sweden have in place integration programs of different types, involving at least a language course, which is mandatory for all non-EU migrants. (For details and comparison of integration programs in the EU-15 countries see the summary in Hübschmann, 2015.) For example, since 2005 Germany has had a program of at least 430 hours of study consisting of a language part and a part dedicated to German history, politics, and culture. In Sweden, the government is running some 30 "fast-track" programs training asylum seekers with experience in occupations where labor is short. Both Germany and Sweden have shifted legal barriers in order to let the asylum seekers start work sooner.

[6] Using 2010-2017 data, Ruiz and Vargas-Silva (2018) find, when they compare the labor market outcomes of asylum seekers, natives, and other migrants in the UK, that asylum seekers earn less than natives and other migrants, and that although the increase in employment of asylum seekers between 2010 and 2016 was significantly higher than that of other migrants, this was not the case for earnings.

solution m^*. Multiplication of m^* by the size of the population yields the optimal number of asylum seekers.

We then investigate a related issue that is relevant to recent policy-making, especially in the European context, namely that of allocating a given number of asylum seekers between a group of host countries. Drawing on a multi-country framework, we find that an allocation that maximizes the countries' aggregate welfare should not be proportional to the size of the populations of the host countries. Instead, the country in which the difference in incomes between the high-income natives and the low-income natives is larger should admit more asylum seekers (as a share of its population) than the other country, assuming that the cost of admission and integration, and the shares of high-income natives and low-income natives, are the same in the two countries. This result arises because the low-income natives in the former country experience higher relative deprivation and consequently stand to gain more from accepting asylum seekers.

Finally, we compare a policy of admitting and integrating the optimal number of asylum seekers with a policy of direct tax and transfer from the high-income group of natives to the low-income group of natives, where the taxing of the high-income natives is the same in both cases. We find that if the cost of admission and integration is not excessive, the policy of letting in asylum seekers is preferable to an equivalent tax and transfer policy.

In our setting, the asylum seekers confer a benefit on the natives not by raising the productivity of the latter or by lifting their incomes but rather by affecting the relative deprivation experienced by the low-income natives. This happens when, and because, the presence of the asylum seekers reduces the share of the high-income natives in the population, which in turn lowers the relative deprivation experienced by the low-income natives. Given the manner in which relative deprivation is measured, namely as the fraction of those members of the population whose incomes are higher, times their mean excess income (see the next section and footnote 8), the relative deprivation gain is conferred not because the low-income natives look "down" in the income distribution. Rather, it follows because in the wake of the admission and integration of the asylum seekers, when the low-income natives look "up" they find that the share of the high-income natives in the population is smaller.

Thus, our main assumptions are that asylum seekers enter the social space of the natives; that they join in at the lowest rung of the income hierarchy; and that the wages of the low-income natives remain approximately constant. The integration programs referred to in footnote 5 see to it that asylum seekers who otherwise might constitute an "outsider group" become an "insider group," both in the social landscape, and in the economic domain. In a way, integration programs constitute a technology that helps convert asylum seekers to productive workers. The assumption that the wages of the low-income natives remain approximately constant can be supported by empirical evidence regarding the effect of low-skill migration on the wage earnings and / or the employment opportunities of low-skill native workers, which finds that the effect tends to be weak, neutral, or slightly positive (LaLonde and Topel, 1991; Card, 2001, 2005; Kifle, 2009; Cohen-Goldner and Paserman, 2011; Manacorda et al., 2012; and Foged and Peri, 2016). Still, this is not a holy grail. Several empirical studies find an adverse effect of low-skill migration on the earnings and / or the employment

opportunities of comparable native workers, and a positive effect on the earnings and / or the employment opportunities of complementary native workers (Dustmann et al., 2013; Borjas, 2017; and Borjas and Monras, 2017). We briefly return to this issue in the next paragraph. In Section 5 ("Measures of robustness"), we show that our results can hold even in the presence of these two effects. Moreover, in our benchmark model, the *net* wages of the low-income natives are already reduced because of the asylum seekers' admission and integration tax paid by these natives.

In fairness to the received literature, we also refer briefly to four related aspects brought up in that literature: a perception of an adverse effect of migration on the wages of low-income natives; the attitude of these natives towards migration; the tax burden incurred following the arrival of migrants; and the direct negative effect of migration on income distribution in the receiving economy. An eloquent representation of the first three aspects is in Mayda (2006). Out of these three aspects, the first two relate to skill-specific attitudes towards migration. It has been argued that when migrants are less skilled than natives, they reduce the relative supply of skilled labor to unskilled labor, which leads to an increase in the skilled wage and a decrease in the unskilled wage. The third aspect relates to public finances. In that context, an assumption has been made with regard to the response of the welfare state to migration: the arrival of unskilled migrants who are considered to be net claimants of welfare benefits calls for an adjustment in the financing of welfare costs (the tax burden) in order to balance the government's budget. The associated assumption made in the received literature is that high-income natives are more negatively affected by unskilled migration than low-income natives because the former bear most of the additional cost of the welfare system. In contrast to these perspectives, we study an environment in which the opposite considerations arise: low-income natives can gain from the arrival of low-skill migrants, and high-income natives need not necessarily oppose the associated tax burden *given* the menu of alternative targets of the tax. Moreover, as modeled below, low-income natives can gain from the admission of migrants even when they share the associated tax burden. A fourth aspect alluded to in the received literature is that an inflow of low-wage migrants can directly worsen the distribution of incomes in the receiving economy (Blau and Kahn, 2015). This effect, however, will not negate the improvement in the natives' wellbeing due to the weakening of the adverse effect of relative deprivation. An example can help clarify this point. Suppose that the incomes of the two natives are 2 and 3. Then, the Gini coefficient is 1/10, and the relative deprivation of the low-income native is 1/2, assuming that this relative deprivation is measured as in footnote 8 below (namely as the fraction of those whose incomes are higher, times their mean excess income). If an asylum seeker joins the population so that his admission and integration result in him obtaining income 1, the Gini coefficient increases from 1/10 to 2/9, but the relative deprivation of the low-income native decreases from 1/2 to 1/3.

A wealth of evidence from field and laboratory studies in economics, social psychology, and neuroscience confirms that individuals routinely engage in, and are affected by, interpersonal comparisons. In particular, people are dissatisfied when their consumption or income levels are lower than those of others who constitute their comparison group. Studies that recognize such discontent are, among others, Stark and Taylor (1991), Zizzo and Oswald (2001), Luttmer (2005), Fliessbach et al.

(2007), Blanchflower and Oswald (2008), Takahashi et al. (2009), Fan and Stark (2011), Stark and Fan (2011), Stark and Hyll (2011), Card et al. (2012), Stark et al. (2012), and Goerke and Pannenberg (2015). The overwhelming weight of the evidence supports the notion of a strong asymmetry: the comparisons that affect an individual's sense of wellbeing significantly are the ones rendered by looking "up" the hierarchy, whereas looking "down" does not appear to be of much consequence or to deliver satisfaction. Cohn et al. (2014) find that in choosing their level of work effort, workers respond to increased relative deprivation but not to increased "relative satisfaction." Frey and Stutzer (2002), Walker and Smith (2002), and Stark (2013) review a large body of evidence that lends support to the "upward comparison" hypothesis.

Motivated by social space considerations, our analysis should be interpreted as adding a novel dimension rather than as constituting a negation of prevailing ones. Specifically, we hold constant a number of variables, and we ask how the social preferences of the low-income natives could be brought to bear on the decisions of whether to admit asylum seekers and, if yes, how many to admit. We are well aware that the list of repercussions of migration of all types is long, and that incorporating a good many of them could strengthen the case for admitting asylum seekers beyond the reduced relative deprivation modeled in this paper. (Low-skill migrants help to make markets denser, strengthen agglomeration economies, increase the returns on capital, stimulate investment, reduce the costs of non-traded services, and so on).[7] Yet the write up of a complete balance sheet, let alone quantification of its entries, are clearly outside the terms of reference of this paper.

2. The calculus of admitting and integrating asylum seekers

2.1. The model

Consider a native population of N individuals. The population consists of two homogeneous income groups, one of N_l individuals where the income of each individual is equal to x_l, the other of N_h individuals where the income of each individual is equal to x_h, such that $0 < x_l < x_h$, and $N_l + N_h = N$. We denote the share of the low-income group in the population by $l = N_l / N$, and the share of the high-income group in the population by $h = N_h / N$.

Let the utility function of an individual whose income is x_l be

$$u_l = (1 - \alpha_l)x_l - \alpha_l RD_l,$$

where RD_l is a measure of the low relative income of individual l. In the individual's utility, relative deprivation is weighted by $\alpha_l \in (0, 1)$, while the preference for absolute income is weighted by $1 - \alpha_l$. The relative deprivation of the individual whose income is x_l is defined as

[7] Bodvarsson and Van den Berg (2013) provide a comprehensive summary of the literature on the economic effects of migration.

$$RD_l \equiv h(x_h - x_l), \tag{1}$$

namely it is the fraction of the higher-income individuals (here this fraction is h) times the mean excess income to which this individual is subjected (here this mean excess is $(x_h - x_l)$).[8]

Let the utility function of an individual whose income is x_h be

$$u_h = (1-\alpha_h)x_h,$$

where $(1-\alpha_h) \in (0,1)$ is the weight that individual h assigns to his absolute income. Because the individual whose income is x_h does not experience relative deprivation, we do not include in his utility function a relative deprivation component.

Suppose now that the government which measures social welfare, SW, by the wellbeing per native

$$SW = lu_l + hu_h,$$

considers admitting and integrating asylum seekers while financing the cost of doing so by means of taxing the natives. We denote the number of asylum seekers by M, and we denote their share in the population by $m = M/(N+M)$. When the cost of admitting and integrating an asylum seeker (involving, for example, language courses and job training paid for by the state) is T, the arrival of M asylum seekers entails an aggregate cost of MT, and a per native tax burden of $\frac{MT}{N} = \frac{m}{1-m}T$ where, when writing this formula, we draw on the identity

$$\frac{M}{N} = \frac{1}{\frac{N}{M}} = \frac{1}{\frac{N+M}{M} - 1} = \frac{1}{\frac{1}{m} - 1} = \frac{m}{1-m}. \tag{2}$$

We assume that following their admission and integration, the asylum seekers integrate economically so that in terms of their earnings or incomes, they join the income distribution of the natives from below. Denoting the income of an asylum seeker by x_m, we thus assume that $x_m \leq x_l - \frac{mT}{1-m}$.[9]

The utility levels of the natives of the two types, expressed as functions of the share of the asylum seekers in the population, are

[8]The formulation of relative deprivation in (1) is a special case of the index of relative deprivation (consult the characterization in Stark, 2013, and in Stark et al., 2017), which for an individual earning x_i in a population with incomes given by cumulative distribution function F, is equal to the fraction of those whose incomes are higher than x_i times their mean excess income, namely $RD(x_i) = [1 - F(x_i)] \cdot E(x - x_i \mid x > x_i)$.

[9]Although the pre-tax income of the low-income natives is held constant, in the wake of their contribution to the cost of admission and integration of the asylum seekers, their net income is lower. Thus, even though we do not account for the possibility that the admittance of asylum seekers may lower the wages of the low-income natives via the labor market channel, we allow for a reduction of their income via the tax channel.

$$
\begin{aligned}
u_l(m) &= (1-\alpha_l)\left(x_l - \frac{mT}{1-m}\right) - \alpha_l \frac{N_h}{N+M}\left[\left(x_h - \frac{mT}{1-m}\right) - \left(x_l - \frac{mT}{1-m}\right)\right] \\
&= (1-\alpha_l)\left(x_l - \frac{mT}{1-m}\right) - \alpha_l h(1-m)(x_h - x_l), \qquad (3) \\
u_h(m) &= (1-\alpha_h)\left(x_h - \frac{mT}{1-m}\right).
\end{aligned}
$$

The utility representation in (3) incorporates the absolute income effect of taxing the natives - hence the $\frac{mT}{1-m}$term - and the relative income effect of the decrease in the share of the high-income group in the population - hence the term $h(1-m)$, which replaces h in (1).[10] Because of the latter effect, the relative deprivation of a low-income native decreases from $h(x_h - x_l)$ to $h(1-m)(x_h - x_l)$. Writing the social welfare of the native population as a function of the share of asylum seekers in the population, m, we have that

$$
SW(m) = l\left[(1-\alpha_l)\left(x_l - \frac{mT}{1-m}\right) - \alpha_l h(1-m)(x_h - x_l)\right] + h(1-\alpha_h)\left(x_h - \frac{mT}{1-m}\right). \qquad (4)
$$

Assuming that the government maximizes the social welfare function in (4) with respect to m, given the cost of admitting and integrating an asylum seeker, T, the government's optimization problem is

$$
\begin{aligned}
&\max_{m \in [0,1)} SW(m) \\
&\text{subject to} \qquad (5) \\
&x_m \leq x_l - \frac{mT}{1-m}.
\end{aligned}
$$

The constraint in (5) represents the assumption that the asylum seekers enter the income distribution from below (their income should not exceed the post-tax income of the low-income natives).

2.2. A welfare gain from admitting and integrating asylum seekers

The following claim reveals that if the cost of admitting and integrating an asylum seeker is low enough, then admission and integration of asylum seekers paid for by a per native tax can increase social welfare.

Claim 1. There exists a critical level of the cost of admitting and integrating an asylum seeker, $T_0 > 0$, such that for any $T < T_0$ the solution of the maximization problem (5) is $m^* > 0$; namely admitting and integrating a specific positive number of asylum seekers enhances the natives' welfare.

[10] Using (2), we get that the share of high-income natives in the population is now equal to $\frac{N_h}{N+M} = h(1-m)$.

Proof. We first search for the optimal share of asylum seekers as a solution to an unconstrained problem, that is, we solve $\max_{m \in (-\infty, 1)} SW(m)$. We have that

$$SW'(m) = \frac{hl\alpha_l(1-m)^2(x_h - x_l) - hT(1-\alpha_h) - lT(1-\alpha_l)}{(1-m)^2}. \tag{6}$$

Setting $SW'(m) = 0$ and solving for $m < 1$, we obtain

$$m^* = 1 - \sqrt{\frac{\left[(1-\alpha_h)h + (1-\alpha_l)l\right]T}{\alpha_l hl(x_h - x_l)}}. \tag{7}$$

Calculating the second derivative of $SW(m)$ with respect to m we get

$$SW''(m) = -\frac{2\left[(1-\alpha_h)h + (1-\alpha_l)l\right]T}{(1-m)^3} < 0.$$

Therefore, m^* is a unique maximum of $SW(m)$ for $m \in (-\infty, 1)$.

To identify the conditions needed to yield a positive m^*, we solve

$$1 - \sqrt{\frac{\left[(1-\alpha_h)h + (1-\alpha_l)l\right]T}{\alpha_l hl(x_h - x_l)}} > 0$$

which implies that

$$\frac{\left[(1-\alpha_h)h + (1-\alpha_l)l\right]T}{\alpha_l hl(x_h - x_l)} < 1,$$

and, therefore, $m^* \in (0, 1)$ if and only if

$$T < \frac{\alpha_l hl(x_h - x_l)}{(1-\alpha_h)h + (1-\alpha_l)l} \equiv T_1,$$

such that $T_1 > 0$. Treating m^* as a function of the tax, we note that $\lim_{T \to 0} \frac{m^*(T)T}{1-m^*(T)} = 0$.[11]

We complete the proof by noting that because $x_m < x_l$, there exists a $T_2 > 0$ such that $x_l - \frac{m^*(T)T}{1-m^*(T)} \geq x_m$ for any $T < T_2$ and, therefore, $m^* = m^*(T) \in (0, 1)$ for any $T < \min\{T_1, T_2\} \equiv T_0$ is the solution of problem (5). Q.E.D.

An implication of Claim 1 is that if $T < T_0$, then the admission of $M^* = \frac{m^* N}{1-m^*}$ asylum seekers is socially preferable to not admitting any asylum

[11] From (7) we note that $\lim_{T \to 0} m^*(T) = 1$. Denoting $\mu(T) = \frac{dm^*(T)}{dT}$, we get that $\lim_{T \to 0} \mu(T) = -\infty$. Thus, using L'Hospital's rule, we have that $\lim_{T \to 0} \frac{m^*(T)T}{1-m^*(T)} = \lim_{T \to 0} \frac{\mu(T)T + m^*(T)}{-\mu(T)} = \lim_{T \to 0} \left[-T - \frac{m^*(T)}{\mu(T)}\right] = 0$.

seekers: $SW(m^*) > SW(0)$. The next remark informs us how m^* relates to the parameters of the model.

Remark 1. Given that m^* is an internal solution of the problem (5), we have that the optimal share of the asylum seekers in the population is

(i) an increasing function of the concern for relative deprivation of the low-income natives, α_l;

(ii) a decreasing function of the taste for absolute income of the high-income natives, $1-\alpha_h$;

(iii) a decreasing function of the income of the low-income natives, x_l;

(iv) an increasing function of the income of the high-income natives, x_h.

Proof. The relations (i) through (iv) are obtained as direct consequences of the derivatives of m^* displayed in (7). Q.E.D.

The intuition for Remark 1 is that a higher initial disutility from relative deprivation experienced by the low-income natives increases the gain (the "value" of lowering the natives' relative deprivation) conferred by the asylum seekers ((i) and (iii)); and that a lower weight assigned by the high-income natives to their income reduces their pain from being taxed ((ii)). In addition, the gain conferred by the asylum seekers upon the low-income natives is higher when the income of the high-income natives is higher ((iv)). This is so because such a higher income implies a higher initial relative deprivation of the low-income natives.

3. Admitting an obligatory number of asylum seekers

A question that has received considerable attention recently, especially in the European Union, is how to allocate a given number of asylum seekers between a group of host countries. Utilizing the framework developed in the preceding section, we first review briefly the problem facing a country that is asked to admit a given number of asylum seekers. We then study the issue of the socially optimal allocation of asylum seekers between several countries.

3.1. Admitting an obligatory number of asylum seekers: One receiving country

First, consider the case in which the government is compelled by some external institution to admit at least $\overline{M}$ asylum seekers. If $\overline{M} > M^*$, then the government has no choice but to admit the obligatory minimal number of asylum seekers. If, however, $\overline{M} < M^*$ and, as described in Sub-section 2.2, the cost of admitting and integrating $\overline{M}$ asylum seekers is distributed evenly among the natives, then the admission of $\overline{M} < M^*$ asylum seekers will obviously be less socially beneficial than the admission of M^* asylum seekers. In this case, the government will be open to admitting more asylum seekers than it is compelled to.

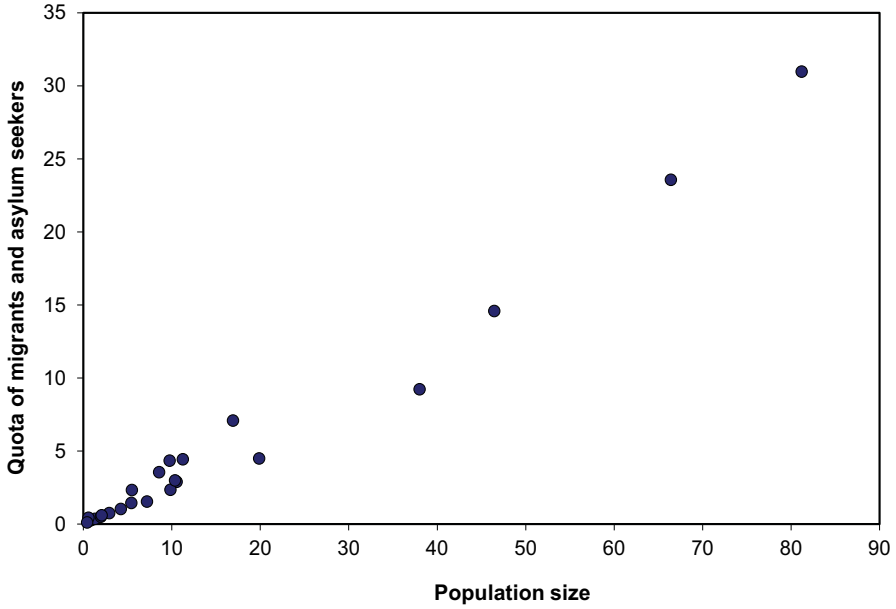

Figure 1. The quota of migrants and asylum seekers for EU member states (in thousands) vs. their populations as of January 1, 2015 (in millions).
Source: *Official Journal of the European Union* (2015), and Eurostat.

3.2. Admitting an obligatory number of asylum seekers when there are several receiving countries: A rule of optimal allocation

Suppose that a given number of asylum seekers has to be allocated between several countries. What is the allocation criterion that maximizes the aggregate welfare of the asylum seekers' receiving countries? This question too is inspired by the recent European asylum seeking and migration crisis. In September 2015, Jean-Claude Juncker, the then President of the European Commission, outlined a legislative proposal that would distribute a total of 120,000 asylum seekers and migrants among the EU member states. According to a bill adopted by the European Council later on in that month, member states will be obliged to admit the prescribed numbers of asylum seekers and migrants, which will essentially be directly proportional to the size of their populations (Figure 1).[12,13] From a social welfare point of view, is this

[12]The graph in Figure 1 illustrates the allocation of asylum seekers and migrants among 23 EU member states in January 2015. Greece and Italy, the countries where the bulk of the arrivals were provisionally housed at the time, were exempted from the scheme. And Denmark, Ireland, and the United Kingdom were exempted as a result of the special status that they enjoy in this sphere of EU policies.

[13]After two and half years of fierce debate and political bickering, the original decision of the European Council was discarded. At the time of writing, the EU member states agreed on (somewhat imprecise) asylum seeker and migrant plans that do not rely on obligatory quotas (Council of the EU, 2018). It is clear that the policy is far from reaching its final shape.

system for distributing an exogenously given number of asylum seekers and migrants optimal?

Consider a group of C countries indexed by i, where the population of country i is N^i and $N = \sum_{i=1}^{C} N^i$. Assume that the C countries have to allocate amongst themselves a given number, $\overline{M}$, of asylum seekers, that is

$$\sum_{i=1}^{C} M^i = \overline{M}, \tag{8}$$

where M^i is the number of asylum seekers to be admitted by country i. By analogy to the preceding sections, we define $m^i \equiv \frac{M^i}{N^i+M^i}$; and we also let $m^i_{\max} \equiv \frac{\overline{M}}{N^i+\overline{M}}$.

The per native social welfare of the C group of countries is

$$W(m^1, ..., m^C) = \frac{1}{N} \sum_{i=1}^{C} N^i SW_i(m^i), \tag{9}$$

where $SW_i(m^i)$ is the per native welfare function of country i, defined in a manner analogous to (4). In order to concentrate on essentials, we consider a case in which the countries are identical with respect to their distaste for low relative income (the parameters α_h and α_l are the same across all countries), as well as with respect to the share of the low-income groups and the high-income groups in their populations (the parameter l is the same in all the countries). We also assume that the cost of admitting and integrating an asylum seeker, T, is the same in all the countries. However, and importantly for our analysis, the countries might differ in the levels of the income of the low-income group and the high-income group, which we denote, respectively, by x^i_l and x^i_h for $i \in \{1, ..., C\}$.

We seek to maximize aggregate social welfare with respect to the ratios $m^1, ..., m^C$ subject to (8) and the conditions $0 \leq m^i \leq m^i_{\max}$ for $i \in \{1, \ldots, C\}$. We can express condition (8) in terms of the ratios $m^1, \ldots, m^C$, drawing on identity (2) applied to countries 1 through C and get, equivalently, that

$$\sum_{i=1}^{C} N^i \frac{m^i}{1-m^i} = \overline{M}.$$

It is helpful to introduce a function $F : \mathrm{A} \to \mathbf{R}$, where we define $\mathrm{A} \equiv \left[0, m^1_{\max}\right] \times ... \times \left[0, m^C_{\max}\right]$, and $F(m^1, ..., m^C) \equiv \sum_{i=1}^{C} N^i \frac{m^i}{1-m^i} - \overline{M}$.

Aggregate (namely that of all the natives) social welfare is at the maximum if and only if the function $W(\cdot)$ in (9) is maximized on A subject to $F(\cdot) = 0$. Given the continuity of the functions $W(\cdot)$ and $F(\cdot)$ on A, and given the compactness of the set A, this maximum exists. The following claim delineates the properties of this maximum.

Claim 2. Let there be C countries that are identical both with respect to the distaste felt by members of their populations for low relative income, and with respect to the share of low-income members and high-income members in their populations, yet the countries can differ in the size of their populations and in the levels of incomes of the low-income groups and the levels of incomes of the high-income groups. Assume, further, that the cost of admitting and integrating an asylum seeker, T, is the same in all the countries. Then, in order for aggregate welfare to be maximized, for any pair of countries the asylum seeker-to-population ratio should be higher in the country in which the difference between the incomes of the high-income members and the incomes of the low-income members is bigger.

Proof. The proof is by contradiction. Let $m^* = (m^{1*}, ..., m^{C*})$ be the vector of asylum seeker-to-population ratios that maximizes aggregate welfare, and suppose that for some countries r and s, $x_h^r - x_l^r \geq x_h^s - x_l^s$ but $m^{r*} < m^{s*}$. That is, suppose that the country in which the difference between the incomes of the high-income group and the incomes of the low-income group is slightly higher admits strictly fewer asylum seekers than the country in which the difference is smaller. Suppose further that we relocate a small number of asylum seekers from country s to country r. Because in the process the aggregate number of asylum seekers in s and in r is constant and equal to, say, $\overline{M}^{sr}$ then, upon reapplying (2), we have that

$$M^s + M^r = N^s \frac{m^s}{1-m^s} + N^r \frac{m^r}{1-m^r} \equiv \overline{M}^{sr}.$$

Using the implicit function theorem, this last condition yields a relationship between m^r and m^s of the form

$$\frac{dm^s(m^r)}{dm^r} = -\frac{N^r(1-m^s(m^r))^2}{N^s(1-m^r)^2}. \tag{10}$$

Recalling (9), the change in social welfare brought about by the reallocation between countries s and r, namely by the increase in the number of asylum seekers in r and the corresponding decrease in the number of asylum seekers in s, is then

$$\begin{aligned} &\frac{d}{dm^r} W(m^{1*}, ..., m^{C*}) \\ &= \frac{N^s}{N} \frac{d}{dm^r} SW_s(m^s(m^r))\Big|_{m^s = m^{s*},\ m^r = m^{r*}} + \frac{N^r}{N} \frac{d}{dm^r} SW_r(m^r)\Big|_{m^r = m^{r*}} \\ &= \frac{N^s}{N} SW_s'(m^{s*}) \frac{dm^s}{dm^r}\Big|_{m^s = m^{s*},\ m^r = m^{r*}} + \frac{N^r}{N} SW_r'(m^{r*}). \end{aligned} \tag{11}$$

Utilizing (6) we get

$$\begin{aligned} SW_i'(m^i) &= \frac{hl\alpha_l(1-m^i)^2(x_h^i - x_l^i) - hT(1-\alpha_h) - lT(1-\alpha_l)}{(1-m^i)^2} \\ &= hl(x_h^i - x_l^i) - \frac{hT(1-\alpha_h) + lT(1-\alpha_l)}{(1-m^i)^2}. \end{aligned} \tag{12}$$

Thus, upon substituting (10) and (12) into (11), we get

$$\begin{aligned}\frac{d}{dm^r}W(m^{1*},\ldots,m^{C*}) &= -\frac{N^s}{N}\left[hl(x_h^s-x_l^s)-\frac{hT(1-\alpha_h)+lT(1-\alpha_l)}{(1-m^{s*})^2}\right]\frac{N^r(1-m^{s*})^2}{N^s(1-m^{r*})^2}\\ &\quad+\frac{N^r}{N}\left[hl(x_h^r-x_l^r)-\frac{hT(1-\alpha_h)+lT(1-\alpha_l)}{(1-m^{r*})^2}\right]\\ &= -\frac{N^r}{N}\left[hl(x_h^s-x_l^s)-\frac{hT(1-\alpha_h)+lT(1-\alpha_l)}{(1-m^{s*})^2}\right]\frac{(1-m^{s*})^2}{(1-m^{r*})^2}\\ &\quad+\frac{N^r}{N}\left[hl(x_h^r-x_l^r)-\frac{hT(1-\alpha_h)+lT(1-\alpha_l)}{(1-m^{r*})^2}\right]\\ &= \frac{N^r hl}{N(1-m^{r*})^2}\left[(x_h^r-x_l^r)(1-m^{r*})^2-(x_h^s-x_l^s)(1-m^{s*})^2\right]>0,\end{aligned} \tag{13}$$

where the inequality at the end of (13) holds true because we have assumed that $x_h^r - x_l^r \geq x_h^s - x_l^s$ and that $1-m^{r*} > 1-m^{s*}$. Thus, we have shown that by relocating a small number of asylum seekers from country s to country r, the aggregate social welfare can be increased, contradicting the optimality of m^*. Therefore, if $x_h^r - x_l^r \geq x_h^s - x_l^s$, then $m^{r*} \geq m^{s*}$. Q.E.D.

The same reasoning can be used to prove the following remark.

Remark 2. For any two countries in the group of C countries, the asylum seeker-to-population ratio should be strictly higher in the country in which the difference between the income of the high-income members and the income of the low-income members is strictly greater.

4. Policy comparison: Admitting m^* asylum seekers, or making a transfer of income from the high-income natives to the low-income natives

From Claim 1 we know that social welfare can be increased by the admission and integration of asylum seekers, which is costly. But what if the high-income members of the native population query the logic of the policy, asking: "given that we are taxed, would not the low-income members of the population gain more by having the tax transferred to them directly rather than being used to finance the admission and integration of asylum seekers? Would it not be better to transfer $m^*T/(1-m^*)$ collected from each of us to the low-income members of the population?"

To respond to this question, we treat the optimal share of asylum seekers exhibited in (7) as a function of the cost T, and we consider a tax-and-transfer policy in which an amount $m^*(T)T/[1-m^*(T)]$ is collected from each of the high-income natives and is distributed uniformly among the low-income natives, such that each of the latter receives $\frac{N_h}{N_l}\frac{m^*(T)T}{1-m^*(T)} = \frac{h}{l}\frac{m^*(T)T}{1-m^*(T)}$, where $T < T_0$, with T_0 defined in Claim 1. Assuming that the transfer is not so great as to reverse the order of the incomes of

the two groups of natives, namely assuming that $x_h - \frac{m^*(T)T}{1-m^*(T)} > x_l + \frac{h}{l}\frac{m^*(T)T}{1-m^*(T)}$, the corresponding post-transfer social welfare, treated as a function of the cost T, is

$$\begin{aligned}\overline{SW}(T) &= l\left[(1-\alpha_l)\left(x_l + \frac{h}{l}\frac{m^*(T)T}{1-m^*(T)}\right) - \alpha_l h\left(x_h - \frac{m^*(T)T}{1-m^*(T)} - x_l - \frac{h}{l}\frac{m^*(T)T}{1-m^*(T)}\right)\right] \\ &\quad + h(1-\alpha_h)\left(x_h - \frac{m^*(T)T}{1-m^*(T)}\right) \\ &= l\left[(1-\alpha_l)\left(x_l + \frac{h}{l}\frac{m^*(T)T}{1-m^*(T)}\right) - \alpha_l h\left(x_h - x_l - \frac{l+h}{l}\frac{m^*(T)T}{1-m^*(T)}\right)\right] \\ &\quad + h(1-\alpha_h)\left(x_h - \frac{m^*(T)T}{1-m^*(T)}\right).\end{aligned}$$

Is it possible then that $SW(m^*(T)) > \overline{SW}(T)$, namely that from a social welfare point of view the optimal policy of admission and integration of asylum seekers is preferable to an equivalent direct transfer? We define

$$\begin{aligned}\Delta SW(T) &\equiv SW(m^*(T)) - \overline{SW}(T) \\ &= \alpha_l h l m^*(T)(x_h - x_l) - \frac{m^*(T)T}{1-m^*(T)}\left\{\alpha_l h^2 + h\left[1-\alpha_l(1-l)\right] + (1-\alpha_l)l\right\}.\end{aligned} \tag{14}$$

From (7) we have that $\lim_{T\to 0} m^*(T) = 1$, and from the calculation in footnote 11 we know that $\lim_{T\to 0} \frac{m^*(T)T}{1-m^*(T)} = 0$. Therefore, an implication of (14) is that

$$\lim_{T\to 0} \Delta SW(T) = \alpha_l h l (x_h - x_l) > 0$$

holds true and, thus, there exists $T_3 > 0$ such that for every $T < T_3$ we have that $SW(m^*(T)) - \overline{SW}(T) > 0$, namely the policy of admitting m^* asylum seekers is preferable to an equivalent transfer policy if the cost of bringing in the asylum seekers is small enough. We summarize the main findings of the preceding analysis in the following claim.

Claim 3. Let $\overline{T} \equiv \min\left\{T_0, T_3\right\}$. Admitting asylum seekers up to the point at which their share in the population is $m^*(T)$, where the cost of admitting and integrating each asylum seeker is $T < \overline{T}$, constitutes a policy that is socially preferable to a policy of redistributing (evenly) among the low-income natives the amount $\frac{m^*T}{1-m^*}$ collected from each of the high-income natives, namely $SW(m^*(T)) > \overline{SW}(T)$.

5. Measures of robustness

The results reported in the preceding sections do not depend on the particular definition of RD_l presented in Sub-section 2.1. For example, we can define relative deprivation as the distance from the mean income of the population taken from below the mean income $\overline{x} = \frac{N_l x_l + N_h x_h + M x_m}{N+M}$. In this case,

$$\overline{RD}_l = \max\{\overline{x} - x_l, 0\} = \max\left\{\frac{N_l x_l + N_h x_h + M x_m - (N_l + N_h + M)x_l}{N+M}, 0\right\}$$
$$= \max\left\{\frac{N_h(x_h - x_l) - M(x_l - x_m)}{N+M}, 0\right\} = \max\{h(1-m)(x_h - x_l) - m(x_l - x_m), 0\},$$

namely we obtain a negative relationship between the share of asylum seekers in the population, m, and the disutility of the low-income natives from experiencing relative deprivation (that is, as long as the asylum seekers join the income hierarchy "from below," and as long as the number of asylum seekers is low enough such that $N_h(x_h - x_l) - M(x_l - x_m) > 0$). Thus, results analogous to those of Claims 1 through 3 will be obtained also under this alternative formulation.

Nor do our results rely on a linear characterization of the preferences for (absolute) income. That is to say, a qualitatively similar analysis to the analysis undertaken in Section 2 can be undertaken for utility functions of, respectively, the low-income natives and the high-income natives defined as

$$\tilde{u}_l = (1-\alpha_l) f(x_l) - \alpha_l RD_l,$$

and

$$\tilde{u}_h = (1-\alpha_h) f(x_h),$$

where $f(\cdot)$ is a twice differentiable, strictly increasing, and strictly concave function.

In addition, our results are robust to a progressive method of taxation in which the high-income natives pay a higher tax than the low-income natives. Under such a scheme, the tax burden for each of the low-income natives is $\theta_l = a\frac{mT}{1-m}$ where $0 < a < 1$, and the tax burden for each of the high-income natives is $\theta_h = \frac{1-al}{h}\frac{mT}{1-m}$. Then, the total tax revenue is

$$N_l\theta_l + N_h\theta_h = N\left(la\frac{mT}{1-m} + h\frac{1-al}{h}\frac{mT}{1-m}\right) = N\frac{mT}{1-m} = MT,$$

which is equal to the entire cost of admitting and integrating the asylum seekers.

We have assumed that the incomes of low-income natives are not affected by the asylum seekers' entry into the host country's labor force other than through the tax levied to pay for their admission and integration. Recent evidence increasingly suggests that less skilled native workers respond to the inward migration of low-skill migrants by moving out of manual jobs and into more complex occupations. As a result of this increased specialization, the wages of the low-skill native workers increase (consult Foged and Peri, 2016, and references to studies and surveys therein). If we consider the less skilled native workers to constitute the low-income natives in our model, then inclusion of this "upgrading" effect will benefit them further. Moreover, the recent wave of asylum seekers into Europe consists largely of people who did not invest in the acquisition of destination-specific human capital before leaving, as people often do when they plan to migrate well in advance of their departure. It is therefore likely

that the recent asylum seekers will have skills that will place them low down in the overall skill distribution of the host countries.

Recalling the utility function $u_l = (1-\alpha_l)x_l - \alpha_l RD_l$, it is worth adding that our modeling framework could accommodate a situation in which the earnings of low-income natives fall in the wake of the admission and integration of asylum seekers, their relative deprivation is reduced, and their wellbeing is increased if the weighted combination of lowered income and lowered relative deprivation is still bigger than the starting combination.

We can likewise accommodate a situation in which in the wake of the admission and integration of asylum seekers, the earnings of low-income natives fall somewhat, and the earnings of high-income natives increase somewhat, in line with findings in some of the empirical literature on the labor market impact of low-skill migration. To this end, we revisit Claim 1, assuming now that the wages of both the low-income natives and the high-income natives are affected by the admission and integration of asylum seekers, so we express $x_l = x_l(m)$, and $x_h = x_h(m)$. We define $\lambda(m) \equiv x_h(m) - x_l(m)$, the income gap within the native population as a function of the share of asylum seekers in the population. For simplicity's sake, we assume that the natives share the same distaste for relative deprivation, namely that $\alpha_l = \alpha_h = \alpha$. In this case, and as compared to (4), the social welfare function of the native population is

$$\begin{aligned} SW(m) &= \left[l(1-\alpha_l)x_l(m) + h(1-\alpha_h)x_h(m)\right] - \frac{mT}{1-m}\left[l(1-\alpha_l) + h(1-\alpha_h)\right] \\ &\quad - \alpha_l hl(1-m)\lambda(m) \\ &= (1-\alpha)\left[lx_l(m) + hx_h(m)\right] - (1-\alpha)\frac{mT}{1-m} - \alpha hl(1-m)\lambda(m). \end{aligned} \tag{15}$$

If we let the admission and integration of the asylum seekers affect negatively the earnings of comparable native workers and positively the earnings of complementary native workers, namely if we let $x_l'(m) < 0$ and $x_h'(m) > 0$ then, if we could reasonably assume that the average income of the natives remains approximately unchanged, namely that $lx_l'(m) + hx_h'(m) = 0$, we will have that

$$SW'(m) = -(1-\alpha)T\frac{1}{(1-m)^2} - \alpha hl\left[-\lambda(m) + (1-m)\lambda'(m)\right], \tag{16}$$

which implies that

$$SW'(0) > 0 \quad \text{iff} \quad (1-\alpha)T < \alpha hl\lambda(0)\left(1 - \frac{\lambda'(0)}{\lambda(0)}\right). \tag{17}$$

Thus, when asylum seekers are admitted and integrated, the social welfare of the natives is more likely to increase when the cost of admission and integration, T, is lower; when the initial income gap between the high-income natives and the low-income natives, $\lambda(0)$, is higher; and when the percentage increase of this gap in the wake of the admission and integration of asylum seekers, $\frac{\lambda'(0)}{\lambda(0)}$, is smaller.

6. Conclusions

In this paper we built on an idea developed in Stark et al. (2015), which modeled the effect of migration into a country on the life satisfaction of the native population. Founded on the concept of relative deprivation, the model in Stark et al. tracked how the inclusion of migrants in the comparison set of the natives affects the wellbeing of the natives. Stark et al. found that the crucial determinants in this regard are the relationship between the relative deprivation experienced by the natives from comparisons with other natives, and the level of integration of the migrants which in turn determines their incomes. In the current paper, when in the wake of their admission and integration the asylum seekers join the income distribution of the native population from below, their presence reduces the relative deprivation of those natives who, prior to the asylum seekers' arrival, experienced relative deprivation. However, this is a benefit that needs to be balanced against a cost; in the present context this is the cost incurred in admitting and integrating the asylum seekers. Assessing these opposing effects in the setting of maximization of social welfare has enabled us to determine the optimal number of asylum seekers, as well as to define a condition under which the admission of asylum seekers is preferable to an alternative policy of direct financial transfers from high-income natives to low-income natives. When several countries receive asylum seekers, we formulated a procedure for allocating the asylum seekers among the countries so as to maximize the countries' aggregate social welfare.

At some point, the asylum seekers could become natives, in which case they will "enter" the social welfare function that a government will seek to maximize. Will they not then experience relative deprivation which might reduce social welfare if they enter the income distribution from below? Could the welfare-increasing effect of the admission and integration in the short run translate into a welfare-decreasing effect in the long run, thereby reversing the predictions of the model? Presumably not. It is likely that over time incomes rise. Of the asylum seekers arriving in the EU in the 1990 and early 2000s, those who have clocked up two decades have caught up with the natives (*The Economist*, June 14, 2018). If the incomes of these asylum seekers-turned-into-natives rise to match those of the low-income natives, then their entering the social welfare constituency actually yields two favorable social welfare effects. First, the relative deprivation of the (original) low-income natives is reduced because of the enlargement of the reference group; a positive externality of sorts. Second, the asylum seekers' own relative deprivation is lower than it would have been had they become part of the social welfare constituency earlier on; namely they enter the social welfare calculus "happier" than if adding them had occurred on, or soon after, arrival.

Although our results do not amount to an ultimate solution regarding the choice of the number of asylum seekers that a country should be willing to admit - many other considerations need to be brought to bear on this issue - our calculations demonstrate how an informed choice can be made if relative deprivation, as a component of the natives' wellbeing, is to be incorporated in configuring the guidance of that choice.

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