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TWO POSSIBLE REASONS BEHIND THE RELUCTANCE OF LOW-SKILLED WORKERS TO MIGRATE TO GENEROUS WELFARE STATES

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Two possible reasons behind the reluctance of low-skilled workers to migrate to generous welfare states

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Abstract: This paper provides two possible explanations for the mixed evidence regarding migration by low-skilled workers to generous welfare states. Using a model of unrestricted migration to a developed, destination country, which provides a direct and equal social benefit to all its residents, we study the impact of the benefit in a country on the size of its low-skilled immigrant population under the assumption that migration is driven by an international difference in returns to skills, employment opportunities in the destination country, and by the generosity of the benefit in that country. We find that the social benefit affects the size of the country's low-skilled immigrant population not only directly, via the difference between the benefit and its cost in the form of taxation, but also via two indirect channels. The benefit incentivizes taking up low-skilled jobs among the destination country's native residents, which adversely affects wages of low-skilled workers in that country, and it increases the risk of unemployment of low-skilled workers therein. Prospective low-skilled migrants view these side effects of the benefit as "stay away" factors. Simulation of the model based on 2018 data for EU-15 economies without Luxembourg highlights the importance of indirect channels in curtailing the inflow of low-skilled migrants to a generous welfare state. When only direct channels are accounted for, semi-elasticities of the size of the low-skilled immigrant population with respect to the social benefit are between 0.2 and 0.54. When indirect channels are allowed to play their roles, the positive relationship between the social benefit and low-skilled immigration is significantly reduced; the semi-elasticities range from 0.13 to 0.4. At the level of the model's fundamentals, the variation in semi-elasticities between EU-15 countries is largely explained by differences in the size of the welfare state and in efficiency of the labor market across these countries.

Keywords: Welfare migration, Migration by low-skilled workers, Skill formation in a destination country, Unemployment in a destination country

JEL codes: F22, H31, J24, J64

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1. Introduction

The concern that countries characterized by generous social benefits and liberal migration policies attract mainly low-skilled, low-earning migrants, who put a pressure on these countries' public finances, threatening the sustainability of the welfare state model, is currently one of the leading topics in political discourse in many countries of the North.[1] Yet the temperature of the discourse seems to result largely from the intuitive appeal of the concern rather than from the evidence assembled thus far. Existing empirical studies do not yield an unequivocal verdict regarding the strength of the "welfare magnet" effect or even its very existence. Borjas (1999) shows that immigrant welfare recipients, unlike natives and immigrants not relying on social assistance, are clustered in US states that offer relatively generous welfare provisions. Levine and Zimmerman (1999) find no effect of the social program *Aid to Families with Dependent Children* on interstate migration decisions of poor single mothers in the US. Gelbach (2004) reports a strong evidence of US interstate welfare migration among never married single mothers who are high-school dropouts in the 1980 sample but not in the 1990 sample. Pedersen, Pytlikova, and Smith (2008) find no evidence of public social expenditures having major influence on migration flows to OECD countries between 1990 and 2000. De Giorgi and Pellizzari (2009) find significant yet small effect of the generosity of welfare states on location decisions of migrants in EU-15 countries. The results of the study by Skupnik (2014) indicate that the size of migration to EU-15 countries from 12 countries which accessed the EU in 2004 and 2007 is not affected by welfare spending at destination. Razin and Wahba (2015) find strong evidence of welfare migration in 14 EU countries (EU-15 without Luxembourg) plus Norway and Switzerland. Ponce (2019) reports that migration to Northern Europe is not driven by welfare provisions at destination. In a quasi-experimental setting, Giua (2020) shows that lifting restrictions on access to welfare benefits in the UK by migrants from A8 countries, which took place in 2011, had no effect on the inflow of migrants from these countries to the UK. De Jong, Adserà, and de Valk (2020) distinguish three types of welfare provisions - family, old-age, and unemployment benefits - and observe a positive relationship between intra-EU migration and

[1] In his Arizona immigration speech in 2016, just prior to presidential elections, Donald Trump said that "all immigration laws will be enforced. (…) Our enforcement priorities will include removing (…) those relying on public welfare or straining the safety net" (Politico, 2016). In 2019, president Donald Trump's administration issued new regulation specifying the requirements based on which an immigrant is classified as likely to be a "public charge," and denied a US visa (USCIS, 2020). In his campaign for the 2015 general election, the former UK prime minister David Cameron promised restricting immigrants' access to welfare benefits in the UK to be "an absolute requirement in the renegotiation" of Britain's special status in the EU (BBC, 2014). After the Brexit, the UK government announced plans to implement a point-based immigration policy designed to reduce the inflow of low-skilled workers (BBC, 2020). Austria's government under chancellor Sebastian Kurz also considered cutting welfare benefits for immigrants (BBC, 2018).

the first two types of benefits, and a negative relationship in the case of unemployment benefits. Because empirical research on the pull exerted by generous social benefits at destination predominantly concern unrestricted migrations between US states or EU member countries, the results of these research cannot be explained by restrictive immigration policies in destination countries. It seems that something else is holding back foreign low-skilled workers from migrating *en masse* to generous welfare states / regions.

The discrepancy between the intuitively appealing concern and a much less clear empirical evidence cannot be explained based on available theory either. Studies which use economic modeling to derive testable hypotheses regarding the impact of social benefits in a country on the intensity of unrestricted migration by low-skilled workers to the country predict a strong and positive relationship (Razin and Sadka, 2000; Cohen and Razin, 2008; Cohen, Razin, and Sadka, 2009). The same result can be derived within the framework of Borjas' (1987) migrant self-selection model. The model predicts that countries characterized by a compressed income distribution will attract relatively low-skilled migrants. Because generous social programs are means of compressing income distribution, a positive relationship between social benefits and low-skilled migration obtains. These predictions are in line with the intuitive concern, but less so with the (mixed) evidence.

We argue that existing economic models provide only a partial picture of the complex relationship between social benefits and immigration by low-skilled workers, as they abstract from two important considerations. First, social benefits in a country affect not only the skill composition of the group of migrants, but, above all, the skill composition of its native workforce. Other things equal, a country characterized by generous social benefits incentivizes taking up low-skilled jobs to a higher degree than a country characterized by less generous social benefits. Consequently, the generous country will have a relatively numerous low-skilled native workforce. If high-skilled work and low-skilled work are complementary factors of production, then we should expect the relatively generous country to end up with lower wages paid to low-skilled workers; a "stay away" factor from the perspective of low-skilled migrants. Second, social benefits can be expected to raise unemployment, because they reduce workers' earnings after taxation (assuming that social programs are financed from a tax levied on wage earnings) while providing a safety net in the case of a job loss. That is, social benefits lower the return from working relative to the return from not working. Therefore, a country characterized by generous social benefits will face a larger share of its workforce unemployed than a country characterized by less generous social benefits, other things equal; a yet another "stay away" factor for low-skilled migrants. These indirect effects via which social programs at destination likely shape the inflow of low-skilled migrant workers should at least partly offset the pull exerted by the programs directly. Therefore, a meaningful assessment of the attractiveness of a country for the migrants should take into consideration the interplay between the country’s social policy, the skill composition of its native workforce, and the prevalence of unemployment. In this paper, we provide such an assessment.

We build a model of unrestricted immigration to a developed, destination country from a less developed, foreign country. The model includes workers of two skill classes (high-skilled and low-skilled), skill complementarity in output production, a social benefit financed from a proportional tax on wage earnings, endogenous unemployment, and endogenous determination of the size of the immigrant population and its skill composition. We derive conditions which characterize market equilibrium, and we quantitatively evaluate the relationship between the social benefit in the destination country and the size and skill composition of the country’s immigrant population. We do this by calculating semi-elasticities with respect to the generosity of the social benefit of the size of the low-skilled immigrant population and the size of the high-skilled immigrant population for EU-15 countries without Luxembourg for the year 2018. We distinguish between direct semi-elasticities and overall semi-elasticities. Direct semi-elasticities are calculated while holding fixed the skill distribution of the native population and unemployment rates in the destination country. Overall semi-elasticities take into account all benefit-induced adjustments, specifically adjustments in the skill distribution of the destination country’s native population and in unemployment rates. We find that direct semi-elasticities of the size of low-skilled immigrant population are positive and strong in all countries (they range from 0.2 to 0.54), and that overall semi-elasticities remain positive yet are significantly lower compared to direct semi-elasticities (they are between 0.13 and 0.4). At the level of the model’s fundamentals, the variation in semi-elasticities between EU-15 countries is largely explained by differences in the size of the welfare state and in efficiency of the labor market across these countries.

To the best of our knowledge, no paper to date has studied migration in a framework with skill complementarity, endogenous skill choice, endogenous unemployment, and endogenous determination of the size and skill composition of the immigrant population. The closest papers to ours in terms of framework (but not in terms of their applications) are by Eggert, Krieger, and Meier (2010), Chassamboulli and Palivos (2014), and Battisti et al. (2018). Eggert, Krieger, and Meier study interregional migration within a model of a welfare state with endogenous skill choice, endogenous unemployment, and endogenous determination of migration, yet without skill complementarity. By assuming that high-skilled workers and low-skilled workers are perfect substitutes in output production, Eggert, Krieger, and Meier abstract from arguably the most often explored channel via which migrants affect their destination: via wage adjustments. Chassamboulli and Palivos (2014), and Battisti et al. (2018) analyze the effects of international migration in models of a welfare state with two skill classes, endogenous unemployment, and skill complementarity, yet without endogenous skill choice and without endogenous determination of the size and skill composition of the immigrant population. They assume that the destination country restricts the inflow of migrants, which places a binding constraint on the number of foreign workers who are allowed in. Consequently, the number of migrants in their models is fixed, and is not affected by social benefits. In contrast, the relationship between social benefits and the size of migration is at the core of our model.

This paper relates to rich literature on location choices, of which recent examples include Caliendo, Dvorkin, and Parro (2019) who study the effects for the US labor market of a productivity rise in China's manufacturing sector, and Caliendo et al. (2021) who measure the welfare effects of the EU enlargement. Their purpose is to quantify the effects of a policy / event, and for that purpose they involve rich, multi-sector, multi-country modeling framework. In contrast, this paper's aim is to contribute to the theory of welfare migration, which is why its modeling framework is much more stylized.

The analysis presented in this paper pays particular attention to the issue of self-selection of the migrants by their skills, which for economic, social, and political reasons is at what the debate over the sustainability of the welfare state in the wake of increasing migration should be centered. According to the labor market competition model, the arrival of migrants will have different redistributive effects depending on the relative supply of low-skilled workers and high-skilled workers among the migrants, because of their complementarity as factors of production. The fiscal burden hypothesis states that high-skilled immigrants are net contributors to social benefit programs while low-skilled immigrants are a net burden. Even though empirical support for the fiscal burden hypothesis is slim (Dustmann and Frattini, 2014; Martinsen and Rotger, 2017; for a comprehensive review of the empirical literature testing the fiscal burden hypothesis see Hennessey and Hagen-Zanker, 2020), citizens of countries characterized by generous social spending view immigrants as less deserving of public assistance than natives (van Oorschot, 2006; van der Waal et al., 2010; Cappelen and Midtbø, 2016; Hjorth, 2016), and immigration by high-skilled workers as more welcome than immigration by low-skilled workers (Hainmueller and Hiscox, 2010; Helbling and Kriesi, 2014; Blinder and Markaki, 2018; and Naumann, Stoetzer, and Pietrantuono, 2018). From the political economy perspective, varying by immigrants' skill class public attitude towards them matters for the formulation of migration policy (Benhabib, 1996; Razin, Sadka and Suwankiri, 2011; Razin and Wahba, 2015; Suwankiri, Razin, and Sadka, 2016) and for public support for redistribution (Alesina, Miano, and Stantcheva, 2023; a review of evidence on the link between public attitude towards immigrants and the support for redistribution can be found in online appendix to Alesina and Stantcheva, 2020). Recent European experience is a case in point: the perceived costs of immigration in terms of excessive use of welfare benefits by the migrants may have had their share in the outcome of the Brexit referendum (Skinner, 2016), and in the recent surge of support for far-right in European countries (Ennser-Jedenastik, 2017; Dustmann, Vasiljeva, and Damm, 2019; Edo et al., 2019). In response to the latter, mainstream political forces in European welfare states already started adopting far-right parties' postulates to update the rules regarding migrants' access to welfare benefits (Schumacher and van Kersbergen, 2016; The New York Times, 2019).

The paper is structured as follows. In Section 2, we build a model of a developed country that is open to unrestricted migration and we establish the relationship between the social benefit, wage rates, and unemployment rates in the country. In Section 3, we provide a quantitative application of the model to the case of migration to EU-15 countries (without Luxembourg). Section 4 discusses limitations of the analysis and concludes.

2. The model

Consider a developed, destination country populated by infinitely-lived individuals who are either natives or immigrants. The size of the native population is normalized at 1; the size of the immigrant population, M, determines endogenously. At the beginning of their lives, native individuals choose whether or not to form skills. If they choose to do so, they become high-skilled workers, denoted by H; if they choose not to, they become low-skilled workers, denoted by L. Skill formation is costly, and the cost differs between the natives. It is a product of a constant $\kappa > 0$ and the realization s of a random variable distributed continuously over the interval $s \in (0, +\infty)$ according to a cumulative distribution function $F(\cdot)$. We denote the size of the low-skilled native population and the size of the high-skilled native population as N_L and N_H, respectively, such that $N_L + N_H = 1$.

Immigrants come from a less developed, foreign country, which is populated by $\tilde{N}_L$ low-skilled workers and $\tilde{N}_H$ high-skilled workers. We assume that migration between the foreign country and the destination country is unrestricted, and that there is perfect skill transferability between the countries. When migrants arrive to the destination country, they are already past their skill choice. We denote the size of the low-skilled immigrant population and the size of the high-skilled immigrant population in the destination country as M_L and M_H, respectively, such that $M_L + M_H = M$. Each foreign worker faces a migration cost which is a realization *m* of a random variable distributed continuously over the interval $(0,+\infty)$ according to acumulative distribution function $F_L(\cdot)$ if the foreign worker is low-skilled or $F_H(\cdot)$ if he is high-skilled, respectively. The migration cost includes all losses associated with the act of migration such as direct cost of setting up a new household and foregone income.

A large number of competitive firms produce the consumption good which they sell at a unit price. Following Battisti et al. (2018), the production technology is Cobb-Douglas with two inputs: physical capital and a composite intermediate good:

$$Y_i = AK_i^{\alpha} Z_i^{1-\alpha}, \tag{1}$$

where Y_i is the output of firm *i*; K_i and Z_i are quantities of capital and the composite good employed by firm *i*, respectively; α and $1-\alpha$, $0<\alpha<1$, are the output elasticities of capital and the composite good, respectively; and $A>0$ is the economy-wide total factor productivity. The composite good is produced by means of a CES technology which uses two intermediate goods: the low-skill intensive good in quantity Y_{Li} and the high-skill intensive good in quantity Y_{Hi}, such that

$$Z_i = \left(xY_{Li}^{\rho} + (1-x)Y_{Hi}^{\rho}\right)^{1/\rho}, \tag{2}$$

where *x*, $0<x<1$, is a productivity parameter, and ρ determines the elasticity of substitution between the two intermediate goods. Guided by the available estimates of the values of α and ρ, we assume that $\alpha + \rho < 1$.

The two intermediate goods are produced by single-worker firms such that a firm employing one low-skilled worker produces π_L units of the low-skill intensive good, whereas a firm employing one high-skilled worker produces π_H units of the high-skill intensive good. The prices of the respective intermediate goods, p_L and p_H, and the gross wage of a low-skilled worker and the gross wage of a high-skilled worker, w_L and w_H, respectively, determine endogenously. On the demand side for intermediate goods, quantities Y_{Li} and Y_{Hi} follow from the regular first-order profit maximization conditions of a firm producing the consumption good. Because all firms produce according to the same Cobb-Douglas production technology, these conditions hold at the aggregate level yielding

$$p_L = AK^{\alpha}(1-\alpha)xY_L^{\rho-1}\left(xY_L^{\rho}+(1-x)Y_H^{\rho}\right)^{\frac{1-\alpha}{\rho}-1} = (1-\alpha)Y\frac{xY_L^{\rho-1}}{xY_L^{\rho}+(1-x)Y_H^{\rho}} \tag{3}$$

and

$$p_H = AK^{\alpha}(1-\alpha)(1-x)Y_H^{\rho-1}\left(xY_L^{\rho}+(1-x)Y_H^{\rho}\right)^{\frac{1-\alpha}{\rho}-1} = (1-\alpha)Y\frac{(1-x)Y_H^{\rho-1}}{xY_L^{\rho}+(1-x)Y_H^{\rho}}, \tag{4}$$

where $K=\sum_i K_i$, $Y_L=\sum_i Y_{Li}$, $Y_H=\sum_i Y_{Hi}$, and $Y=\sum_i Y_i$. The quantity of capital rented by firm *i* is determined by equating the rental cost of capital with its marginal product, which also holds at the aggregate level:

$$(r+\delta)K = AK^{\alpha}Z^{1-\alpha} = \alpha Y, \tag{5}$$

where $Z=\sum_i Z_i$, r is the world interest rate, and δ is the rate at which capital depreciates. On the supply side, the quantities of intermediate goods produced by all firms are given by firm-level outputs, π_L and π_H, aggregated over all firms within respective sectors. Because each firm employs exactly one worker, the mass of firms producing intermediate goods is equal to the mass of employed workforce, yielding

$$Y_k = \left(1-u_k\right)\left(N_k+M_k\right)\pi_k \tag{6}$$

for $k=L,H$, where u_k, the unemployment rate in sector *k*, is endogenously determined.

We assume a segregated labor market with search frictions. Firms post vacancies separately for low-skilled jobs and for high-skilled jobs, and bear a fixed cost c_k per unit of time for an open vacancy of in sector $k = L, H$, while unemployed low-skilled workers and unemployed high-skilled workers search for jobs. Firms do not discriminate between native and immigrant workers, who are equally productive and, thus, receive the same gross market wage w_L if they work as low-skilled workers or w_H if they work as high-skilled workers, per unit of time. All workers, native and immigrant alike, enter the labor market unemployed. We assume the existence of a matching function which pairs vacancies with unemployed workers. Denoting the mass of vacancies and the mass of unemployed workers searching for jobs at every instant of time as *V* and *U*, respectively, the matching function is given by

$$Q(V_k, U_k) = \xi U_k^{\varepsilon}, V_k^{1-\varepsilon}$$

for sector $k = L, H$, where ε, $0 < \varepsilon < 1$, is the matching elasticity and $\xi > 0$ is the efficiency parameter. We denote labor market tightness as $\theta \equiv V / U$, namely as the mass of vacancies relative to the mass of unemployed workers, which we use to express the arrival rate of unemployed workers to vacancies as $Q(U_k, V_k) / V_k = \xi \theta_k^{-\varepsilon} \equiv q(\theta_k)$ and the arrival rate of jobs to unemployed workers as $Q(U_k, V_k) / U_k = \xi \theta_k^{1-\varepsilon} = \theta_k q(\theta_k)$. Firms producing intermediate goods face a positive probability of a negative shock which reduces productivity of its worker to an arbitrarily low value, making further production unprofitable. When that happens, the firm closes, its worker becomes unemployed and starts searching for another job. Shocks hit firms according to a Poisson process at an exogenous rate λ_k, $k = L, H$, which may differ between the two sectors. In equilibrium, within each sector, the mass of workers who become unemployed is equal to the mass of unemployed workers who find new jobs (per unit of time), namely $\lambda_k (1 - u_k)(N_k + M_k) = \theta_k q(\theta_k) u_k (N_k + M_k)$, which pegs the equilibrium rate of unemployment at

$$u_k = \frac{\lambda_k}{\lambda_k + \theta_k q(\theta_k)}. \tag{7}$$

The value of a firm producing intermediate goods, J^P, and the value of an open vacancy, J^V, are given in equilibrium by the following Bellman equations:

$$rJ_k^P = p_k \pi_k - w_k + \lambda_k \left(J_k^V - J_k^P \right) \tag{8}$$

and

$$rJ_k^V = -c_k + q(\theta_k)\left(J_k^P - J_k^V\right). \tag{9}$$

Because the free entry condition brings down expected profits of a firm to zero, we have that $J_k^V = 0$, which allows us to solve (9) for J_k^P, yielding

$$J_k^P = \frac{c_k}{q(\theta_k)}. \tag{10}$$

On substitution of $J_k^V = 0$ and (10) into (8), we obtain the condition that governs the demand for work in sector $k = L, H$:

$$p_k \pi_k = w_k + \frac{(r + \lambda_k)c_k}{q(\theta_k)}. \tag{11}$$

For workers, the value of being employed, J^E, and the value of being unemployed, J^U, are given in equilibrium by

$$rJ_k^E = (1-\tau)w_k + b\bar{w} + \lambda_k(J_k^U - J_k^E) \tag{12}$$

and

$$rJ_k^U = b\bar{w} + \theta_k q(\theta_k)(J_k^E - J_k^U), \tag{13}$$

respectively, where τ is the tax rate and where the social benefit, discussed in more detail further below, is expressed as a fraction b of the country's mean wage, $\bar{w}$, given by

$$\bar{w} = w_L(1-u_L)\frac{N_L + M_L}{1+M} + w_H(1-u_H)\frac{N_H + M_H}{1+M}. \tag{14}$$

A worker's wage in firm *i* is determined by Nash wage bargaining rule: it is given by $w_{ki} = \arg\max\left(J_{ki}^E - J_k^U\right)^\beta \left(J_{ki}^P - J_k^V\right)^{1-\beta}$, which on substitution for J_{ki}^E from a rewrite of (12) and for J_{ki}^P from a rewrite of (8), namely $J_{ki}^E = \frac{(1-\tau)w_{ki} + b\bar{w} + \lambda_k J_k^U}{r + \lambda_k}$ and $J_{ki}^P = \frac{p_k \pi_k - w_{ki}}{r + \lambda_k}$, respectively, on recalling that $J_k^V = 0$, and on noticing that the outcome of wage bargaining is the same across all firms within a sector (which allows us to drop subscripts *i*) yields

$$w_k = \beta \pi_k p_k + (1-\beta)\frac{rJ_k^U - b\bar{w}}{1-\tau}. \tag{15}$$

Substituting for $J_k^E - J_k^U$ in (13) from a rewrite of the first order condition for wage bargaining, $\beta \frac{1-\tau}{J_k^E - J_k^U} = (1-\beta)\frac{1}{J_k^P}$, on utilizing (10), we get that

$$rJ_k^U = b\bar{w} + (1-\tau)\frac{\beta c_k \theta_k}{1-\beta}. \tag{16}$$

That is, at every moment, being unemployed generates discounted expected flow of income rJ_k^U equal to the social benefit, $b\bar{w}$, augmented by the average gain from possible change of employment status, $(1-\tau)\beta c_k \theta_k / (1-\beta)$. Using (16) to substitute for rJ_k^U in (15), we arrive at

$$w_k = \beta\left(\pi_k p_k + c_k \theta_k\right). \tag{17}$$

Jointly (17) and (11) yield the conditions for the supply of intermediate goods

$$p_L = \frac{c_L\left(r + \lambda_L + \beta\theta_L q\left(\theta_L\right)\right)}{\pi_L\left(1-\beta\right)q\left(\theta_L\right)} \tag{18}$$

and

$$p_H = \frac{c_H\left(r + \lambda_H + \beta\theta_H q\left(\theta_H\right)\right)}{\pi_H\left(1-\beta\right)q\left(\theta_H\right)}. \tag{19}$$

The gross wage of a low-skilled worker and the gross wage of a high-skilled worker are given by (17), on substitution for p_k from (18) or from (19), respectively:

$$w_L = \frac{c_L\beta\left(r + \lambda_L + \theta_L q\left(\theta_L\right)\right)}{\left(1-\beta\right)q\left(\theta_L\right)} \tag{20}$$

and

$$w_H = \frac{c_H\beta\left(r + \lambda_H + \theta_H q\left(\theta_H\right)\right)}{\left(1-\beta\right)q\left(\theta_H\right)}. \tag{21}$$

We now proceed with establishing the condition that governs the division of native individuals between skill classes. Assuming that all individuals maximize expected present discounted value of income subject to discount rate *r*, and that new entrants to the labor market are initially unemployed, a native individual compares the value of being an unemployed high-skilled worker, $J_H^U - \kappa s$, with the value of being an unemployed low-skilled worker, J_L^U.

Because the cost of skill formation is distributed continuously in the native population, there will be an individual characterized with the value of $s = s_0$ such that $J_H^U - \kappa s_0 = J_L^U$. On substitution for J_H^U and J_L^U from (16), on some rearrangement, the latter equality becomes

$$\frac{(1-\tau)\beta}{1-\beta}\left(c_H\theta_H - c_L\theta_L\right) = r\kappa s_0, \tag{22}$$

which is the equilibrium condition that determines the division of native individuals between low-skilled workers and high-skilled workers. The interpretation of (22) is as follows. For the native individual who is indifferent between becoming a low-skilled worker or a high-skilled worker, the assets needed to cover the cost of skill formation can be invested in the financial market, yielding the flow of income $r\kappa s_0$. When invested in skill formation, these assets yield the flow of income equal to the average skill premium in the labor market. Because workers of both skill classes receive the same income when unemployed, equal $b\overline{w}$, the skill premium is given by the average gain from change in employment status, $(1-\tau)\beta\left(c_H\theta_H - c_L\theta_L\right)/(1-\beta)$. All individuals for whom the skill formation cost is lower than s_0 strictly prefer investing their assets in skill formation. Thus, the size of the native low-skilled population and the size of the native high-skilled population are given by $N_L = 1 - F\left(s_0\right)$ and $N_H = F\left(s_0\right)$, respectively.

Next, we specify the conditions that determine the size of the low-skilled immigrant population and the size of the high-skilled immigrant population residing in the country. A foreign worker of skill class $k = L, H$ and migration cost m will choose to migrate if the value of migrating for the worker more than offsets his migration cost, namely if $J_k^U > m$. There will be a threshold level of migration cost $m = m_k$ such that foreign workers of skill class k and migration cost $m < m_k$ will choose to migrate, whereas all those of skill class k and migration cost $m \geq m_k$ will stay in their home country. For the foreign worker of skill class k and migration cost m_k we have that $J_k^U = m_k$ which, on substitution for J_k^U from (16), delivers the conditions that determine the values of threshold migration costs:

$$b\overline{w} + (1-\tau)\frac{\beta c_L\theta_L}{1-\beta} = rm_L \tag{23}$$

and

$$b\bar{w}+(1-\tau)\frac{\beta c_H\theta_H}{1-\beta}=rm_H\,, \tag{24}$$

respectively. The interpretation of (23) and (24) is akin to that of (22). A foreign worker (low-skilled or high-skilled) who is indifferent between migrating and staying in his home country can invest assets equal to his migration cost in the financial market, which yield the flow of income rm_k, $k=L,H$. When "invested" in migration, these assets will yield the flow of income equal $b\bar{w}$ plus the average gain associated with the change of status of an unemployed worker, $(1-\tau)\beta c_k\theta_k/(1-\beta)$, $k=L,H$. All workers of respective skill classes, whose migration cost is lower than m_k, will strictly prefer investing their assets in migration than in the financial market. Thus, the size of the low-skilled immigrant population and the size of the high-skilled immigrant population are given by $M_L=F_L\left(m_L\right)\tilde{N}_L$ and $M_H=F_H\left(m_H\right)\tilde{N}_H$, respectively.

What remains is linking the tax rate, τ, with the social benefit, $b\bar{w}$. We assume that the government of the country collects a fraction τ of each workers gross wage and uses the tax revenue to provide a direct and indiscriminate social benefit $b\bar{w}$ per resident. Capital income is not taxed. The government runs a balanced budget, which yields the following relationship between τ and b: $\tau\left[w_L\left(1-u_L\right)\left(N_L+M_L\right)+w_H\left(1-u_H\right)\left(N_H+M_H\right)\right]=b\bar{w}\left(1+M\right)$, which on utilizing (14) simplifies to

$$\tau=b\,. \tag{25}$$

We now have all the building blocks required for determining equilibrium values of the model's endogenous variables. The equilibrium is fully characterized by six variables - these are K^*, θ_L^*, θ_H^*, s_0^*, m_L^*, and m_H^*, where henceforth an asterisk denotes an equilibrium value of a variable - which solve the system of six equations: (5), two which equate the demands for intermediate goods, (3) and (4), with their respective supplies, (18) and (19), namely

$$AK^{\alpha}(1-\alpha)xY_L^{\rho-1}\left(xY_L^{\rho}+(1-x)Y_H^{\rho}\right)^{\frac{1-\alpha}{\rho}-1}=\frac{c_L\left(r+\lambda_L+\beta\theta_Lq\left(\theta_L\right)\right)}{\pi_L\left(1-\beta\right)q\left(\theta_L\right)} \tag{26}$$

and

$$AK^{\alpha}(1-\alpha)(1-x)Y_H^{\rho-1}\left(xY_L^{\rho}+(1-x)Y_H^{\rho}\right)^{\frac{1-\alpha}{\rho}-1}=\frac{c_H\left(r+\lambda_H+\beta\theta_Hq\left(\theta_H\right)\right)}{\pi_H\left(1-\beta\right)q\left(\theta_H\right)}, \tag{27}$$

where $Y_L = (1-u_L)\left(1-F(s_0)+F_L(m_L)\tilde{N}_L\right)\pi_L$ and $Y_H = (1-u_H)\left(F(s_0)+F_H(m_H)\tilde{N}_H\right)\pi_H$, and by (22), (23), and (24). Then, all of the remaining endogenous variables are retrieved using K^*, θ_L^*, θ_H^*, s_0^*, m_L^*, and m_H^*: p_L^* from (3) or (18), p_H^* from (4) or (19), w_L^* and w_H^* from (20) and (21), respectively, u_L^* and u_H^* from (7), the sizes of the native populations by skill class from $N_L^* = 1-F\left(s_0^*\right)$ and $N_H^* = F\left(s_0^*\right)$, and the sizes of immigrant populations by skill class from $M_L^* = F_L\left(m_L^*\right)\tilde{N}_L$ and $M_H^* = F_H\left(m_H^*\right)\tilde{N}_H$.

The impact of the social benefit on the country's labor market characteristics is not clear. However, obtaining unambiguous results in that regard is possible when we assume that the destination country redistributes very little ($b, \tau \to 0$). Defining $r_0 \equiv \left(c_H\theta_H^* - c_L\theta_L^*\right)\left(N_L^* + M_L^*\right)\left[\frac{c_L\theta_L^*\left(N_L^* + M_L^*\right)}{\lambda_L + \theta_L^* q\left(\theta_L^*\right)} + \frac{c_H\theta_H^*\left(N_H^* + M_H^*\right)}{\lambda_H + \theta_H^* q\left(\theta_H^*\right)}\right]^{-1}$, we present the following Claim.

Claim 1. In the neighborhood of $b = 0$, if $r < r_0$, a marginal increase in the generosity of the social benefit in a country, *b*, results in

(a) a reduction in the country's gross wage rate of low-skilled workers, $dw_L^* / db < 0$, and an increase in the country's gross wage rate of high-skilled workers, $dw_H^* / db > 0$, and

(b) an increase in the country's unemployment rate among low-skilled workers, $du_L^* / db > 0$, and a reduction in the country's unemployment rate among high-skilled workers, $du_H^* / db < 0$.

Proof. The proof is in the Appendix.

Claim 1 indicates that the effects of the government's social policy go beyond the redistribution of income: the social benefit adversely affects labor market characteristics of low-skilled work and it has a positive impact on high-skilled workers. The consequences of running a generous social policy listed in Claim 1 motivate our subsequent analysis, as they have the potential to become important "stay away" factors for foreign low-skilled workers. Unfortunately, because the response of native workers (in terms of their skill choices) and the response of foreign workers (in terms of their immigration decisions) depend on the distributions of skill formation cost and migration costs of unspecified shapes, it is not clear whether an increase in the social benefit from zero to a positive value will result in expansion or contraction of the low-skilled immigrant population; explicit assumptions about these shapes must be imposed to make that verdict.

The sufficient (but not necessary) condition for obtaining results reported in Claim 1 is that the interest rate is sufficiently small, which ensures that high-skilled workers are net contributors to the welfare system. This is because all new entrants to the labor market, low-skilled and high-skilled alike, are initially unemployed, which means that initially they take advantage of the benefit without being burdened with supporting the welfare system. If the interest rate was high, the initial net gain of an unemployed high-skilled worker could dominate the future net losses in which case high-skilled immigrants, just as low-skilled immigrants, would find income redistribution beneficial. We assume that this is not the case.[2]

Lastly, it can be shown that the indirect impact of the social benefit on the return from migration for foreign low-skilled workers at least partly reduces the inflow of these workers following an increase in the generosity of the social benefit at destination. On fully differentiating (23), dividing both sides by db, and evaluating at $b=0$, we get that

$$\bar{w}^* - \frac{\beta c_L \theta_L^*}{1-\beta} + \frac{\beta c_L}{1-\beta}\frac{d\theta_L^*}{db} = r\frac{dm_L^*}{db}. \tag{28}$$

The first two elements on the left-hand side capture the direct effect of the social benefit on the return from migration for low-skilled workers, which is unambiguously positive.[3] The third element on the left-hand side, which captures the indirect effect, is negative for $r<r_0$ (we show that $d\theta_L^*/db<0$ in the neighborhood of $b=0$ and for $r<r_0$ in the proof of Claim 1 in Appendix A). As already stated, the overall effect of the benefit on low-skilled immigration, captured by the term on the right-hand side of (28), is not clear.

Because we are unable to provide analytical results regarding the impact of the social benefit on the sizes of the low-skilled immigrant population and the high-skilled immigrant population for any level of the social benefit, we resort to a simulation.

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[2] The assumption of a sufficiently small r is supported by the results of our simulation in Section 3. The right-hand side of $r<r_0$ is greater than 0.048 - the chosen value of r in our simulation - for every country in the sample.

[3] This becomes apparent on substitution for $\bar{w}^*$ from (14) and then for w_L from (20), w_H from (21), u_L and u_H from (7), and on noticing that from (22) it follows that $c_H\theta_H^* > c_L\theta_L^*$.

3. Quantitative application: Migration to EU-15 countries

3.1. Setup

Our quantitative analysis proceeds in three steps. In the first step, we calibrate the model for 14 European countries (EU-15 without Luxembourg) based on 2018 data from Eurostat, the OECD database, and the World Bank database. We then solve the calibrated model obtaining the values of the model's endogenous variables that match data records, in particular the sizes of the immigrant populations of each skill class, M_L and M_H. Solution to the calibrated model will be our benchmark setting.

In the second step, we assess the direct effect of the social benefit on the size and skill composition of the immigrant population. We consider a counterfactual setting where b is one percentage point higher compared to the benchmark setting. Holding unemployment rates and the skill composition of the destination country's native population fixed at their equilibrium values calculated in the benchmark setting, we solve the model to obtain the size of the immigrant low-skilled population and the size of the immigrant high-skilled population. By holding θ_L, θ_H, and s_0 fixed at their benchmark values, we ensure that adjustments in the values of the remaining variables which characterize market equilibrium, K, m_L, and m_H, and, consequently, in the values of M_L and M_H, do not take into account indirect channels via which the social benefit affects the size and skill composition of the immigrant population. Percentage changes between the values of M_L and M_H calculated in this setting and their respective values calculated in the benchmark setting, namely semi-elasticities of M_L and M_H with respect to b, are our measures of the direct effect of the social benefit in the destination country on immigration to that country.

In the third step, we consider the overall effect of the social benefit on the size and skill composition of the immigrant population. We do this by repeating the second step in a setting where all of the model's endogenous variables are determined in equilibrium. Then, we re-calculate M_L and M_H, and again compare them with their respective benchmark values; that is, we calculate overall semi-elasticities of M_L and M_H with respect to b.

3.2. Calibration

We define high-skilled (low-skilled) workers as individuals aged 15-64 with(out) completed tertiary education, and native residents (immigrants) as residents of the destination country who are (not) citizens of that country. We obtain estimates of N_L, N_H, M_L, and M_H by combining Eurostat country data on population aged 15-64 by citizenship with Eurostat data on the percentage of tertiary educated individuals in the population aged 15-64 by citizenship. Accommodating to our unrestricted migration assumption, we differentiate between immigrants from EU member states and immigrants from outside the EU, and we only let the size of the former group to vary with the level of the social benefit; the latter group, as it faces migration restrictions, is exogenously given. Thus, we have $M_k = M_k^{EU} + M_k^{NEU}$, $k = L, H$, with superscripts *EU* and *NEU* denoting immigrants from EU member states and immigrants from outside the EU, respectively, and where M_k^{NEU} is fixed for $k = L, H$. We normalize the size of the destination country's native population at 1, and we scale the size of the country's immigrant population accordingly. We use Eurostat data on unemployment rates by educational attainment for u_L and u_H, and OECD data on mean annual gross earnings by educational attainment to calculate the ratios w_H / w_L.[4] We also use World Bank data on GDP per capita in PPP for $Y/(1+M)$. We normalize GDP per capita at 1 in Ireland and we scale it in other countries accordingly, that is preserving actual cross-country differences. Following Battisti et al. (2018), we take output elasticity of labor, $1-\alpha$, from OECD database on labor costs indicators for 2012.[5] We use Eurostat data on expenditure on social protection as percent of GDP for $b\overline{w}/Y$ and the data on annual transition rates from unemployment to employment and from unemployment to unemployment, denoted respectively as $tr_{U\to E}$ and $tr_{U\to U}$, in[6]

$$\frac{tr_{U\to E}}{tr_{U\to E} + tr_{U\to U}} = \frac{u_L\left(N_L + M_L\right)\theta_L q\left(\theta_L\right) + u_H\left(N_H + M_H\right)\theta_H q\left(\theta_H\right)}{u_L\left(N_L + M_L\right) + u_H\left(N_H + M_H\right)}. \tag{29}$$

[4] Eurostat data on earnings and unemployment rates by educational attainment distinguish three levels of education: lower secondary and below, upper secondary and post-secondary non-tertiary, and tertiary. We report w_H and u_H based on relevant data for the tertiary educated, and w_L and u_L as weighted averages of earnings and unemployment rates among the former two education groups, respectively, where weights are relative sizes of these two groups.

[5] 2012 is the latest year for which the data on output elasticity of labor was released; the earliest data is for 2001. Estimates of output elasticity of labor in each of EU-15 countries were subject to some variation over the period 2001-2012, yet without any visible trend; the values at the beginning of the period are similar to those at the end of the period. Therefore, we believe that 2018 estimates of output elasticity of labor, if available, would not be significantly different from their 2012 values.

[6] Transition rate from unemployment to employment is defined in Eurostat as the ratio of all transitions from unemployment to employment to the sum of all transitions from unemployment (to employment, to unemployment, and to inactivity). We use $tr_{U\to E} / \left(tr_{U\to E} + tr_{U\to U}\right) > tr_{U\to E}$ rather than $tr_{U\to E}$ as the transition rate from unemployment to employment due to absence of inactivity in our model.

That is, (29) relates data on annual transition rates from unemployment to employment (left-hand side) to a weighted average of arrival rates of jobs to unemployed low-skilled workers and to unemployed high-skilled workers (right-hand side). The weights are shares of unemployed workers of respective skill classes in overall unemployment. The data used for calibrating the model, by country, is presented in Appendix B, Table B1.

Guided by the literature (Chassamboulli and Palivos, 2014; Battisti et al., 2018), we assume that $\beta=\varepsilon=\rho=0.5$, $\pi_L=\pi_H=1$, $r=0.048$, and $\delta=0.073$. We refer to Muehlemann and Pfeifer (2016) who estimate the hiring cost of a high-skilled worker in Germany at over 8 weeks of the worker's wage earnings, which yields $c_H=0.16w_H^*/q\left(\theta_H^*\right)$.[7] In line with the (sparse) evidence reported in Manning (2011, p. 983), we set $c_L=0.5c_H$. We then calibrate the values of A, K, x, ξ, λ_L, λ_H, w_L, θ_L, θ_H, and b using (5), (7), (20), (21), (22), (26), (27), (29), and $Y=AK^{\alpha}\left\{x\left[\pi_L\left(1-u_L\right)\left(N_L+M_L\right)\right]^{\rho}+(1-x)\left[\pi_H\left(1-u_H\right)\left(N_H+M_H\right)\right]^{\rho}\right\}^{\frac{1-\alpha}{\rho}}$, where $N_L+M_L=1-F\left(s_0\right)+M_L^{NEU}+F_L\left(m_L\right)\tilde{N}_L$ and $N_H+M_H=F\left(s_0\right)+M_H^{NEU}+F_H\left(m_H\right)\tilde{N}_H$.

What remains is to characterize the distribution of the skill formation cost in the native population, two distributions of migration costs in the foreign population, and to calibrate κ, $\tilde{N}_L$, and $\tilde{N}_H$. We assume that the skill formation cost, the migration cost for foreign low-skilled workers, and the migration cost for foreign high-skilled workers are all lognormally distributed with equal between the countries parameter values: $\Lambda(\mu,\sigma)$, $\Lambda\left(\mu_L,\sigma_L\right)$, and $\Lambda\left(\mu_H,\sigma_H\right)$, respectively.[8] Recalling the relationships $N_H=F\left(s_0\right)$, $M_L=F_L\left(m_L\right)\tilde{N}_L$, and $M_H=F_H\left(m_H\right)\tilde{N}_H$, we obtain the said parameter values from fitting three lognormal cumulative distribution functions to data points $\left(s_0,N_H\right)$, $\left(m_L,M_L^{EU}\right)$, and $\left(m_H,M_H^{EU}\right)$. For that purpose, we must first calculate for each country s_0, m_L, and m_H from (22), (23), and (24),

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[7] To retrieve c_H from Muehlemann and Pfeifer's estimate, we multiply the wage earnings by $1/q\left(\theta_H^*\right)$, namely the expected duration of filling a vacancy.

[8] The choice of a lognormal density functions for the distribution of the cost of skill formation is motivated by the fact that the distribution of wage earnings in a population is best described by this density function, that there is significant accumulated evidence on the link between an individual's ability or cognitive skills and the individual's wage earnings, and by the presumption that there should be a similar link between ability or cognitive skills and the cost of skill formation. In turn, the choice of a lognormal density function for the distribution of migration costs follows from the fact that the distribution of wage earnings within a skill class in a (foreign) country – the opportunity cost of immigration – is best described by this density function.

respectively, which require some initial assumptions on κ, $\tilde{N}_L$, and $\tilde{N}_H$, respectively. We thus (initially) assume that $\kappa = \tilde{N}_L = \tilde{N}_H = 1$.[9] Then, after obtaining fitted values of parameters of the distribution functions, we calibrate κ, $\tilde{N}_L$, and $\tilde{N}_H$ from (22) on recalculating s_0 using $N_H = F(s_0)$, from $M_L = F_L(m_L)\tilde{N}_L$, and from $M_H = F_H(m_H)\tilde{N}_H$, respectively.

Fitting $F_L(m)$ to data on m_L and M_L^{EU}, and $F_H(m)$ to data on m_H and M_H^{EU}, yield $(\mu_L, \sigma_L) = (4.6, 1.51)$ and $(\mu_H, \sigma_H) = (4.14, 0.96)$, whereas fitting $F(s)$ to data on s_0 and N_H is more problematic due to low correlation between s_0 and N_H.[10] Therefore, we choose to impose $\sigma = 3$ and we fit $F(s)$ to data on s_0 and N_H to obtain μ, which yields $\mu = 1.56$. The choice of $\sigma = 3$ is guided by our sensitivity analysis (see Appendix C) which indicates that the overall semi-elasticity of the low-skilled immigrant population with respect to *b* first increases with σ, and then, for $\sigma \geq 3$, it remains approximately constant. Therefore, the analysis for $\sigma = 3$ produces the upper bound for the true semi-elasticities of low-skilled migration with respect to *b*. The full set of calibrated values of the model's parameters which differ between countries is listed in Appendix B, Table B2.

3.3. Analysis

Having identified or, in some cases, imposed the values of the model's parameters, we can now evaluate numerically the direction and strength of the relationship between the social benefit in the destination country and the size and skill composition of its immigrant population. We do this by calculating semi-elasticities with respect to the generosity of the social benefit, *b*, henceforth referred to simply as semi-elasticities and denoted by $e_b(\cdot)$, of the size of the low-skilled immigrant population, $e_b(M_L)$, and the size of the high-skilled immigrant population, $e_b(M_H)$. To supplement the analysis, we also calculate $e_b(w_L)$, $e_b(w_H)$, $e_b(u_L)$, $e_b(u_H)$, and $e_b(N_H)$. These semi-elasticities measure the strength of "stay away" factors as seen by foreign low-skilled workers and the strength of "pull" factors as seen by foreign high-skilled workers, resulting indirectly from the social benefit. The results of our analysis are displayed in Table 1.

[9] The initially chosen values of κ, $\tilde{N}_L$, and $\tilde{N}_H$, as long as they are the same across countries, have no impact on the goodness of fit of the relevant functions.

[10] Correlations between m_L and M_L^{EU}, between m_H and M_H^{EU}, and between s_0 and N_H are 0.53, 0.74, and 0.09, respectively.

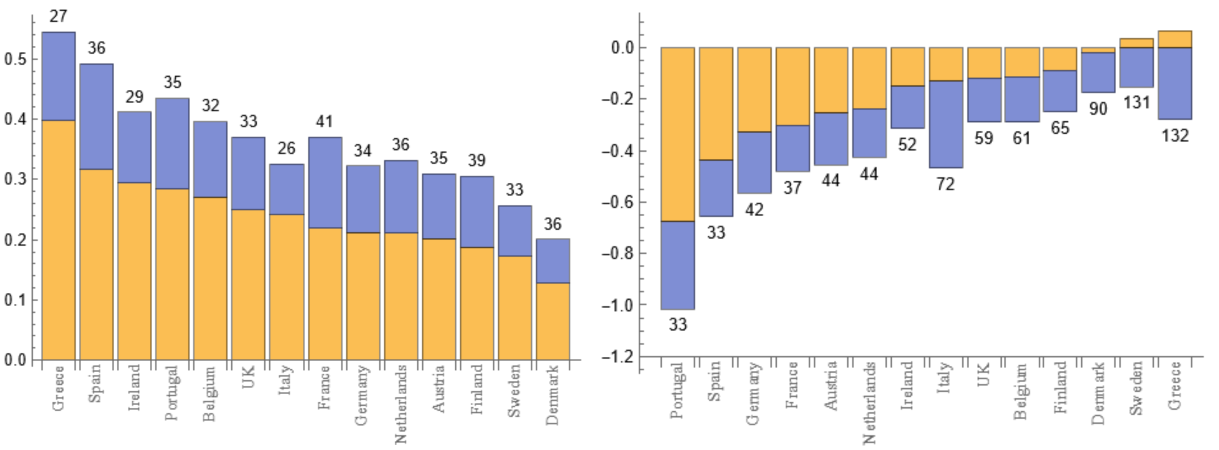
Table 1. Semi-elasticities with respect to *b* of wage rates, unemployment rates, and the size of the native and immigrant populations in EU-15 countries without Luxembourg, by skill class.

	1	2	3	4	5	6	7	8	9
Country	$e_b(w_L)$	$e_b(w_H)$	$e_b(u_L)$	$e_b(u_H)$	$e_b(N_H)$	$e_b(M_L)$		$e_b(M_H)$	
						Direct	Overall	Direct	Overall
Austria	-0.12	0.18	0.06	-0.09	-0.46	0.31	0.20	-0.45	-0.25
Belgium	-0.14	0.16	0.07	-0.08	-0.39	0.40	0.27	-0.29	-0.11
Denmark	-0.10	0.15	0.05	-0.08	-0.37	0.20	0.13	-0.18	-0.02
Finland	-0.14	0.17	0.07	-0.09	-0.38	0.31	0.19	-0.25	-0.09
France	-0.16	0.21	0.08	-0.11	-0.50	0.37	0.22	-0.48	-0.30
Germany	-0.12	0.21	0.06	-0.11	-0.50	0.32	0.21	-0.57	-0.33
Greece	-0.12	0.21	0.06	-0.11	-0.47	0.54	0.40	-0.21	0.07
Ireland	-0.12	0.11	0.06	-0.06	-0.28	0.41	0.29	-0.31	-0.15
Italy	-0.08	0.25	0.04	-0.13	-0.53	0.33	0.24	-0.47	-0.13
Netherlands	-0.13	0.17	0.07	-0.09	-0.40	0.33	0.21	-0.43	-0.24
Portugal	-0.12	0.21	0.06	-0.11	-0.49	0.43	0.28	-1.02	-0.68
Spain	-0.15	0.17	0.07	-0.09	-0.42	0.49	0.32	-0.66	-0.44
Sweden	-0.10	0.13	0.05	-0.07	-0.32	0.26	0.17	-0.12	0.04
UK	-0.13	0.13	0.07	-0.07	-0.34	0.37	0.25	-0.29	-0.12

Source: Own calculations

Our simulation indicates that direct semi-elasticities of the size of the immigrant population, by skill class, are as predicted by previous models of welfare migration. When the skill distribution of the native population and unemployment rates in the destination country are irresponsive to the level of the social benefit, the benefit acts as a strong magnet for foreign low-skilled workers, who are net beneficiaries of the welfare program, with semi-elasticities of the low-skilled immigrant population ranging from 0.2 in Denmark to 0.54 in Greece (column 6). In turn, the benefit directly discourages from migrating foreign high-skilled workers, who contribute to the program more than they take from it. In this case, respective semi-elasticities range from -0.12 in Sweden to -1.02 in Portugal (column 8). The picture changes when indirect effects of the social benefit on wage rates and unemployment rates are allowed to play their roles. First, generous social policy leads to less skill formation by the destination country's native individuals (column 5), pulling down the low-skilled wage rate (column 1). Second, expansion in the size of the low-skilled workforce lengthens unemployment intervals for the low-skilled, which translates into higher low-skilled unemployment rate (column 3). These side effects of an increase in the generosity of the social benefit attenuate welfare migration by foreign low-skilled workers (column 7 vs 6) by 34 percent, on average. Overall semi-elasticities of the size of the low-skilled immigrant population vary between 0.13 in Denmark to 0.4 in Greece. We get the opposite results for the high-skilled immigrant population: higher wage rate (column 2) and lower risk of unemployment (column 4) cushion the direct negative impact of the social benefit on the size of that population (column 9 vs 8). The impact of indirect effects of the social benefit on the size of the high-skilled immigrant population is larger than it is on the size of the low-skilled immigrant population, with mean reduction from direct to overall semi-elasticities at 64 percent. Figure 1 presents direct, indirect, and overall semi-elasticities of the low-skilled immigrant population (panel (a)) and the high-skilled immigrant population (panel (b)) across EU-15 countries without Luxembourg. Interestingly, in two countries, Sweden and Greece, indirect effects of the social benefit on the size of the high-skilled immigrant population more than offset the direct effect; according to the results of our simulation, the social benefit is a magnet for high-skilled immigrants in these two countries.

Figure 1. Overall (orange) and indirect (blue) semi-elasticities of the immigrant populations, by country and by skill class.



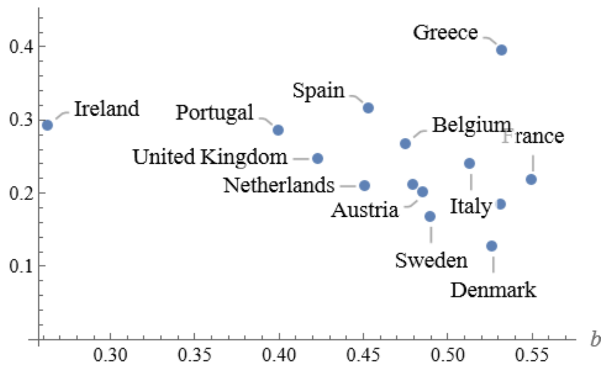
(a) low-skilled (b) high-skilled

Note: Numbers above/below the bars indicate the percentage reduction in semi-elasticity due to indirect channels via which the social benefit impacts immigration, namely the absolute value of the ratio of indirect to direct semi-elasticities.

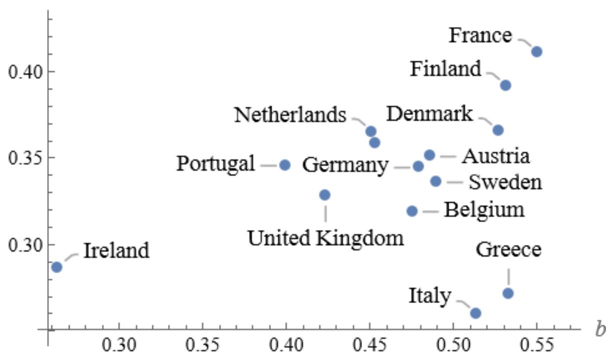
3.4. Possible reasons for the mixed evidence behind welfare migration

So far we have shown that indirect effects associated with the social benefit reduce (or, in a few cases, fully offset) the strength of the relationship between the benefit and immigration by skill class. However, the magnitude of the reduction is not uniform across EU-15 countries, which gives rise to the following question: which of the model's fundamentals are the most responsible for the cross-country variation in the overall semi-elasticity of the low-skilled immigrant population (the measure of welfare migration by foreign low-skilled workers at the margin) and in the absolute value of the ratio of indirect to direct semi-elasticities (the measure of importance of indirect channels for attenuating welfare migration by low-skilled workers at the margin)? Guided by the results of the sensitivity analysis (see Appendix C), we identify two such fundamentals; these are b and ξ.[11] Figure 2 depicts correlations between b and ξ on the one hand and overall semi-elasticity of the low-skilled immigrant population and the absolute value of the ratio of indirect to direct semi-elasticities on the other hand.

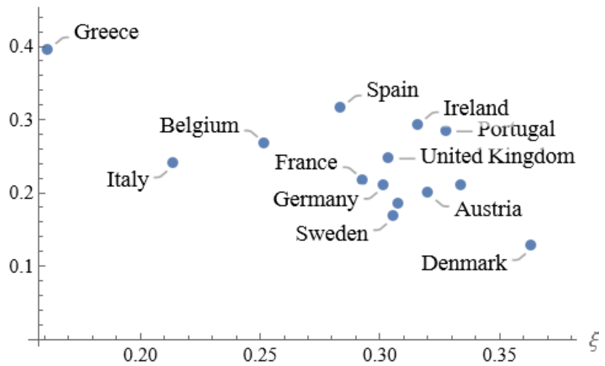
Figure 2. Simulated overall semi-elasticity of the low-skilled immigrant population (panels (a) and (c)) and the absolute value of indirect semi-elasticity as percent of direct semi-elasticity of the low-skilled immigrant population (panels (b) and (d)), by b and ξ.



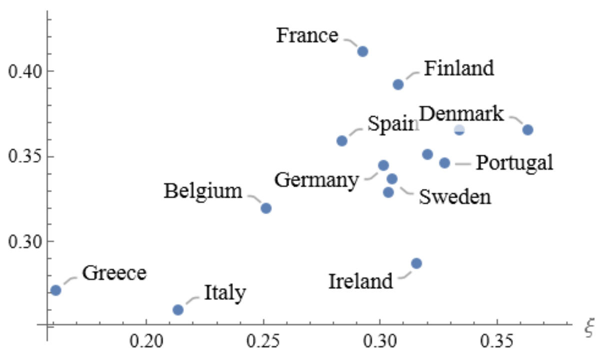
(a) Overall semi-elasticity



(b) Indirect semi-elasticity as percent of the direct semi-elasticity



(c) Overall semi-elasticity



(d) Indirect semi-elasticity as percent of the direct semi-elasticity

[11] Correlation coefficients between ξ on the one hand and overall semi-elasticity of low-skilled immigrant population and the ratio of indirect to direct semi-elasticities on the other are relatively high at 0.64 and -0.68, respectively, but they are significantly lower between b and the relevant variables, at 0.31 and -0.29, respectively. This is because two countries, Greece and Italy, are characterized by very high values of b and very low values of ξ. Low values of ξ make these countries appear in the top-right corner in panel (a) and in the bottom-right corner in panel (b), so that they do not match the pattern in two-dimensional scatter plots.

An inspection of panels (a) and (c) in Figure 2 reveals that countries with higher calibrated values of b and ξ are characterized by lower overall semi-elasticities of the low-skilled immigrant population. The reason lies in the growing with b and ξ importance of indirect channels associated with the social benefit which attenuate welfare migration by low-skilled workers at the margin. When income redistribution in a country is substantial (high b), the country hosts a relatively numerous (native and migrant) low-skilled workforce, which bears adversely on low-skilled wage rate and unemployment rate, and it witnesses lower per capita output, which brings down wages of all workers. These "stay away" factors gain on importance with the degree of income redistribution. In effect, foreign low-skilled workers are little responsive at the margin to changes in welfare generosity in the destination country when welfare generosity there is already high. In turn, when matching in the destination country's labor market is efficient (high ξ), foreign low-skilled workers expect to find a job relatively quickly on arrival to the country or on getting laid off there. While this is overall beneficial for these workers and induces more immigration, it also means that the welfare system becomes less advantageous for low-skilled workers, as the (non-contributory) spells of unemployment become shorter. Consequently, at the margin, welfare migration by foreign low-skilled workers will be reduced when labor market efficiency is high compared to when it is low.

Based on these results, we formulate two hypotheses which have the potential to explain at the level of the model's fundamentals why the evidence behind welfare migration by low-skilled workers to EU-15 countries is mixed. First, this may be because EU-15 countries differ by the degree of income redistribution, with highly redistributive countries hosting more numerous foreign low-skilled populations yet witnessing less welfare migration at the margin than countries which redistribute little. Put differently, generous welfare states may be characterized by larger stocks of foreign low-skilled workers, but experience smaller flows of these workers than less generous welfare states. Second, mixed evidence on the incidence of welfare migration to EU-15 countries may stem from differences in labor market efficiency across these countries. Other things being equal, countries which efficiently match vacancies with the unemployed are more attractive destinations for foreign low-skilled workers than countries where the matching is sluggish, due to shorter duration of unemployment and the resulting higher expected lifetime income in the former countries. However, in countries where spells of unemployment are short, the demand for a generous welfare state is diminished. As a result, countries with efficient labor markets may host more foreign low-skilled workers, but witness smaller flows of these workers than countries with less efficient labor markets.

4. Discussion and conclusions

We identified two possible reasons behind relatively weak, in light of economic theory, role of the social benefit in a destination country / region in shaping migration to that country / region, particularly by low-skilled workers, witnessed in existing empirical research. The relationships between the social benefit in a destination country on the one hand, and wage earnings (via skill composition of the country's native population) and the risk of unemployment in that country on the other, were shown to constitute "stay away" factors from the perspective of foreign low-skilled workers. A quantitative applications of the model to EU-15 countries without Luxembourg showed that when these "stay away" factors are not taken into account, all foreign workers in general and low-skilled workers in particular are strongly responsive to changes in the generosity of the social benefit at destination, as predicted by theoretical models of welfare migration to date. Conversely, when the relationship between the benefit and unemployment rates and between the benefit and skill choices of the native population are allowed to play their roles, the social benefit has a weaker overall impact on the size of the low-skilled immigrant population by 1/3 on average. These results indicate that the part of the variation among destination countries in skill composition of their populations and unemployment rates that can be attributed to differences in their social policies have the potential to explain, at least in part, why the results of empirical studies on the incidence of welfare migration are mixed. On a more fundamental level, guided by the results of our simulation and the sensitivity analysis, we argued that mixed results of empirical research may be the consequence of the differences across EU-15 countries in the level of income redistribution and in matching efficiency in the labor market.

Our analysis has two important limitations. First, the model developed in Section 2 is fitted for an equilibrium analysis, whereas the characteristics of EU-15 countries and, consequently, the pattern of migration to these countries should rather be viewed through the lens of transitional dynamics towards equilibrium. For example, 2018 Eurostat data show that the rate of participation in tertiary education is significantly higher among younger cohorts than among older cohorts in all analyzed countries, whereas equilibrium demands constant by age tertiary education attainment rates. In effect, our quantitative analysis does not aspire to predict the actual magnitude of the response of foreign workers to changes in the generosity of social benefits in EU-15 countries; it aims at highlighting the importance of taking into account indirect channels via which the social benefit affects immigration. In this context, it is a *comparison* of the direct and overall semi-elasticities of the size of the low-skilled immigrant population that drives the main conclusions of this paper, not the magnitude of each of these semi-elasticities. Second, our modeling framework does not involve the choice between actively searching for a job and voluntary unemployment (non-participation). In principle, an increase in unearned income (the social benefit) should reduce labor force participation especially among the low-earning, low-skilled workers, while the corresponding decrease in net wage due to increased taxation would have an ambiguous effect on labor supply, depending on relative strength of the substitution and the income effects. If the social benefit were to discourage from working disproportionally more low-skilled workers than high-skilled workers, then the reduction in welfare migration due to indirect channels associated with the social benefit would be smaller than our simulation indicated.

We leave aside several other possible reasons behind the mixed evidence on the negative relationship between the generosity of the welfare state and migrants' self-selection. These include the role of the social benefit in the origin country, diversity of the types of welfare provisions, nonlinear income taxation, or temporariness of migration. Out of this list, the role of the generosity of the social benefit in the origin country can be successfully studied in an extension of our framework. However, because it is a mirror reflection of the analysis for the destination country, it is straightforward and is not pursued here.

Diversity of welfare provisions can be an important factor in determining how migrants self-select. For example, a study by de Jong, Adserà, and de Valk (2020) shows that the impact of social benefits at destination on intra-EU migration differs depending on the type of social assistance. The modelled effects of the social benefit on the skill composition of migration could be vastly different if the direct and equal social benefit, financed mainly by high-earning, high-skilled workers, was replaced by a set of provisions of different types, directed mainly to low-earning, low-skilled individuals, as it is usually the case. Modelling social benefits as, say, unemployment benefits, which due to higher mean duration of unemployment among low-skilled workers than among high-skilled workers in our model would target predominantly the former, could reduce the gap between the direct impact and the overall impact of the social benefit on low-skilled migration. We note here that our motivation for modelling welfare provisions as a direct and equal social benefit (rather than, say, an unemployment benefit) was to minimize the impact on the skill composition of the immigrant population of other factors than skill choices of native residents and unemployment rates at destination. This is best done by adopting a skill-neutral social benefit.

Employing nonlinear (progressive) taxation would increase relative burden of financing the social policy by high-skilled workers and reduce that burden for low-skilled workers. Therefore, the results of a version of the model with progressive taxation would differ from the results presented in Section 3 such that both the positive direct effect and the negative indirect effect of social benefits on the size of the immigrant low-skilled population would be stronger. Finally, it stands to reason that temporariness of migration should reduce the role of welfare provisions for migration choices, especially in countries with means-tested access to these provisions. However, while temporary migrants could be less responsive than permanent migrants to any changes in the generosity of social benefits at destination, there is no reason to expect that the importance of indirect channels via which social benefits shape migration relative to the direct channel - the main focus of our analysis - should be quantitatively different.

References

Alesina, A., Miano, A., and Stantcheva, S. (2023) "Immigration and redistribution," *Review of Economic Studies* 90(1): 1-39.

Alesina, A. and Stantcheva, S. (2020) "Diversity, immigration, and redistribution," *AEA Papers & Proceedings* 110: 329-34.

Battisti, M., Felbermayr, G., Peri, G., and Poutvaara, P. (2018) "Immigration, search and redistribution: A quantitative assessment of native welfare," *Journal of the European Economic Association* 16(4): 1137-1188.

BBC (2014) https://www.bbc.com/news/uk-politics-30250299

BBC (2018) https://www.bbc.com/news/world-europe-44281683

BBC (2020) https://www.bbc.com/news/uk-politics-51550421

Benhabib, J. (1996) "On the political economy of immigration," *European Economic Review* 40(9): 1737-1743.

Blinder, S. and Markaki, Y. (2018) "Europeans' attitudes to immigration from within and outside Europe: A role for perceived welfare impacts?" Reminder: Working Paper.

Borjas, G.J. (1987) "Self-selection and the earnings of immigrants," *American Economic Review* 77(4): 531-553.

Borjas, G.J. (1999) "Immigration and welfare magnets," *Journal of Labor Economics* 17(4): 607-637.

Caliendo, L., Dvorkin, M., and Parro, F. (2019) "Trade and labor market dynamics: General equilibrium analysis of the China trade shock," *Econometrica*, 87(3): 741-835.

Caliendo, L., Opromolla, L.D., Parro, F., and Sforza, A. (2021) "Goods and factor market integration: A quantitative assessment of the EU enlargement," *Journal of Political Economy* 129(12).

Cappelen, C. and Midtbø, T. (2016) "Intra-EU labour migration and support for the Norwegian welfare state," *European Sociological Review* 32(6): 691-703.

Chassamboulli, A. and Palivos, T. (2014) "A search-equilibrium approach to the effects of immigration on labor market outcomes," *International Economic Review* 55(1): 111-129.

Cohen, A. and Razin, A. (2008) "The skill composition of immigrants and the generosity of the welfare state: Free vs. policy-controlled migration," Working Paper 14459, Cambridge, MA: National Bureau of Economic Research.

Cohen, A., Razin, A., and Sadka, E. (2009) "The skill composition of migration and the generosity of the welfare state," Working Paper 14738, Cambridge, MA: National Bureau of Economic Research.

Dustmann, C. and Frattini, T. (2014) "The fiscal effects of immigration to the UK," *Economic Journal* 124(580): F593-F643.

Dustmann, C., Vasiljeva, K., and Damm, A.P. (2019) "Refugee migration and electoral outcomes," *Review of Economic Studies* 86(5): 2035-2091.

Edo, A., Giesing, Y., Öztunc, J., and Poutvaara, P. (2019) "Immigration and electoral support for the far-left and the far-right," *European Economic Review* 115: 99-143.

Eggert, W., Krieger, T., and Meier, V. (2010) "Education, unemployment and migration," *Journal of Public Economics* 94(5-6): 354-362.

Ennser-Jedenastik, L. (2017) "Welfare chauvinism in populist radical right platforms: The role of redistributive justice principles," *Social Policy Administration* 52(1): 293-314.

Gelbach, J.B. (2004) "Migration, the life cycle, and state benefits: How low is the bottom?" *Journal of Political Economy* 112(5): 1091-1130.

de Giorgi, G. and Pellizzari, M. (2009) "Welfare migration in Europe," *Labour Economics* 16(4): 353-363.

Giua, L. (2020) "Removing the wall around welfare: What do We learn from A8 immigrants in the UK?" *Economic Policy* 35(102): 305-356.

Hainmueller, J. and Hiscox, M.J. (2010) "Attitudes toward highly skilled and low-skilled immigration: Evidence from a survey experiment," *American Political Science Review* 104(1): 61-84.

Helbling, M. and Kriesi, H. (2014) "Why citizens prefer high- over low-skilled immigrants. Labor market competition, welfare state, and deservingness," *European Sociological Review* 30(5): 595-614.

Hennessey, G. and Hagen-Zanker, J. (2020) "The fiscal impact of immigration: A review of the evidence," Swiss Agency for Development and Cooperation: Working paper 573.

Hjorth, F. (2016) "Who benefits? Welfare chauvinism and national stereotypes," *European Union Politics* 17(1): 3-24.

de Jong, P.W., Adserà, A., and de Valk, H.A.G. (2020) "The role of welfare in locational choices: Modelling intra-European migration decisions across the life-course," *Journal of Economic and Social Geography* 111(2): 163-181.

Levine, P.B. and Zimmerman, D.J. (1999) "An empirical analysis of the welfare magnet debate using the NLSY," *Journal of Population Economics* 12: 391-409.

Manning, A. (2011) "Imperfect competition in the labor market," In: Card, David and Ashenfelter, Orley (Eds.) *Handbook of Labor Economics* 4: 973-1041. Amsterdam: Elsevier.

Martinsen, D. and Rotger, G. (2017) "The fiscal impact of EU immigration on the tax-financed welfare state: testing the "welfare burden" thesis," *European Union Politics* 18(4): 620-639.

Muehlemann, S. and Pfeifer, H. (2016) "The structure of hiring costs in Germany: Evidence from firm-level data," *Industrial Relations* 55(2): 193-218.

Naumann, E., Stoetzer, L.F., and Pietrantuono, G. (2018) "Attitudes towards highly skilled and low-skilled immigration in Europe: A survey experiment in 15 European countries," *European Journal of Political Research* 57(4): 1009-1030.

van Oorschot, W. (2006) "Making the difference in social Europe: deservingness perceptions among citizens of European welfare states," *Journal of European Social Policy* 16(1): 23-42.

Pedersen, P.J., Pytlikova, M., and Smith, N. (2008) "Selection and network effects – Migration flows into OECD countries 1990-2000," *European Economic Review* 52(7): 1160-1186.

Politico (2016) https://www.politico.com/story/2016/08/donald-trump-immigration-address-transcript-227614

Ponce, A. (2019) "Is welfare a magnet for migration? Examining universal welfare institutions and migration flows," *Social Forces* 98(1): 245-278.

Razin, A. and Sadka, E. (2000) "Interactions between international migration and the welfare state," Working paper 337, Munich: CESifo.

Razin, A., Sadka, E., and Suwankiri, B. (2011) *Migration and the welfare state. Political-economy policy formation*, Cambridge, MA: MIT Press.

Razin, A. and Wahba, J. (2015) "Welfare magnet hypothesis, fiscal burden, and immigration skill selectivity," *Scandinavian Journal of Economics* 117(2): 369-402.

Schumacher, G. and van Kersbergen, K. (2016) "Do mainstream parties adapt to the welfare chauvinism of populist parties?" *Party Politics* 22(3): 300-312.

Skinner, G. (2016) *Immigration is now the top issue for voters in the EU referendum* [Online], London: Ipsos. Available at: https://www.ipsos.com/ipsos-mori/en-uk/immigration-now-top-issue-voters-eu-referendum [Accessed: September 26, 2020]

Skupnik, C. (2014) "EU enlargement and the race to the bottom of welfare states," *IZA Journal of Migration* 3: 15.

Suwankiri, B., Razin, A., and Sadka, E. (2016) "The welfare state and migration: A dynamic analysis of political coalitions," *Research in Economics* 70(1): 122-142.

The New York Times (2019) France announces tough new measures on immigration [Online] Available at: https://www.nytimes.com/2019/11/06/world/europe/france-macron-immigration.html [Accessed: September 26, 2020]

USCIS, 2020. https://www.uscis.gov/archive/public-charge-fact-sheet

van der Waal, J., Achterberg, P., Houtman, D., de Koster, W., and Manevska, K. (2010) "'Some are more equal than others': Economic egalitarianism and welfare chauvinism in the Netherlands," *Journal of European Social Policy* 20(4): 350-363.

Appendix A

Proof of Claim 1. We first prove that in a setting with $b \to 0$, if $r < \frac{\left(c_H\theta_H^* - c_L\theta_L^*\right)\left(N_L^* + M_L^*\right)}{\frac{c_L\theta_L^*\left(N_L^*+M_L^*\right)}{\lambda_L+\theta_L^* q\left(\theta_L^*\right)} + \frac{c_H\theta_H^*\left(N_H^*+M_H^*\right)}{\lambda_H+\theta_H^* q\left(\theta_H^*\right)}}$, then $\frac{d\theta_L^*}{db} < 0$ and $\frac{d\theta_H^*}{db} > 0$. Recalling (25), we define:

$$G_1\left(K,\theta_L,\theta_H,s_0,m_L,m_H\right) = \alpha\frac{Y}{K} - \left(r+\delta\right)$$

$$= \alpha AK^{\alpha-1}\left\{x\left[\frac{\xi\theta_L^{1-\varepsilon}\left(1-F\left(s_0\right)+\tilde{N}_L F_L\left(m_L\right)\right)\pi_L}{\lambda_L+\xi\theta_L^{1-\varepsilon}}\right]^{\rho} + (1-x)\left[\frac{\xi\theta_H^{1-\varepsilon}\left(F\left(s_0\right)+\tilde{N}_H F_H\left(m_H\right)\right)\pi_H}{\lambda_H+\xi\theta_H^{1-\varepsilon}}\right]^{\rho}\right\}^{\frac{1-\alpha}{\rho}}$$
$$-\left(r+\delta\right),$$

$$G_2\left(K,\theta_L,\theta_H,s_0,m_L,m_H\right) = (1-\alpha)Y\frac{xY_L^{\rho-1}}{xY_L^{\rho}+(1-x)Y_H^{\rho}} - \frac{c_L\left(r+\lambda_L+\beta\theta_L q\left(\theta_L\right)\right)}{\pi_L\left(1-\beta\right)q\left(\theta_L\right)}$$

$$= AK^{\alpha}(1-\alpha)x\left[\frac{\xi\theta_L^{1-\varepsilon}\left(1-F\left(s_0\right)+\tilde{N}_L F_L\left(m_L\right)\right)\pi_L}{\lambda_L+\xi\theta_L^{1-\varepsilon}}\right]^{\rho-1}$$

$$\cdot\left\{x\left[\frac{\xi\theta_L^{1-\varepsilon}\left(1-F\left(s_0\right)+\tilde{N}_L F_L\left(m_L\right)\right)\pi_L}{\lambda_L+\xi\theta_L^{1-\varepsilon}}\right]^{\rho} + (1-x)\left[\frac{\xi\theta_H^{1-\varepsilon}\left(F\left(s_0\right)+\tilde{N}_H F_H\left(m_H\right)\right)\pi_H}{\lambda_H+\xi\theta_H^{1-\varepsilon}}\right]^{\rho}\right\}^{\frac{1-\alpha}{\rho}-1}$$
$$-\frac{c_L\left(r+\lambda_L+\beta\xi\theta_L^{1-\varepsilon}\right)}{\pi_L\left(1-\beta\right)\xi\theta_L^{-\varepsilon}},$$

$$G_3\left(K,\theta_L,\theta_H,s_0,m_L,m_H\right) = (1-\alpha)Y\frac{(1-x)Y_H^{\rho-1}}{xY_L^{\rho}+(1-x)Y_H^{\rho}} - \frac{c_H\left(r+\lambda_H+\beta\theta_H q\left(\theta_H\right)\right)}{\pi_H\left(1-\beta\right)q\left(\theta_H\right)}$$

$$= AK^{\alpha}(1-\alpha)(1-x)\left[\frac{\xi\theta_H^{1-\varepsilon}\left(F\left(s_0\right)+\tilde{N}_H F_H\left(m_H\right)\right)\pi_H}{\lambda_H+\xi\theta_H^{1-\varepsilon}}\right]^{\rho-1}$$

$$\cdot\left\{x\left[\frac{\xi\theta_L^{1-\varepsilon}\left(1-F\left(s_0\right)+\tilde{N}_L F_L\left(m_L\right)\right)\pi_L}{\lambda_L+\xi\theta_L^{1-\varepsilon}}\right]^{\rho} + (1-x)\left[\frac{\xi\theta_H^{1-\varepsilon}\left(F\left(s_0\right)+\tilde{N}_H F_H\left(m_H\right)\right)\pi_H}{\lambda_H+\xi\theta_H^{1-\varepsilon}}\right]^{\rho}\right\}^{\frac{1-\alpha}{\rho}-1}$$
$$-\frac{c_H\left(r+\lambda_H+\beta\xi\theta_H^{1-\varepsilon}\right)}{\pi_H\left(1-\beta\right)\xi\theta_H^{-\varepsilon}},$$

$$G_4\left(\theta_L,\theta_H,s_0,b\right) = \frac{(1-b)\beta}{1-\beta}\left(c_H\theta_H - c_L\theta_L\right) - r\kappa s_0,$$

$$G_5\left(\theta_L,\theta_H,s_0,m_L,m_H,b\right)=b\bar{w}+(1-b)\frac{\beta c_L\theta_L}{1-\beta}-rm_L$$
$$=\frac{\beta}{1-\beta}\left[b\left(c_L\theta_L\frac{r+\lambda_L+\xi\theta_L^{1-\varepsilon}}{\lambda_L+\xi\theta_L^{1-\varepsilon}}\frac{1-F\left(s_0\right)+\tilde{N}_LF_L\left(m_L\right)}{1+\tilde{N}_LF_L\left(m_L\right)+\tilde{N}_HF_H\left(m_H\right)}\right.\right.$$
$$\left.\left.+c_H\theta_H\frac{r+\lambda_H+\xi\theta_H^{1-\varepsilon}}{\lambda_H+\xi\theta_H^{1-\varepsilon}}\frac{F\left(s_0\right)+\tilde{N}_HF_H\left(m_H\right)}{1+\tilde{N}_LF_L\left(m_L\right)+\tilde{N}_HF_H\left(m_H\right)}\right)+(1-b)c_L\theta_L\right]-rm_L,$$

and

$$G_6\left(\theta_L,\theta_H,s_0,m_L,m_H,b\right)=b\bar{w}+(1-b)\frac{\beta c_H\theta_H}{1-\beta}-rm_H$$
$$=\frac{\beta}{1-\beta}\left[b\left(c_L\theta_L\frac{r+\lambda_L+\xi\theta_L^{1-\varepsilon}}{\lambda_L+\xi\theta_L^{1-\varepsilon}}\frac{1-F\left(s_0\right)+\tilde{N}_LF_L\left(m_L\right)}{1+\tilde{N}_LF_L\left(m_L\right)+\tilde{N}_HF_H\left(m_H\right)}\right.\right.$$
$$\left.\left.+c_H\theta_H\frac{r+\lambda_H+\xi\theta_H^{1-\varepsilon}}{\lambda_H+\xi\theta_H^{1-\varepsilon}}\frac{F\left(s_0\right)+\tilde{N}_HF_H\left(m_H\right)}{1+\tilde{N}_LF_L\left(m_L\right)+\tilde{N}_HF_H\left(m_H\right)}\right)+(1-b)c_H\theta_H\right]-rm_H.$$

Because $G_1\left(K^*,\theta_L^*,\theta_H^*,s_0^*,m_L^*,m_H^*\right)=0$, $G_2\left(K^*,\theta_L^*,\theta_H^*,s_0^*,m_L^*,m_H^*\right)=0$, $G_3\left(K^*,\theta_L^*,\theta_H^*,s_0^*,m_L^*,m_H^*\right)=0$, $G_4\left(\theta_L^*,\theta_H^*,s_0^*,b\right)=0$, $G_5\left(\theta_L^*,\theta_H^*,s_0^*,m_L^*,m_H^*,b\right)=0$, and $G_6\left(\theta_L^*,\theta_H^*,s_0^*,m_L^*,m_H^*,b\right)=0$, we can calculate $d\theta_L^*/db$ and $d\theta_H^*/db$ by applying the implicit function theorem to these equalities. Specifically, $d\theta_L^*/db$ and $d\theta_H^*/db$ can be obtained from the following linear system:

$$\begin{bmatrix}\frac{\partial G_1}{\partial K^*} & \frac{\partial G_1}{\partial \theta_L^*} & \frac{\partial G_1}{\partial \theta_H^*} & \frac{\partial G_1}{\partial s_0^*} & \frac{\partial G_1}{\partial m_L^*} & \frac{\partial G_1}{\partial m_H^*}\\ \frac{\partial G_2}{\partial K^*} & \frac{\partial G_2}{\partial \theta_L^*} & \frac{\partial G_2}{\partial \theta_H^*} & \frac{\partial G_2}{\partial s_0^*} & \frac{\partial G_2}{\partial m_L^*} & \frac{\partial G_2}{\partial m_H^*}\\ \frac{\partial G_3}{\partial K^*} & \frac{\partial G_3}{\partial \theta_L^*} & \frac{\partial G_3}{\partial \theta_H^*} & \frac{\partial G_3}{\partial s_0^*} & \frac{\partial G_3}{\partial m_L^*} & \frac{\partial G_3}{\partial m_H^*}\\ \frac{\partial G_4}{\partial K^*} & \frac{\partial G_4}{\partial \theta_L^*} & \frac{\partial G_4}{\partial \theta_H^*} & \frac{\partial G_4}{\partial s_0^*} & \frac{\partial G_4}{\partial m_L^*} & \frac{\partial G_4}{\partial m_H^*}\\ \frac{\partial G_5}{\partial K^*} & \frac{\partial G_5}{\partial \theta_L^*} & \frac{\partial G_5}{\partial \theta_H^*} & \frac{\partial G_5}{\partial s_0^*} & \frac{\partial G_5}{\partial m_L^*} & \frac{\partial G_5}{\partial m_H^*}\\ \frac{\partial G_6}{\partial K^*} & \frac{\partial G_6}{\partial \theta_L^*} & \frac{\partial G_6}{\partial \theta_H^*} & \frac{\partial G_6}{\partial s_0^*} & \frac{\partial G_6}{\partial m_L^*} & \frac{\partial G_6}{\partial m_H^*}\end{bmatrix}\times\begin{bmatrix}\frac{dK^*}{db}\\ \frac{d\theta_L^*}{db}\\ \frac{d\theta_H^*}{db}\\ \frac{ds_0^*}{db}\\ \frac{dm_L^*}{db}\\ \frac{dm_H^*}{db}\end{bmatrix}=\begin{bmatrix}-\frac{\partial G_1}{\partial b}\\ -\frac{\partial G_2}{\partial b}\\ -\frac{\partial G_3}{\partial b}\\ -\frac{\partial G_4}{\partial b}\\ -\frac{\partial G_5}{\partial b}\\ -\frac{\partial G_6}{\partial b}\end{bmatrix}, \tag{A1}$$

where, utilizing $Y=AK^{\alpha}\left(xY_L^{\rho}+(1-x)Y_H^{\rho}\right)^{\frac{1-\alpha}{\rho}}$, $p_LY_L+p_HY_H=(1-\alpha)Y$, $\frac{\theta q'(\theta)}{q(\theta)}=1-\varepsilon$, p_L from (3) and (18), p_H from (4) and (19), Y_L and Y_H from (6), and u_L and u_H from (7), we have that $\frac{\partial G_1}{\partial K^*}=-\frac{\alpha(1-\alpha)Y^*}{K^{*2}}$, $\frac{\partial G_1}{\partial \theta_L^*}=\frac{\alpha(1-\varepsilon)u_L^* p_L^* Y_L^*}{K^*\theta_L^*}$, $\frac{\partial G_1}{\partial \theta_H^*}=\frac{\alpha(1-\varepsilon)u_H^* p_H^* Y_H^*}{K^*\theta_H^*}$, $\frac{\partial G_1}{\partial s_0^*}=\frac{\alpha F'(s_0^*)}{K^*}\left(\frac{p_H^* Y_H^*}{N_H^*+M_H^*}-\frac{p_L^* Y_L^*}{N_L^*+M_L^*}\right)$, $\frac{\partial G_1}{\partial m_L^*}=\frac{\alpha p_L^* Y_L^*}{K^*}\frac{F_L'(m_L^*)\tilde{N}_L}{N_L^*+M_L^*}$, $\frac{\partial G_1}{\partial m_H^*}=\frac{\alpha p_H^* Y_H^*}{K^*}\frac{F_H'(m_H^*)\tilde{N}_H}{N_H^*+M_H^*}$, $\frac{\partial G_2}{\partial \theta_K^*}=\frac{\alpha p_L^*}{K^*}$, $\frac{\partial G_2}{\partial \theta_L^*}=-c_L\frac{\varepsilon r+\varepsilon\lambda_L+\beta\theta_L^* q(\theta_L^*)}{(1-\beta)\pi_L\theta_L^* q(\theta_L^*)}-\left[\alpha p_L^* Y_L^*+(1-\rho)p_H^* Y_H^*\right]\frac{(1-\varepsilon)u_L^* p_L^*}{(1-\alpha)Y^*\theta_L^*}$, $\frac{\partial G_2}{\partial \theta_H^*}=(1-\alpha-\rho)\frac{(1-\varepsilon)u_H^* p_L^* p_H^* Y_H^*}{(1-\alpha)Y^*\theta_H^*}$, $\frac{\partial G_2}{\partial s_0^*}=\frac{p_L^* F'(s_0^*)}{(N_L^*+M_L^*)(N_H^*+M_H^*)}\left[\alpha(N_H^*+M_H^*)+(1-\rho-\alpha)\frac{p_H^* Y_H^*}{(1-\alpha)Y^*}(1+M^*)\right]$, $\frac{\partial G_2}{\partial m_L^*}=-\frac{p_L^*\left[\alpha p_L^* Y_L^*+(1-\rho)p_H^* Y_H^*\right]}{(1-\alpha)Y^*}\frac{F_L'(m_L^*)\tilde{N}_L}{N_L^*+M_L^*}$, $\frac{\partial G_2}{\partial m_H^*}=(1-\rho-\alpha)\frac{p_L^* p_H^* Y_H^*}{(1-\alpha)Y^*}\frac{F_H(m_H^*)\tilde{N}_H}{N_H^*+M_H^*}$, $\frac{\partial G_3}{\partial K^*}=\frac{\alpha p_H^*}{K^*}$, $\frac{\partial G_3}{\partial \theta_L^*}=(1-\rho-\alpha)\frac{(1-\varepsilon)u_L^* p_H^* p_L^* Y_L^*}{\theta_L^*(1-\alpha)Y^*}$, $\frac{\partial G_3}{\partial \theta_H^*}=-c_H\frac{\varepsilon r+\varepsilon\lambda_H+\beta\theta_H^* q(\theta_H^*)}{(1-\beta)\pi_H\theta_H^* q(\theta_H^*)}-\left[\alpha p_H^* Y_H^*+(1-\rho)p_L^* Y_L^*\right]\frac{(1-\varepsilon)u_H^* p_H^*}{(1-\alpha)Y^*\theta_H^*}$, $\frac{\partial G_3}{\partial s_0^*}=-\frac{p_H^* F'(s_0^*)}{(N_L^*+M_L^*)(N_H^*+M_H^*)}\left[\alpha(N_L^*+M_L^*)+(1-\rho-\alpha)\frac{p_L^* Y_L^*}{(1-\alpha)Y^*}(1+M^*)\right]$, $\frac{\partial G_3}{\partial m_L^*}=(1-\rho-\alpha)\frac{p_H^* p_L^* Y_L^*}{(1-\alpha)Y^*}\frac{F_L'(m_L^*)\tilde{N}_L}{N_L^*+M_L^*}$, $\frac{\partial G_3}{\partial m_H^*}=-\frac{p_H^*\left[\alpha p_H^* Y_H^*+(1-\rho)p_L^* Y_L^*\right]}{(1-\alpha)Y^*}\frac{F_H'(m_H^*)\tilde{N}_H}{N_H^*+M_H^*}$, $\frac{\partial G_4}{\partial \theta_L^*}=-\frac{c_L\beta}{1-\beta}$, $\frac{\partial G_4}{\partial \theta_H^*}=\frac{c_H\beta}{1-\beta}$, $\frac{\partial G_4}{\partial m_L^*}=\frac{\partial G_4}{\partial m_H^*}=\frac{\partial G_5}{\partial \theta_H^*}=\frac{\partial G_5}{\partial s_0^*}=\frac{\partial G_5}{\partial m_H^*}=\frac{\partial G_6}{\partial \theta_L^*}=\frac{\partial G_6}{\partial s_0^*}=\frac{\partial G_6}{\partial m_L^*}=0$, $\frac{\partial G_4}{\partial N_H^*}=-r\kappa$, $\frac{\partial G_5}{\partial \theta_L^*}=\frac{c_L\beta}{1-\beta}$, $\frac{\partial G_6}{\partial \theta_H^*}=\frac{c_H\beta}{1-\beta}$, $\frac{\partial G_5}{\partial m_L^*}=\frac{\partial G_6}{\partial m_H^*}=-r$, $\frac{\partial G_1}{\partial b}=\frac{\partial G_2}{\partial b}=\frac{\partial G_3}{\partial b}=0$, $\frac{\partial G_4}{\partial b}=-\frac{\beta(c_H\theta_H^*-c_L\theta_L^*)}{1-\beta}$, $\frac{\partial G_5}{\partial b}=\frac{\beta}{1-\beta}\left[(c_H\theta_H^*-c_L\theta_L^*)\frac{N_H^*+M_H^*}{1+M^*}+r\left(\frac{c_L\theta_L^*}{\lambda_L+\theta_L^* q(\theta_L^*)}\frac{N_L^*+M_L^*}{1+M^*}+\frac{c_H\theta_H^*}{\lambda_H+\theta_H^* q(\theta_H^*)}\frac{N_H^*+M_H^*}{1+M^*}\right)\right]$, and $\frac{\partial G_6}{\partial b}=-\frac{\beta}{1-\beta}\left[(c_H\theta_H^*-c_L\theta_L^*)\frac{N_L^*+M_L^*}{1+M^*}-r\left(\frac{c_L\theta_L^*}{\lambda_L+\theta_L^* q(\theta_L^*)}\frac{N_L^*+M_L^*}{1+M^*}+\frac{c_H\theta_H^*}{\lambda_H+\theta_H^* q(\theta_H^*)}\frac{N_H^*+M_H^*}{1+M^*}\right)\right]$, with all partial derivatives evaluated at $b=0$. Solving (A1) for $d\theta_L^*/db$ and $d\theta_H^*/db$, we get that $\frac{d\theta_L^*}{db}=\frac{B_1}{C}$ and $\frac{d\theta_H^*}{db}=\frac{B_2}{C}$ where

$$B_1 = -Y_H^* c_H \frac{\varepsilon r + \varepsilon\lambda_H + \beta\theta_H^* q(\theta_H^*)}{(1-\beta)\pi_H \theta_H^* q(\theta_H^*)} \left\{ \frac{\beta(c_H\theta_H^* - c_L\theta_L^*)}{1-\beta} \frac{F'(s_0^*)(1+M^*)}{(N_L^*+M_L^*)(N_H^*+M_H^*)} \right.$$
$$\left. +\kappa\left[\frac{\partial G_5}{\partial b}\frac{F_L'(m_L^*)\tilde{N}_L}{N_L^*+M_L^*} - \frac{\partial G_6}{\partial b}\frac{F_H'(m_H^*)\tilde{N}_H}{N_H^*+M_H^*} \right]\right\},$$

$$B_2 = Y_L^* c_L \frac{\varepsilon r + \varepsilon\lambda_L + \beta\theta_L^* q(\theta_L^*)}{(1-\beta)\pi_L \theta_L^* q(\theta_L^*)} \left\{ \frac{\beta(c_H\theta_H^* - c_L\theta_L^*)}{1-\beta} \frac{F'(s_0^*)(1+M^*)}{(N_L^*+M_L^*)(N_H^*+M_H^*)} \right.$$
$$\left. +\kappa\left[\frac{\partial G_5}{\partial b}\frac{F_L'(m_L^*)\tilde{N}_L}{N_L^*+M_L^*} - \frac{\partial G_6}{\partial b}\frac{F_H'(m_H^*)\tilde{N}_H}{N_H^*+M_H^*} \right]\right\},$$

and

$$C = \frac{1}{(1-\beta)}\left\{ r\kappa\left[\frac{(1-\alpha)Y^* c_L c_H}{(1-\rho)(1-\beta)p_L^* p_H^*} \frac{\varepsilon r + \varepsilon\lambda_L + \beta\theta_L^* q(\theta_L^*)}{\pi_L\theta_L^* q(\theta_L^*)} \frac{\varepsilon r + \varepsilon\lambda_H + \beta\theta_H^* q(\theta_H^*)}{\pi_H\theta_H^* q(\theta_H^*)} \right.\right.$$
$$\left. +(1-\varepsilon)\left(\frac{c_L u_L^* Y_L^*}{\theta_L^*} \frac{\varepsilon r + \varepsilon\lambda_L + \beta\theta_L^* q(\theta_L^*)}{\pi_L\theta_L^* q(\theta_L^*)} + \frac{c_H u_H^* Y_H^*}{\theta_H^*} \frac{\varepsilon r + \varepsilon\lambda_H + \beta\theta_H^* q(\theta_H^*)}{\pi_H\theta_H^* q(\theta_H^*)} \right)\right]$$
$$+\beta \frac{F'(s_0^*)(1+M^*)}{(N_L^*+M_L^*)(N_H^*+M_H^*)}\left[\frac{\varepsilon c_L}{\theta_H^*} p_H^* Y_H^* + \frac{\varepsilon c_H}{\theta_L^*} p_L^* Y_L^* + \frac{c_L c_H (1-\varepsilon)\beta}{1-\beta}\left(\frac{Y_H^*}{\pi_H} + \frac{Y_L^*}{\pi_L} \right)\right]$$
$$\left. +\kappa\beta c_L c_H \left(\frac{\varepsilon r + \varepsilon\lambda_H + \beta\theta_H^* q(\theta_H^*)}{\pi_H\theta_H^* q(\theta_H^*)} \frac{Y_H^* F_L'(m_L^*)\tilde{N}_L}{N_L^*+M_L^*} + \frac{\varepsilon r + \varepsilon\lambda_L + \beta\theta_L^* q(\theta_L^*)}{\pi_L\theta_L^* q(\theta_L^*)} \frac{Y_L^* F_H'(m_H^*)\tilde{N}_H}{N_H^*+M_H^*} \right)\right\}.$$

Because $C>0$, $\frac{d\theta_L^*}{db}<0$ and $\frac{d\theta_H^*}{db}>0$ obtain if $B_1<0$ and $B_2>0$. In turn, because from (22) it follows that $c_H\theta_H^* > c_L\theta_L^*$, a sufficient condition for $B_1<0$ and $B_2>0$ is that $\frac{\partial G_5}{\partial b}>0$ and $\frac{\partial G_6}{\partial b}<0$. Recalling again that $c_H\theta_H^* > c_L\theta_L^*$ we get that $\frac{\partial G_5}{\partial b}>0$ and $\frac{\partial G_6}{\partial b}<0$ if $r < (c_H\theta_H^* - c_L\theta_L^*)(N_L^*+M_L^*)\left[\frac{c_L\theta_L^*(N_L^*+M_L^*)}{\lambda_L+\theta_L^* q(\theta_L^*)} + \frac{c_H\theta_H^*(N_H^*+M_H^*)}{\lambda_H+\theta_H^* q(\theta_H^*)} \right]^{-1} = r_0$, which is our assumption.

Having shown that $\frac{d\theta_L^*}{db}<0$ and $\frac{d\theta_H^*}{db}>0$, we proceed with the proof of Claim 1, starting with point (a). Recalling (20), (21), and $q(\theta)=\xi\theta^{-\varepsilon}>0$, we have that if

$r<\left(c_H\theta_H^*-c_L\theta_L^*\right)\left(N_L^*+M_L^*\right)\cdot\left[\frac{c_L\theta_L^*\left(N_L^*+M_L^*\right)}{\lambda_L+\theta_L^*q\left(\theta_L^*\right)}+\frac{c_H\theta_H^*\left(N_H^*+M_H^*\right)}{\lambda_H+\theta_H^*q\left(\theta_H^*\right)}\right]^{-1}$, then $\frac{dw_L^*}{db}=\frac{\partial w_L^*}{\partial\theta_L^*}\frac{d\theta_L^*}{db}$ $=\frac{c_L\beta}{1-\beta}\left[1+\frac{\varepsilon\left(r+\lambda_L\right)}{\theta_L^*q\left(\theta_L^*\right)}\right]\frac{d\theta_L^*}{db}<0$ and $\frac{dw_H^*}{db}=\frac{\partial w_H^*}{\partial\theta_H^*}\frac{d\theta_H^*}{db}=\frac{c_H\beta}{1-\beta}\left[1+\frac{\varepsilon\left(r+\lambda_H\right)}{\theta_H^*q\left(\theta_H^*\right)}\right]\frac{d\theta_H^*}{db}>0$. Next, we prove part (b) of Claim 1. Recalling (7) and $q\left(\theta\right)=\xi\theta^{-\varepsilon}>0$, we have that if $r<\left(c_H\theta_H^*-c_L\theta_L^*\right)\left(N_L^*+M_L^*\right)\cdot\left[\frac{c_L\theta_L^*\left(N_L^*+M_L^*\right)}{\lambda_L+\theta_L^*q\left(\theta_L^*\right)}+\frac{c_H\theta_H^*\left(N_H^*+M_H^*\right)}{\lambda_H+\theta_H^*q\left(\theta_H^*\right)}\right]^{-1}$, then $\frac{du_L^*}{db}=\frac{\partial u_L^*}{\partial\theta_L^*}\frac{d\theta_L^*}{db}$ $=-\frac{\lambda_L\left(1-\varepsilon\right)q\left(\theta_L^*\right)}{\left(\lambda_L+\theta_L^*q\left(\theta_L^*\right)\right)^2}\frac{d\theta_L^*}{db}>0$ and $\frac{du_H^*}{db}=\frac{\partial u_H^*}{\partial\theta_H^*}\frac{d\theta_H^*}{db}=-\frac{\lambda_H\left(1-\varepsilon\right)q\left(\theta_H^*\right)}{\left(\lambda_H+\theta_H^*q\left(\theta_H^*\right)\right)^2}\frac{d\theta_H^*}{db}>0$. Q.E.D.

Appendix B

Table B1. Country statistics for the year 2018 used for calibrating the model

Country	$\frac{w_H}{w_L}$	Y	u_L	u_H	N_H	M_L^{EU}	M_H^{EU}	M_L^{NEU}	M_H^{NEU}	α	$\frac{b\bar{w}}{Y}$	$\frac{tr_{U\to E}}{tr_{U\to E}+tr_{U\to U}}$
Austria	1.536	0.823	0.063	0.033	0.302	0.071	0.042	0.086	0.023	0.332	0.284	0.571
Belgium	1.487	0.721	0.090	0.035	0.361	0.063	0.041	0.042	0.015	0.319	0.273	0.420
Denmark	1.272	0.761	0.060	0.043	0.322	0.025	0.029	0.046	0.021	0.347	0.305	0.757
Finland	1.342	0.620	0.107	0.043	0.381	0.019	0.005	0.031	0.006	0.349	0.296	0.573
France	1.525	0.594	0.121	0.055	0.333	0.019	0.008	0.044	0.015	0.322	0.314	0.474
Germany	1.631	0.760	0.045	0.019	0.258	0.055	0.017	0.073	0.019	0.326	0.284	0.541
Greece	1.475	0.381	0.223	0.143	0.287	0.021	0.006	0.063	0.006	0.356	0.252	0.156
Ireland	1.568	1.180	0.084	0.038	0.384	0.070	0.063	0.016	0.031	0.395	0.138	0.584
Italy	1.464	0.570	0.125	0.061	0.178	0.032	0.004	0.071	0.008	0.324	0.279	0.385
Netherlands	1.558	0.731	0.048	0.024	0.333	0.027	0.015	0.027	0.008	0.323	0.271	0.672
Portugal	1.956	0.433	0.079	0.054	0.225	0.010	0.006	0.031	0.007	0.329	0.231	0.533
Spain	1.625	0.541	0.197	0.090	0.355	0.037	0.016	0.060	0.015	0.366	0.232	0.423
Sweden	1.244	0.705	0.096	0.037	0.367	0.019	0.023	0.049	0.026	0.344	0.277	0.565
UK	1.475	0.639	0.054	0.025	0.382	0.045	0.036	0.025	0.028	0.313	0.255	0.557

Source: OECD, Eurostat, World Bank

Table B2. Calibrated values of the model's parameters, by country

Country	A	x	λ_L	λ_H	ξ	κ	$\tilde{N}_L$	$\tilde{N}_H$	b	c_H
Austria	0.932	0.497	0.030	0.013	0.317	1.409	1.582	1.383	0.487	0.315
Belgium	0.914	0.472	0.031	0.010	0.248	0.719	1.641	1.899	0.477	0.326
Denmark	0.885	0.525	0.037	0.021	0.360	0.574	0.529	1.119	0.527	0.257
Finland	0.818	0.492	0.052	0.016	0.302	0.403	0.532	0.300	0.533	0.248
France	0.854	0.484	0.052	0.020	0.290	0.785	0.556	0.479	0.551	0.271
Germany	0.921	0.513	0.019	0.007	0.299	2.393	1.267	0.542	0.480	0.337
Greece	0.635	0.519	0.044	0.022	0.161	0.531	1.594	2.869	0.533	0.250
Ireland	1.010	0.436	0.039	0.015	0.312	1.413	1.258	1.065	0.264	0.411
Italy	0.792	0.598	0.035	0.014	0.213	2.952	1.088	0.376	0.514	0.320
Netherlands	0.950	0.477	0.023	0.010	0.330	1.212	0.587	0.448	0.452	0.312
Portugal	0.709	0.487	0.035	0.023	0.328	3.434	0.455	0.508	0.400	0.229
Spain	0.742	0.461	0.083	0.032	0.282	0.780	1.642	1.688	0.454	0.235
Sweden	0.862	0.509	0.047	0.014	0.297	0.398	0.453	1.196	0.491	0.261
UK	0.846	0.456	0.024	0.009	0.299	0.600	1.247	1.868	0.424	0.262

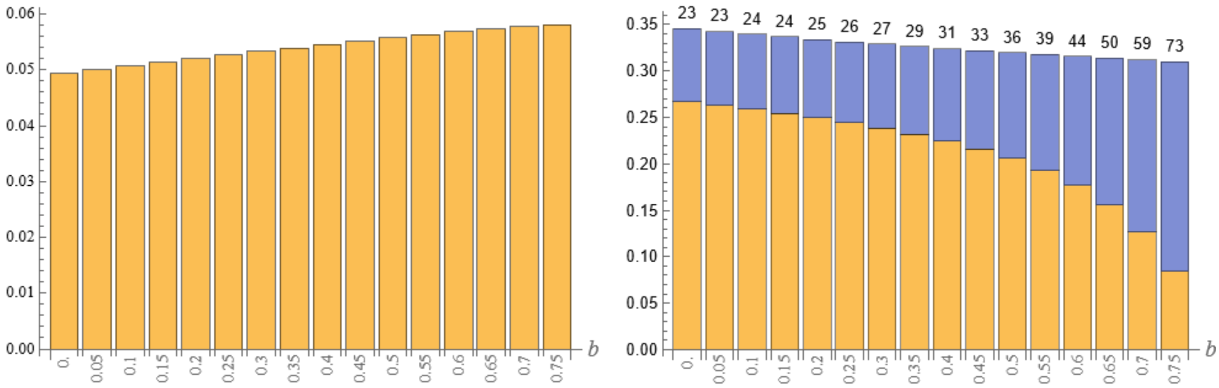
Source: Own calculations

Appendix C

In this appendix, we study the sensitivity of our results to the variation in the values of the model's parameters. We perform a series of analyses such that for each analysis we select a single parameter that we allow to vary while fixing all the remaining parameters at their calibrated values for Germany. We choose Germany because of its representativeness as the country which ranks in the middle of EU-15 countries in terms of the generosity of the social benefit (see Table B2 in Appendix B), the overall semi-elasticity of the size of the low-skilled immigrant population (see Figure 1 panel (a)), and the ratio of the indirect semi-elasticity to direct semi-elasticity of the size of the low-skilled immigrant population (see Figure 1 panel (b)), and because, to the best of our knowledge, the most recent estimate of hiring cost in the group of EU-15 countries is available for Germany (Muehlemann and Pfeifer, 2016).

For each parameter that we allow to vary, we assess the sensitivity of our results in two dimensions: the variation in the size of the low-skilled immigrant population and the variation in the magnitude of direct, indirect, and overall semi-elasticities of the size of the low-skilled immigrant population with respect to b. The first dimension aims at identifying parameters the variation in which has a noticeable impact on the attractiveness of the country as a migration destination from the perspective of foreign low-skilled workers. The second dimension serves the purpose of identifying parameters the variation in which impacts the strength of the relationship between the social benefit on the one hand, and the size of the low-skilled immigrant population when indirect channels are accounted for and when they are not on the other hand. Therefore, the first dimension looks at the overall attractiveness of the destination country as seen by foreign low-skilled workers, while the second dimension focuses specifically on attractiveness for these workers of the country's welfare system. The results of the sensitivity analysis are presented in the following set of eight figures.

Fig C1. The role of the level of income redistribution: simulated size of the low-skilled immigrant population (panel (a)) and overall, direct, and indirect semi-elasticities of the low-skilled immigrant population (panel (b)) for Germany, by *b*.

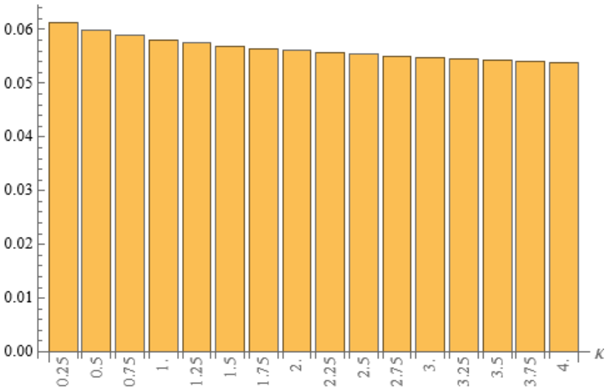


(a) Low-skilled immigrant population (b) Direct, indirect, and overall semi-elasticities

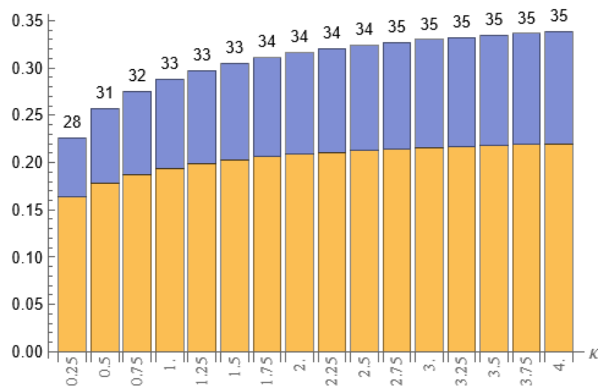
Note: In panel (b), a yellow bar corresponds to overall semi-elasticity, the sum of a yellow and a blue bars corresponds to direct semi-elasticity, and the blue bar corresponds the absolute value of indirect semi-elasticity (indirect semi-elasticities are negative). Numbers above blue bars indicate the percentage reduction in semi-elasticities due to indirect channels via which the social benefit impacts immigration, namely the height of a blue bar in relation to the height of the sum of the blue bar and the corresponding yellow bar, in percent.

As shown in Figure C1 panel (a), under the configuration of the model's parameters corresponding to simulated Germany, more income redistribution is associated with more low-skilled immigration. The "welfare magnet" effect is rather weak, with the relative difference between the sizes of the low-skilled immigrant populations under high income redistribution, $b = 0.75$, and under no income redistribution, $b = 0$, at only 17.5 percent. An inspection of panel (b) in Figure C1 reveals that a one percentage point increase in *b* triggers less and less additional welfare migration as *b* becomes larger. The reason lies in the growing with *b* importance of indirect channels via which the social benefit affects immigration. When income redistribution is substantial, the country hosts a relatively numerous (native and migrant) low-skilled workforce, which bears adversely on these workers' wage rate and unemployment rate, and it witnesses lower per capita output, which brings down wages of all workers. These become increasingly important "stay away" factors for foreign low-skilled workers as *b* increases.

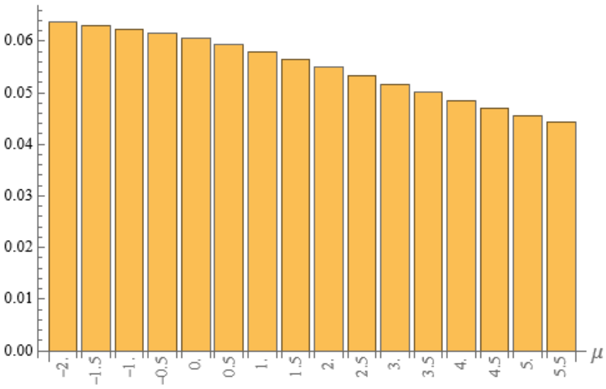
Fig C2. The role of the skill formation cost: simulated size of the low-skilled immigrant population (panels (a), (c), and (e)) and overall, direct, and indirect semi-elasticities of the low-skilled immigrant population (panels (b), (d), and (f)) for Germany, by κ, μ, and σ.



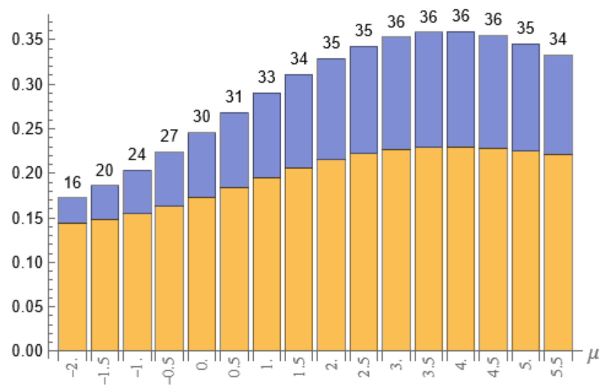
(a) Low-skilled immigrant population



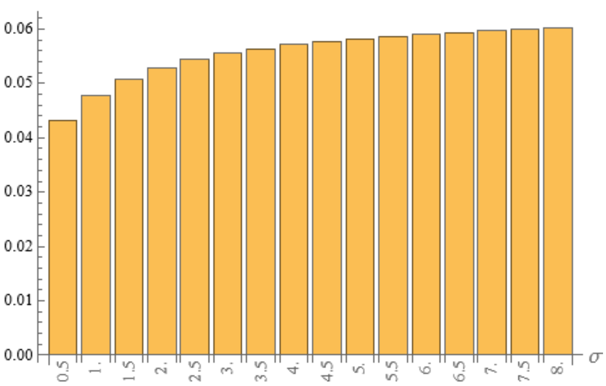
(b) Direct, indirect, and overall semi-elasticities



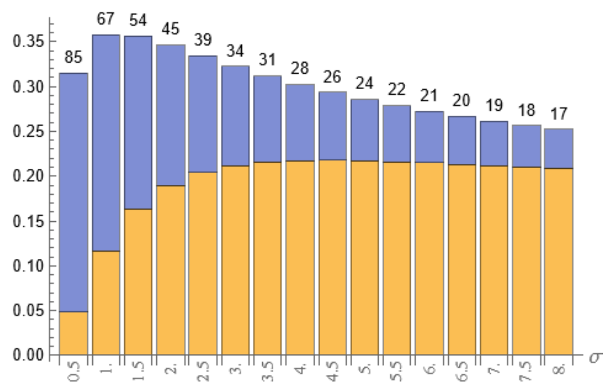
(c) Low-skilled immigrant population



(d) Direct, indirect, and overall semi-elasticities



(e) Low-skilled immigrant population

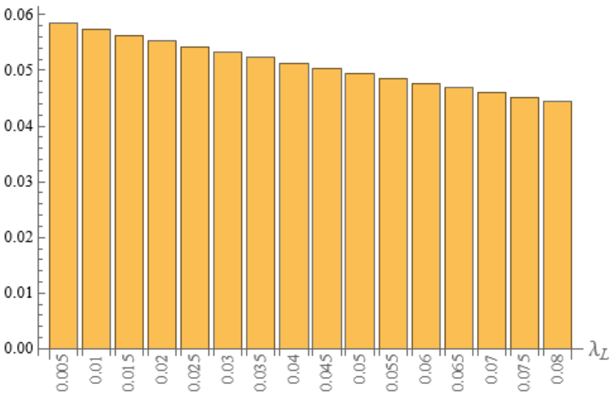


(f) Direct, indirect, and overall semi-elasticities

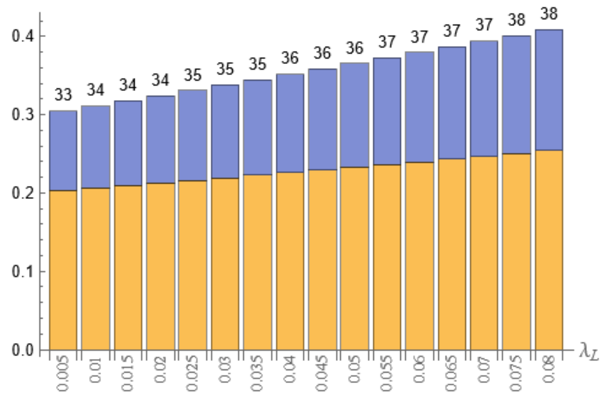
Note: In panels (b), (d), and (f), a yellow bar corresponds to overall semi-elasticity, the sum of a yellow and a blue bars corresponds to direct semi-elasticity, and the blue bar corresponds the absolute value of indirect semi-elasticity (indirect semi-elasticities are negative). Numbers above blue bars indicate the percentage reduction in semi-elasticities due to indirect channels via which the social benefit impacts immigration, namely the height of a blue bar in relation to the height of the sum of the blue bar and the corresponding yellow bar, in percent.

Figure C2 shows that the higher the value of the parameter augmenting the private skill formation cost, κ, the less attractive the country becomes as a migration destination for foreign low-skilled workers (panel (a)). This is because when κ is large, fewer native individuals choose to become high-skilled workers, which has a detrimental effect on low-skilled wage rate; a "stay away" factor for foreign low-skilled workers. In turn, a reduction in low-skilled wage means that low-skilled workers contribute little to the welfare system, which strengthens welfare migration (panel (b)). Figure C2 also indicates that our results are sensitive to the chosen values of μ and σ - parameters governing the magnitude and the dispersion of the skill formation cost in the destination country's native population. Higher values of μ are associated with less numerous low-skilled immigrant population (panel (c)) because high μ translates into high skill formation cost, less numerous native high-skilled workforce and, consequently, reduced low-skilled wage. In turn, higher values of σ coincide with more numerous low-skilled immigrant population (panel (e)). This is because high σ means that the skill formation cost is more dispersed around the median, which in our context (less than half of the population choose to form skills) results in lower skill formation costs at the margin (around s_0), expansion of the high-skilled workforce, and a higher wage of low-skilled workers. Indirect effects via which the social benefit affects immigration are particularly important when σ is low and diminish with σ (panel (f)). This is because when native individuals are fairly similar by the cost of skill formation (low σ), a small change in incentives to acquire skills triggers a large response in skill choices. As a result, following the increase in the social benefit, the bulk of the expansion in the size of the low-skilled workforce takes place domestically, leaving little room for welfare migration by low-skilled workers. The effect of higher μ on the role of indirect channels is inverse u-shaped (panel (d)), because higher μ increases both the median and the variance of the cost of skill formation.

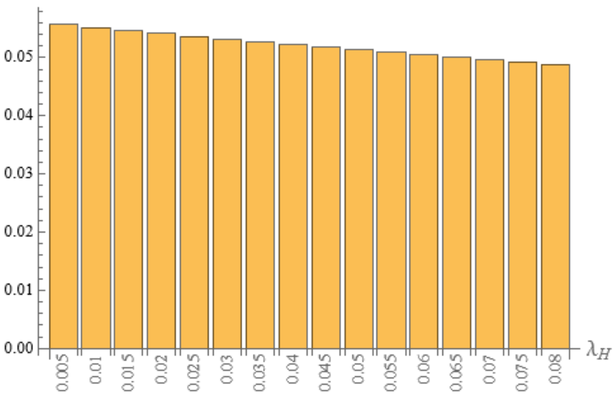
Fig. C3. The role of the risk and duration of unemployment: simulated size of the low-skilled immigrant population (panels (a), (c), and (e)) and overall, direct, and indirect semi-elasticities of the low-skilled immigrant population (panels (b), (d), and (f)) for Germany, by λ_L, λ_H, and ξ.



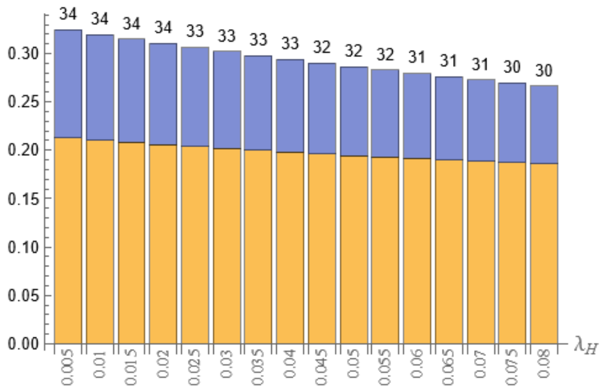
(a) Low-skilled immigrant population



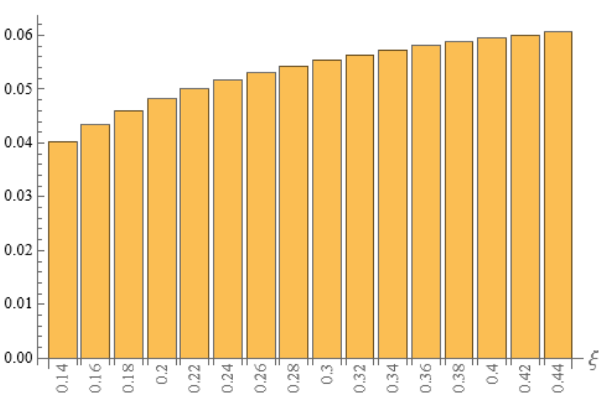
(b) Direct, indirect, and overall semi-elasticities



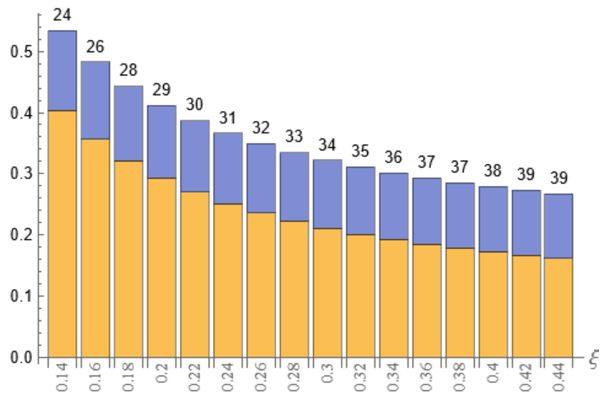
(c) Low-skilled immigrant population



(d) Direct, indirect, and overall semi-elasticities



(e) Low-skilled immigrant population

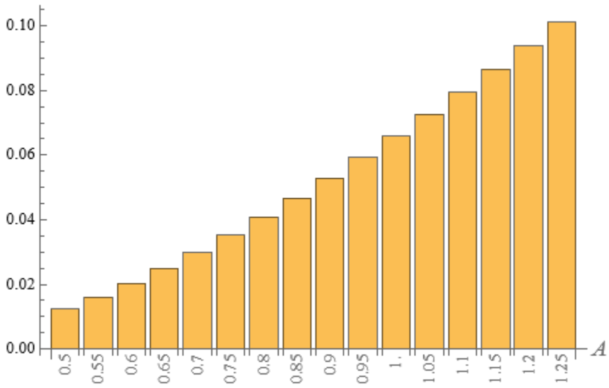


(f) Direct, indirect, and overall semi-elasticities

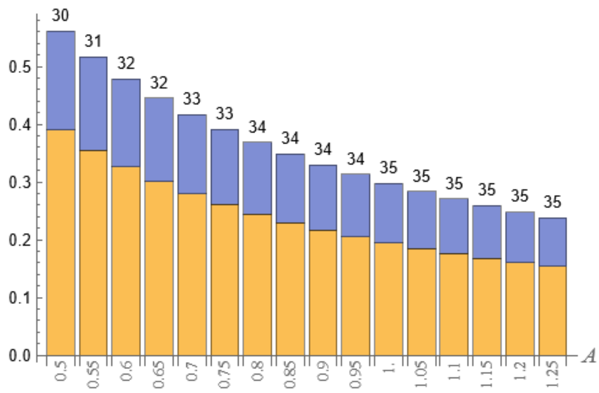
Note: In panels (b), (d), and (f), a yellow bar corresponds to overall semi-elasticity, the sum of a yellow and a blue bars corresponds to direct semi-elasticity, and the blue bar corresponds the absolute value of indirect semi-elasticity (indirect semi-elasticities are negative). Numbers above blue bars indicate the percentage reduction in semi-elasticities due to indirect channels via which the social benefit impacts immigration, namely the height of a blue bar in relation to the height of the sum of the blue bar and the corresponding yellow bar, in percent.

Short employment intervals among low-skilled workers resulting from λ_L being large discourage foreign low-skilled workers from migration (Figure C3, panel (a)). A similar, albeit weaker effect obtains when λ_H is large. Reduced immigration by foreign high-skilled workers and skill formation by native individuals due to short employment spells among high-skilled workers bear adversely on low-skilled wage rate and, thus, on immigration by low-skilled workers (panel (c)). The impact of an increase in λ_L and λ_H on low-skilled workers' support for income redistribution is, however, different (panels (b) and (d)). When λ_L is large, low-skilled workers view income redistribution more favorably than when it is low, because time intervals during which these workers contribute to the welfare system, namely spells of employment, are shorter. In turn, when λ_H is large, their support for income redistribution shrinks, because shorter employment intervals of high-skilled workers mean that the burden of financing the welfare system is increasingly on the shoulders of low-skilled workers. When matching in the destination country's labor market is efficient, namely when ξ is large, foreign low-skilled workers expect to find a job relatively quickly on arrival to the country or on getting laid off there. While this is overall beneficial for these workers and induces more migration (panel (e)), it also means that income redistribution becomes less advantageous for low-skilled workers, as the (non-contributory) spells of unemployment become shorter (panel (f)).

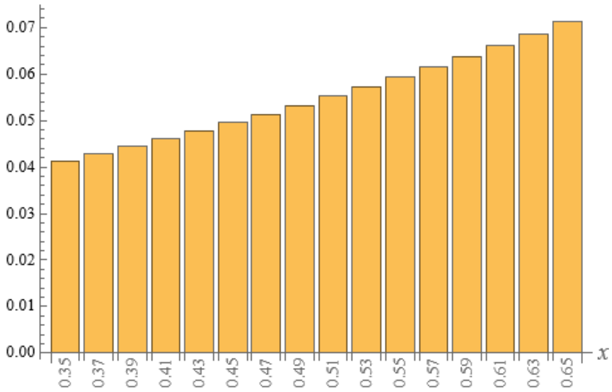
Fig. C4. The role of the level of development: simulated size of the low-skilled immigrant population (panels (a) and (c)) and overall, direct, and indirect semi-elasticities of the low-skilled immigrant population (panels (b) and (d)) for Germany, by *A* and *x*.



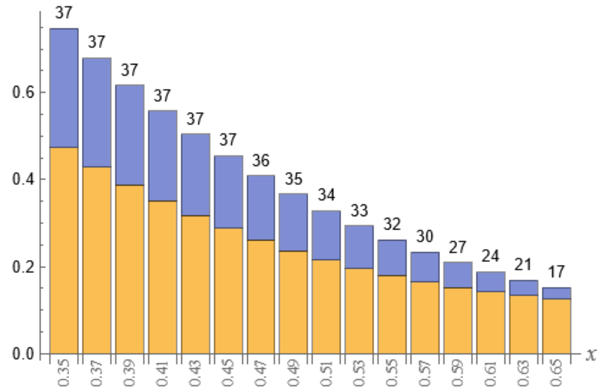
(a) Low-skilled immigrant population



(b) Direct, indirect, and overall semi-elasticities



(c) Low-skilled immigrant population

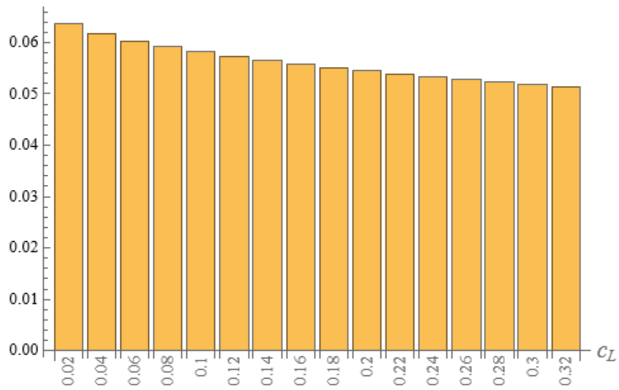


(d) Direct, indirect, and overall semi-elasticities

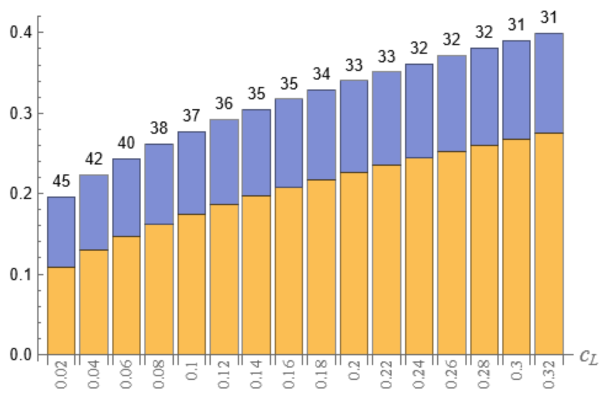
Note: In panels (b) and (d), a yellow bar corresponds to overall semi-elasticity, the sum of a yellow and a blue bars corresponds to direct semi-elasticity, and the blue bar corresponds the absolute value of indirect semi-elasticity (indirect semi-elasticities are negative). Numbers above blue bars indicate the percentage reduction in semi-elasticities due to indirect channels via which the social benefit impacts immigration, namely the height of a blue bar in relation to the height of the sum of the blue bar and the corresponding yellow bar, in percent.

While the size of the low-skilled immigrant population increases with the level of technological development for obvious reasons (Figure C4, panel (a)), welfare migration decreases with it (panel (b)). This is because the share of high-skilled workers in a country's workforce increases with the level of technological development, which reduces the wage gap and, consequently, the tax burden gap between high-skilled workers and low-skilled workers. Seeing that their role in financing the welfare system increases with technological development, foreign low-skilled workers will be less responsive to changes in the generosity of the welfare state. We get the same results when the importance of low-skilled intermediate goods in production of the composite good, *x*, increases. Higher *x* pushes up the demand for low-skilled work, which is reflected in higher wage of low-skilled workers and their lower unemployment rate, inducing more immigration by low-skilled workers (panel (c)). However, increased role of low-skilled workers in the production of the composite good translates into lower wage gap and unemployment gap between high-skilled workers and low-skilled workers, increasing the relative burden for low-skilled workers of financing the welfare system. In effect, welfare migration is reduced (panel (d)).

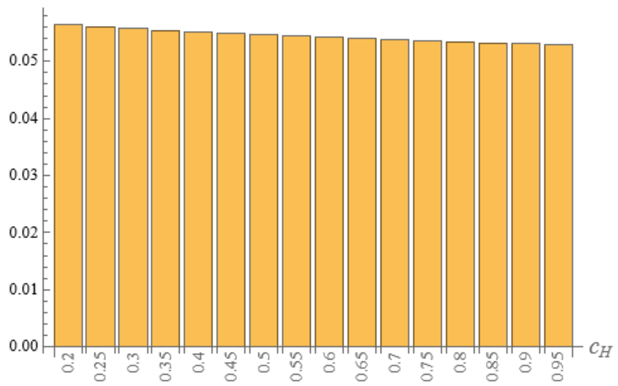
Fig. C5. The role of the vacancy cost: simulated size of the low-skilled immigrant population (panels (a) and (c)) and overall, direct, and indirect semi-elasticities of the low-skilled immigrant population (panels (b) and (d)) for Germany, by c_L and c_H.



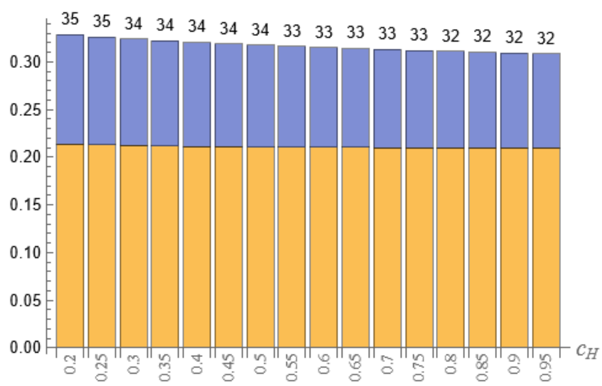
(a) Low-skilled immigrant population



(b) Direct, indirect, and overall semi-elasticities



(c) Low-skilled immigrant population

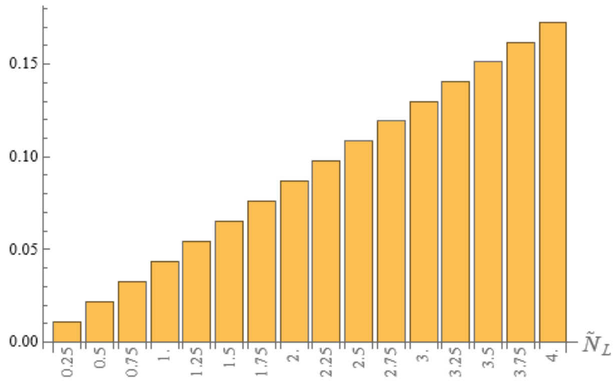


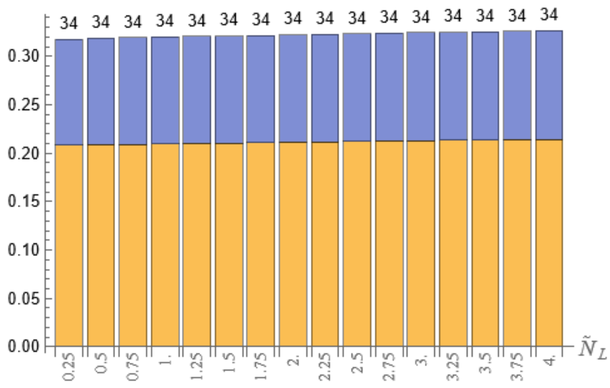
(d) Direct, indirect, and overall semi-elasticities

Note: In panels (b) and (d), a yellow bar corresponds to overall semi-elasticity, the sum of a yellow and a blue bars corresponds to direct semi-elasticity, and the blue bar corresponds the absolute value of indirect semi-elasticity (indirect semi-elasticities are negative). Numbers above blue bars indicate the percentage reduction in semi-elasticities due to indirect channels via which the social benefit impacts immigration, namely the height of a blue bar in relation to the height of the sum of the blue bar and the corresponding yellow bar, in percent.

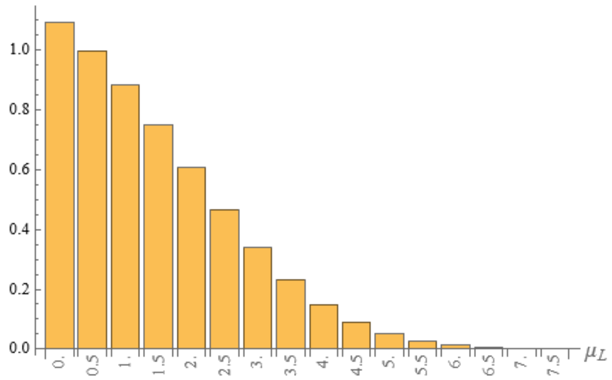
The higher the cost of a low-skilled vacancy, c_L, or the cost of a high-skilled vacancy, c_H, the fewer low-skilled workers choose to migrate to the country (Figure C5, panels (a) and (c)). This is because when the vacancy costs are high, the larger share of the country's income gets wasted on firms' search for employees and the smaller share of the country's income ends up in the hands of workers as wage earnings. The size of the low-skilled immigrant population decreases more rapidly with c_L than with c_H because higher c_L reduces the vacancy-to-unemployment ratio in the low-skilled sector, which has a negative effect on low-skilled wage rate and pushes low-skilled unemployment rate up; both being "stay away" factors for foreign low-skilled workers. Higher c_H does the same with high-skilled wage rate and unemployment rate, reducing skill formation among the natives and immigration by foreign high-skilled workers, which carry a secondary-order negative effects on low-skilled wage rate and, thus, on migration by low-skilled workers. The support for income redistribution changes visibly only with c_L, but not with c_H (panels (b) and (d)). This is because when c_L is large, its negative consequences for economic conditions of low-skilled workers hit these workers directly (first-order effect), whereas the negative consequences of large c_H hit low-skilled workers only indirectly (second-order effect).

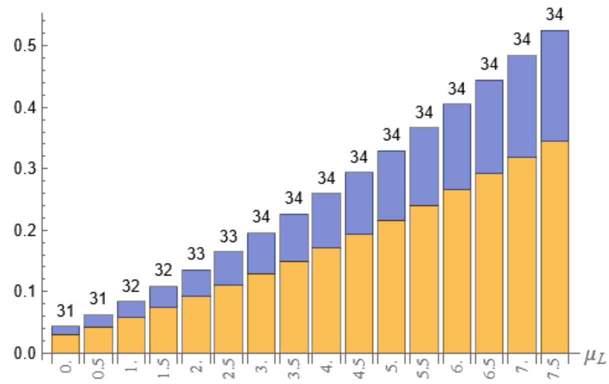
Fig. C6. The role of characteristic of the foreign low-skilled workforce: simulated size of the low-skilled immigrant population (panels (a) and (c)) and overall, direct, and indirect semi-elasticities of the low-skilled immigrant population (panels (b) and (d)) for Germany, by $\tilde{N}_L$ and μ_L and σ_L.



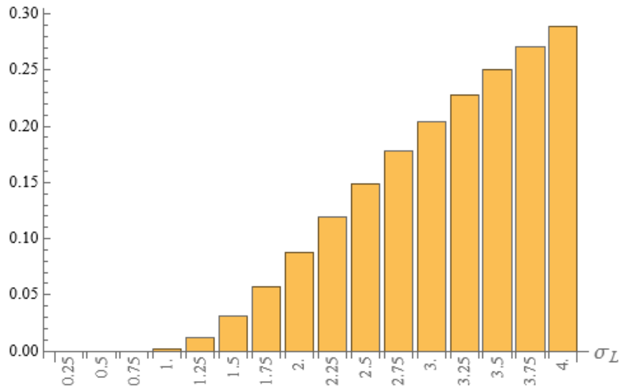


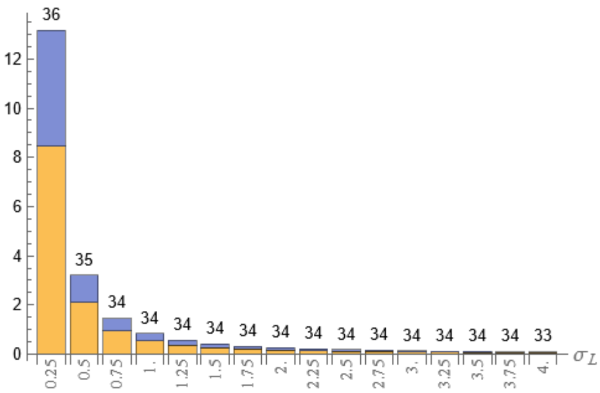
(a) Low-skilled immigrant population (b) Direct, indirect, and overall semi-elasticities





(c) Low-skilled immigrant population (d) Direct, indirect, and overall semi-elasticities



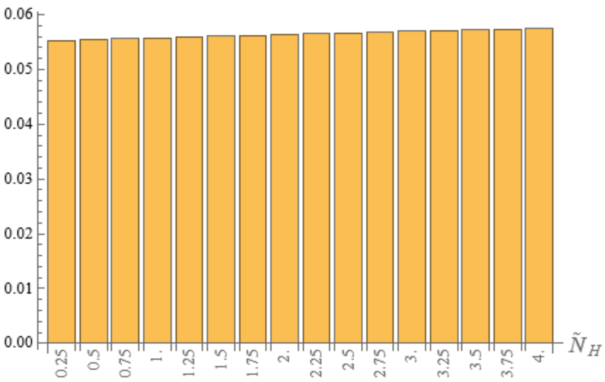


(e) Low-skilled immigrant population (f) Direct, indirect, and overall semi-elasticities

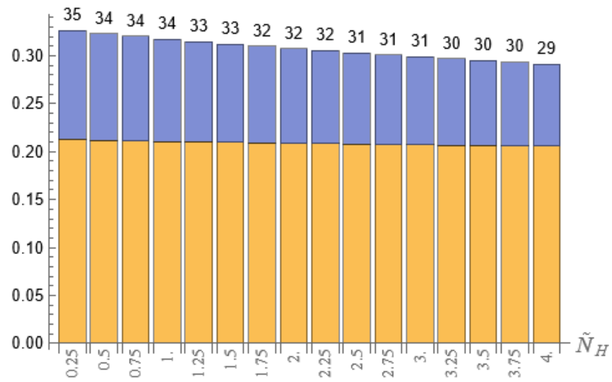
Note: In panels (b), (d), and (f), a yellow bar corresponds to overall semi-elasticity, the sum of a yellow and a blue bars corresponds to direct semi-elasticity, and the blue bar corresponds the absolute value of indirect semi-elasticity (indirect semi-elasticities are negative). Numbers above blue bars indicate the percentage reduction in semi-elasticities due to indirect channels via which the social benefit impacts immigration, namely the height of a blue bar in relation to the height of the sum of the blue bar and the corresponding yellow bar, in percent.

That when foreign low-skilled workforce is more numerous so is immigration by low-skilled workers is self-explanatory (Figure C6 panel (a)). Social benefit semi-elasticities of the low-skilled immigrant population are virtually constant with the size of the foreign low-skilled workforce (panel (b)). Higher values of μ_L and σ_L have opposite effects on the size of the low-skilled immigrant population: higher μ_L increases migration cost for all foreign low-skilled workers, which translates into less immigration by these workers (panel (c)), whereas higher σ_L increases the proportion of foreign low-skilled workers with very high and very low migration costs, which, given that in our configuration of the model's parameters only those with very low migration costs choose to migrate, has a positive effect on the magnitude of low-skilled immigration at the margin (panel (e)). Welfare migration by low-skilled workers intensifies (in relative terms) with μ_L and diminishes with σ_L (panels (d) and (f)). These effects stem from the properties of the lognormal distribution around the equilibrium value of m_L for different values of μ_L and σ_L, specifically they stem from the value of the second derivative of $F_L(\cdot)$ evaluated at m_L^*. In our configuration of the model's parameters, $F_L''(m_L^*)$ increases with μ_L and decreases with σ_L, which translates into foreign low-skilled workers' responsiveness to the social benefit increasing with μ_L and decreasing with σ_L.

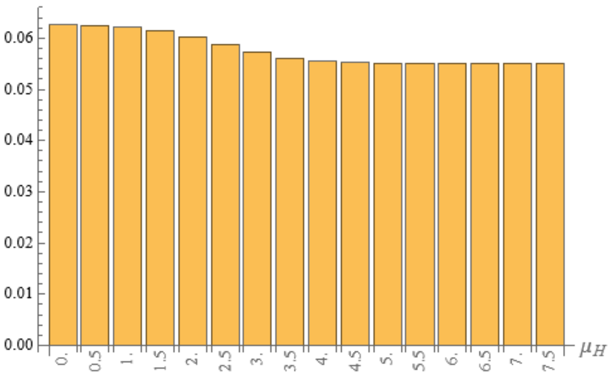
Fig. C7. The role of characteristic of the foreign high-skilled workforce: simulated size of the low-skilled immigrant population (panels (a) and (c)) and overall, direct, and indirect semi-elasticities of the low-skilled immigrant population (panels (b) and (d)) for Germany, by $\tilde{N}_H$ and μ_H and σ_H.



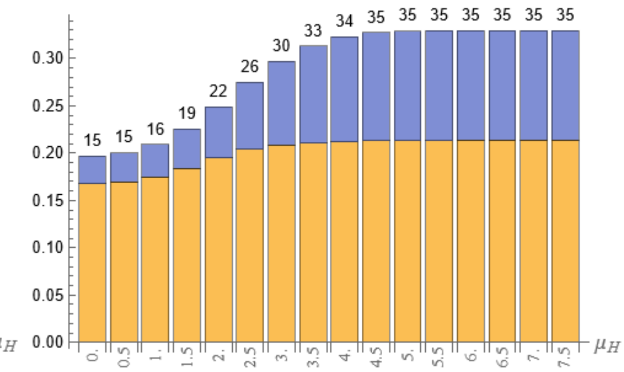
(a) Low-skilled immigrant population



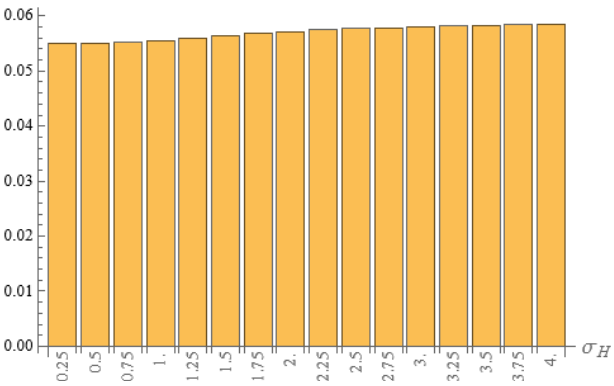
(b) Direct, indirect, and overall semi-elasticities



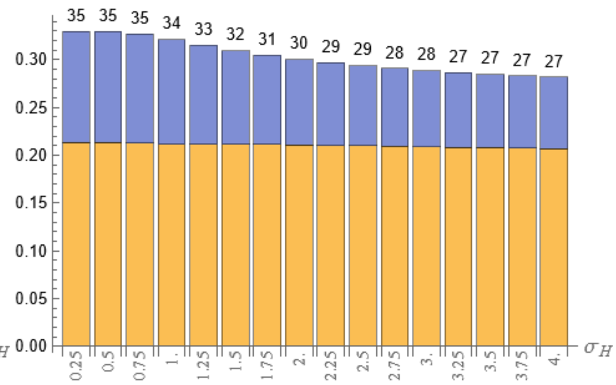
(c) Low-skilled immigrant population



(d) Direct, indirect, and overall semi-elasticities



(e) Low-skilled immigrant population

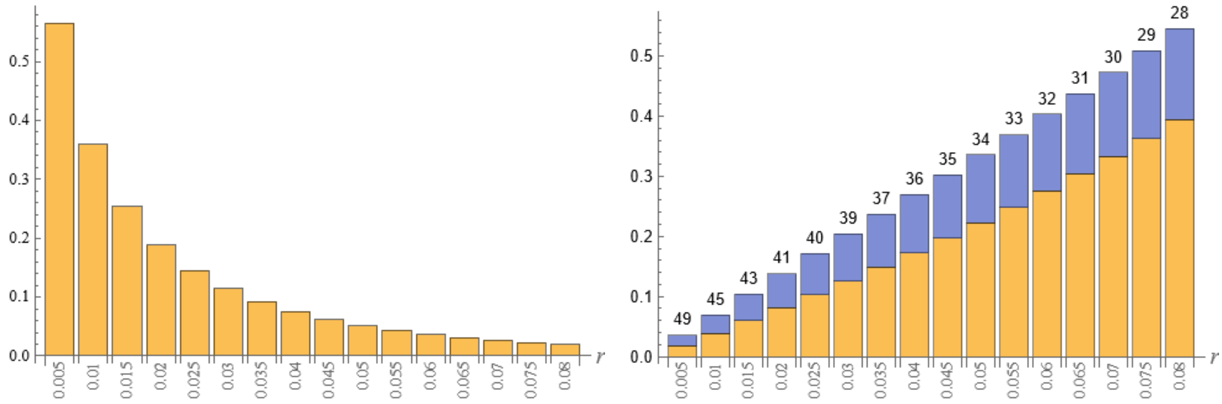


(f) Direct, indirect, and overall semi-elasticities

Note: In panels (b), (d), and (f), a yellow bar corresponds to overall semi-elasticity, the sum of a yellow and a blue bars corresponds to direct semi-elasticity, and the blue bar corresponds the absolute value of indirect semi-elasticity (indirect semi-elasticities are negative). Numbers above blue bars indicate the percentage reduction in semi-elasticities due to indirect channels via which the social benefit impacts immigration, namely the height of a blue bar in relation to the height of the sum of the blue bar and the corresponding yellow bar, in percent.

The size of the foreign high-skilled workforce has a small positive impact on the size of the low-skilled immigrant population (Figure C7 panel (a)). This is because when high-skilled immigration is numerous, economic conditions for low-skilled workers at destination improve inducing foreign low-skilled workers to migrate too. Relatively fewer foreign low-skilled workers engage in welfare migration for that same reason: improved economic conditions of low-skilled workers at destination reduce the demand for the welfare state (panel (b)). Higher values of μ_H and σ_H have a weaker but qualitatively the same effects on the size of the low-skilled immigrant population as μ_L and σ_L, respectively. Higher μ_H makes migrating costlier for foreign high-skilled workers, which reduces their inflow to the destination country. This negatively affects immigration by foreign low-skilled workers by worsening their economic conditions at destination (panel (c)). Conversely, immigration by high-skilled workers intensifies with σ_H at the margin improving economic conditions for low-skilled workers, thus inducing immigration by these workers as well (panel (e)). The impact of higher μ_H and σ_H on welfare migration by foreign low-skilled workers is again qualitatively the same as that of μ_L and σ_L, respectively, but follows from different reasons. Widening of the wage gap between low-skilled workers and high-skilled workers with μ_H increases low-skilled workers' support for the welfare state and induces welfare migration by these workers (panel (d)). In turn, because the economic conditions improve for low-skilled workers as σ_H becomes larger, their role in financing the welfare system increases, diminishing their support for the welfare state and reducing welfare migration by foreign low-skilled workers (panel (f)).

Fig. C8. The role of time discounting: simulated size of the low-skilled immigrant population (panels (a) and (c)) and overall, direct, and indirect semi-elasticities of the low-skilled immigrant population (panels (b) and (d)) for Germany, by *r*.



(a) Low-skilled immigrant population (b) Direct, indirect, and overall semi-elasticities

Note: In panel (b), a yellow bar corresponds to overall semi-elasticity, the sum of a yellow and a blue bars corresponds to direct semi-elasticity, and the blue bar corresponds the absolute value of indirect semi-elasticity (as indirect semi-elasticities are always negative). Numbers above blue bars indicate the percentage reduction in semi-elasticities due to indirect channels via which the social benefit impacts immigration, namely the height of a blue bar in relation to the height of the sum of the blue bar and the corresponding yellow bar, in percent.

When the interest rate is high, capital is costly and firms will use it to a lesser extent. Less capital means lower marginal productivity and price of the composite good, which maps onto lower wage earnings of workers of both skill classes. This reduces immigration by workers of both skill classes (Figure C8 panel (a)). Higher interest rate also discourages from skill formation, because it reduces present value of returns from skill formation. High-skilled workers become relatively scarce increasing the wage earnings gap and, consequently, the support for income redistribution by low-skilled workers (panel (b)).

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