DE GRUYTER OLDENBOURG Review of Economics 2021; 72(1): 29–50

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Strategic Welfare Policies with Migration: A Theoretical Model and Empirical Evidence

https://doi.org/10.1515/roe-2020-0033
Received October 5, 2020; accepted April 7, 2021

Abstract: We test the welfare magnet hypothesis for Europe. We modify the existing theoretical frameworks assuming that: (a) welfare services, intended as the output of welfare expenditure, not the poor's income or social expenditure, enter the median voter's utility function; (b) preferences depend on the position of the median voter in the income distribution; and (c) the total amount of welfare services provided may differ from the amount needed to finance them, because of inefficiencies in the transfer process. We then test the welfare magnet hypothesis for 22 European countries by estimating a reaction function corresponding to the generic form adopted by the literature, but using the variables inspired by the model. We find evidence of a positive strategic interaction among countries, which suggests a downward bias in the choice of the protection level because of welfare competition. The level of social protection also positively depends on GDP, the redistributive attitudes of residents and their weight in the population, vis-à-vis the migrants' share, and the efficiency of social expenditure.

Keywords: welfare, social spending, migration, strategic interaction, European Union

JEL classification: H53, H77, H87

1 Introduction

Welfare migration has been the object of theoretical and political debates in Europe since the opening of its internal borders at the beginning of the 1990s and is receiving renewed attention given the developments of the world economy

We thank the referees for helpful comments. The usual disclaimer applies.

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(Ashenfelter et al. 2019; Salvatore 2017), among which the globalisation of labour markets (Basu 2016). The term refers to the movement of welfare recipients to high benefits countries and its effect on the level of welfare benefits, as in the Tiebout (1956) model. The mechanism works through the decision faced by a country's residents: they confront the benefit from providing welfare services with the corresponding tax burden. With a given number of recipients, if welfare benefits increase, the tax burden also increases; with welfare migration, also the number of recipients rises, because the number of welfare recipients in the population goes up. Thus, the tax burden increases more rapidly than without welfare migration. A country might thus choose to reduce the level of welfare services provided to avoid becoming a welfare magnet. This occurs in each country, leading to a downward bias in the levels of welfare services with respect to the situation without migration.

Migration has been found to be the main determinant of spillovers deriving from differences in the spending choices of local governments (Baicker 2005). Thus, different welfare programmes might not survive migration and competition if net beneficiaries move in and net contributors move out of more generous jurisdictions. Support for the welfare magnet hypothesis has been found in the interactions between states in the US (see, among others, Figlio et al. 1999; Saavedra 2000; Smith 1991) and counties in Germany (Borck et al. 2007). The general theoretical and empirical frameworks of these studies, that apply the literature on tax competition to welfare benefits, have been analysed by Brueckner (2000, 2003).

A similar scenario has been first foreseen and then detected for countries belonging to the European Union (Razin and Wahba 2015; Scharpf 1997, 2000; Sinn 1990, 2002), with an attention also to the political consequences of decreased welfare benefits (Oesch 2008).

In this paper we aim at testing the welfare magnet hypothesis for Europe. In Section 2, we present a modification of the model in Brueckner (2000). Differently from the existing frameworks, we assume that welfare services, intended as the output of welfare expenditure, not the poor's income or social expenditure, enter the median voter's utility function. This is because of two reasons. First, individuals are affected by the total amount of welfare services provided, not just by income transfers. Second, the monetary value of welfare services can differ from the amount of taxes necessary to finance them, because of inefficiencies in the transfer process. We also assume that preferences depend on the position of the median voter in the income distribution,[1] given the risk reducing

1 Saavedra (2000) includes party representation of the state legislature among the variables explaining state expenditure on AFDC.

function of welfare systems and the inverse relationship existing between income and risk aversion. In Section 3, we test the welfare magnet hypothesis for 22 European countries for the period 2009–2015 by estimating a reaction function corresponding to the generic form adopted by the literature but using the output of social expenditure as a dependent variable and some new variables inspired by the model among the explanatory variables. Section 4 concludes the paper.

2 The Theoretical Framework

To analyse the effect of welfare migration on benefit levels, we consider a model adapted from Brueckner (2000), Razin and Sadka (2005), and Antonelli and De Bonis (2017)Antonelli and De Bonis 2017, 2019; Brueckner 2000; Razin and Sadka 2005.[2] The economy is composed by two countries, 1 and 2. Each country contains R non-poor consumers. To simplify the analysis and following Brueckner (2000), we assume that these are immobile across countries. This precludes considering out-migration of the rich in response to a high tax burden. We think that this might well be a relevant issue in the analysis of intra-national migration decisions when considering the choice of the local income and sales tax rates. However, given the international context that we wish to analyse, and the limited share of national budgets devoted to welfare expenditure, we believe that out-migration to avoid the tax burden needed to finance welfare benefits can be overlooked. The economy also contains $2\overline{N}$ mobile poor individuals, who receive welfare benefits from the country of residence, with N_1 the number of poor residents in country 1 and $N_2 = 2\overline{N} - N_1$ the number of poor residents in country 2. The poor does not contribute to financing welfare expenditure. The government provides social protection and finances it through taxation. The choice of the level of welfare services is the result of the maximisation of the utility function of the median rich voter.

2.1 The Government

The government provides welfare services to the poor, paid for by the rich. For simplicity, these are considered as a composite good of unitary cost and price. Each

2 We adopt the general assumptions of these models, when not differently specified.

beneficiary receives an amount g, that can thus be interpreted either as a vector of services or as the implicit income deriving from it. Changes in the amount of social protection that each beneficiary is entitled to receive are represented by a change in the level of g. Total welfare services provided in each country will amount to $g_i N_i$, $i = 1, 2$.

The amount of total welfare services can differ from the amount needed to finance them, because of inefficiencies in the transfer process. These can stem from the spending side, that is, some resources are wasted in the process of being distributed to beneficiaries, and from the revenue side, that is, funds are collected by means of distortionary taxation. In what follows, we concentrate on inefficiency in expenditure. Thus, total welfare expenditure is given by:

$$S_i = \alpha_i g_i N_i, \alpha \geq 1, \tag{1}$$

where α is the *inefficiency parameter*. The case of $\alpha = 1$ corresponds to an efficient provision of welfare services, while α will exceed 1 in the presence of waste, a higher level of α corresponding to a larger waste.

Welfare benefits are financed by means of a fixed tax and the government budget constraint imposes that total revenues, T, equal total expenditure, S:

$$T_i = S_i. \tag{2}$$

Given that we assume that the poor does not contribute, the individual contribution of the rich will be given by:

$$t_i = \frac{T_i}{R_i} = \frac{\alpha_i g_i N_i}{R_i}. \tag{3}$$

2.2 Welfare Migration

Following Brueckner (2000), we assume that the incomes of the poor reflect the marginal productivity of unskilled labour; the output of country i, $f(N_i)$, depends on N_i and other fixed factors; the unskilled wage w_i will then be $w(N_i) \equiv f'(N_i)$, with $f'(N_i)$ indicating the marginal product of labour and $f''(N_i) < 0$. Given the welfare benefit g_i, the total income of the poor is $w(N_1) + g_1$ in country 1 and $w(N_2) + g_2$ in country 2. Assuming zero migration costs, the migration equilibrium obtains when the poor's income levels are equalised between the two countries:

$$w(N_1) + g_1 = w\left(2\overline{N} - N_1\right) + g_2. \tag{4}$$

Equation (4) is the migration equilibrium condition. An increase in g_1 (g_2) makes country 1 more (less) attractive for the poor, causing a welfare migration inflow (outflow). Formally, by differentiating Eq. (4):

$$\frac{\partial N_1}{\partial g_1} = -\frac{1}{w'(N_1) + w'\left(2\overline{N} - N_1\right)} > 0 \tag{5}$$

$$\frac{\partial N_1}{\partial g_2} = -\frac{\partial N_1}{\partial g_1} < 0 \tag{6}$$

given that w' is negative. The negative relation between the wage level and N_1 is the mechanism equilibrating migration flows: an increase in g_1 attracts poor immigrants; however, the increase in N_1 brings about a reduction in w_1, so that the equilibrium condition is restored without all the poor migrating into country 1.

Assuming linearity of the wage function:

$$w(N_1) = d - hN_1, \tag{7}$$

Equation (4) becomes:

$$d - hN_1 + g_1 = d - h\left(2\overline{N} - N_1\right) + g_2. \tag{8}$$

From (8) one obtains N_1 as a function of g_1 and g_2:

$$N_1 = \frac{g_1 - g_2}{2h} + \overline{N} \tag{9}$$

$$\frac{\partial N_1}{\partial g_1} = \frac{1}{2h}. \tag{10}$$

2.3 The Residents' Utility Function

We assume that welfare services enter the utility function of the rich residents even if they do not directly receive welfare services. We reconnect this feature to the risk reducing function of welfare systems (today's rich might be tomorrow's poor), connected to the ability of the government to handle moral hazard problems better than private companies in providing income insurance (Acemoglu et al. 2015; Borck 2007; Sinn 1995); the issue is tackled also in the public choice literature (Buchanan and Tullock 1965). Other explanations are altruism, that is, concern for others, through the interdependence of the utility functions (Mishan 1972), or the intent of ensuring social cohesion (Brennan 1973).

Thus, resident's j utility depends on g and on disposable income, that is, income net of the flat tax raised by the government to finance welfare expenditure:

$$U^j = \left(g,\, Y^j - t\right) \tag{11}$$

where Y^j is individual j's income, considered exogenous.

2.4 The Government Maximisation Problem

The level of g is decided by rich residents through majority voting; thus, the government maximises the median rich resident's utility function w.r.t. g only, subject to the budget constraint in per capita terms (Eq. 3); in the case of country 1:

$$\max_{g_1} U_1^m = U_1^m\left(g_1, Y_1^m - t_1\right) \tag{12}$$

$$\text{s.t.} t_1 = \frac{\alpha_1 g_1 N_1}{R_1}$$

where m denotes the median voter.

For simplicity, let us assume that the utility function is quasi linear:

$$U_1^m\left(g_1, Y_1^m - t_1\right) \equiv V_1\left(g_1\right) + Y_1^m - \frac{\alpha_1 g_1 N_1\left(g_1\right)}{R_1} \tag{13}$$

The F.O.C. yields:

$$R_1 V_1' = \alpha_1 N_1 + \alpha_1 g_1 \frac{\partial N_1}{\partial g_1}. \tag{14}$$

Note that the F.O.C. is sufficient for a maximum, given the usual assumptions on the concavity of the utility function and the linearity of the constraint. Eq. (14) says that the marginal benefit accruing to society from an increase in g is equated to its marginal cost. As for the marginal benefit, we assume that preferences over g depend on the position of the median voter in the income distribution. This is in line with the risk protection function of the welfare system mentioned above and with the suggestion that individuals become increasingly risk averse as they move closer to poverty.

The marginal cost increases with the inefficiency parameter, that is, other things being equal, the equilibrium level of g_1 decreases as α_1 increases (see Antonelli and De Bonis 2017, for a discussion of this issue in a closed economy). The marginal cost also depends on the number of beneficiaries and its increase due to the increase in g. This latter term represents an extra marginal cost increase with respect to the case of a closed economy. This is the base of the welfare game played by country 1, that sets g_1 considering that an increase in welfare benefits induces immigration, given the level of g_2.

3 The Reaction Functions and the Nash Equilibrium: Asymmetric Countries

To obtain the reaction function of country 1, let us consider, for simplicity, a quadratic form for V_1 with $V_1{}' = l_1 - p_1 g_1$. Given that preferences over g depend on the position of the median voter in the income distribution, we assume $l_1 = k_1{}^m Y_1{}^m$, where $k_1^m = \frac{Y_1^m + \overline{Y_{\min 1}}}{2Y_1^m}$ and $\overline{Y_{\min 1}}$ is the lowest income level in the population of country 1. Since the value of k_1^m increases as the median voter's income comes closer to $\overline{Y_{\min}}$, social preferences will be more oriented towards social protection services in societies with higher concentration in the lower tail of income distribution.

By substituting into Eq. (14) for N_1 from Eq. (9) and for $\frac{\partial N_1}{\partial g_1}$ from Eq. (10), we obtain the reaction function of country 1, F_1:

$$R_1 V_1' = \alpha_1 \frac{g_1 - g_2}{2h} + \overline{N} + \frac{\alpha_1 g_1}{2h}, \tag{15}$$

that, for the case of $V' = l_1 - p_1 g_1$ yields (see Appendix):

$$g_1 = \frac{h\left(R_1 l_1 - \overline{N}\right)}{\alpha_1 + hR_1 p_1} + \frac{\alpha_1}{2(\alpha_1 + hR_1 p_1)} g_2 \tag{16}$$

Given that g, and not the poor's income, enters the utility function of the median voter, the slope of the reaction function is unambiguously positive $\left(\frac{\partial g_1}{\partial g_2} > 0\right)$, differently from Brueckner (2000).

Analogously, the reaction function of country 2, F_2, is:

$$g_2 = \frac{h\left(R_2 l_2 - \overline{N}\right)}{\alpha_2 + hR_2 p_2} + \frac{\alpha_2}{2(\alpha_2 + hR_2 p_2)} g_1. \tag{17}$$

The Nash equilibrium levels of g_1 and g_2 are (see Appendix):

$$\begin{aligned} g_1 &= \frac{4h(\alpha_2 + hR_2 p_2)\left(R_1 l_1 - \overline{N}\right) + 2\alpha_1 h\left(\left(R_1 l_1 - \overline{N}\right)\right)}{4(\alpha_2 + hR_2 p_2)(\alpha_1 + hR_1 p_1) - \alpha_1 \alpha_2} \\ &= \frac{2h\left(R_1 l_1 - \overline{N}\right)(2\alpha_2 + 2hR_2 p_2 + \alpha_1)}{4(\alpha_2 + hR_2 p_2)(\alpha_1 + hR_1 p_1) - \alpha_1 \alpha_2} \end{aligned} \tag{18}$$

$$g_2 = \frac{4h(\alpha_1 + hR_1 p_1)\left(R_2 l_2 - \overline{N}\right) + \alpha_2 h\left(\left(R_2 l_2 - \overline{N}\right)\right)}{4(\alpha_1 + hR_1 p_1)(\alpha_2 + hR_2 p_2) - \alpha_1 \alpha_2}$$
$$= \frac{2h\left(R_2 l_2 - \overline{N}\right) + (\alpha_1 + 2hR_1 p_1 + \alpha_2)}{4(\alpha_1 + hR_1 p_1)(\alpha_2 + hR_2 p_2) - \alpha_1 \alpha_2} \tag{19}$$

4 Strategic Interaction and the Level of Social Benefits

The reaction functions can be used to represent the effects of welfare migration on social protection. To do this, we compare the level of g obtained at the Nash equilibrium of the game played by the two countries with the one obtained in the absence of welfare migration. To better isolate the effects of strategic interdependence and inefficiency, we assume that countries are symmetric (R_1=R_2=R, l_1=l_2=l, p_1=p_2=p). As a reference situation, we first consider the case of both strategic interdependence and inefficiency being absent.

4.1 Case 1. Symmetric Countries: The No Interdependence-No Inefficiency Case

Let us consider a situation without welfare migration, that is, $\frac{\partial N_1}{\partial g_1} = 0$. This eliminates the interdependency between the choices of the two countries. We also assume that inefficiency is absent ($\alpha_1 = \alpha_2 = 1$).

The maximisation problem of each country will then become:

$$\max\nolimits_{\mathrm{T}g}\ V(g) + Y^m - \frac{g\overline{N}}{R}. \tag{20}$$

The F.O.C. yields:[3]

$$RV' = \overline{N}. \tag{21}$$

With $V' = l - pg$ because of the symmetry assumption, we have:

$$Rl - Rpg = \overline{N} \tag{22}$$

3 Eq. (21) can be directly obtained from Eq. (14).

from which we get the equilibrium level of g:

$$g^* = \frac{Rl - \overline{N}}{pR}. \tag{23}$$

4.2 Case 2. Symmetric Countries: The Welfare Migration-No Inefficiency Case

In the case of welfare migration, the Nash equilibrium is the solution of the system formed by Eqs. (16) and (17), which, in the symmetry-no inefficiency case yields:[4]

$$g_1^N = g_2^N = \frac{2h\left(Rl - \overline{N}\right)(3 + 2hRp))}{4(1 + hRp)^2 - 1}. \tag{24}$$

We can thus state the following claims.

Claim 1. *With welfare migration, the level of social benefits decreases.*

Proof. Let us compare this result with the equilibrium level of g resulting from a situation without welfare migration (case 1). Since $\frac{Rl-\overline{N}}{pR} > \frac{2h(Rl-\overline{N})(3+2hRp))}{4(1+hRp)^2-1}$, we obtain $g^* > g^N$. This difference captures the effect of the term $g_1\frac{\partial N_1}{\partial g_1}$ in the R.H.S. of Eq. (14), that is, of course, absent in Eq. (23): with welfare migration, an increase in g in one country makes expenditure rise not only because of the increase in the benefit level, but also because of the increase in the poor population.

Claim 2. *The equilibrium amount of welfare services to which each beneficiary is entitled increases as the ratio between the upper bound income level of the first decile and the median voter's income increases.*

Proof. The proof is straightforward by inspection of Eqs. (23) and (24), recalling that $l = k^m Y^m$, and that $k_m = \frac{Y_m + \overline{Y_{\min}}}{2Y_m}$, which increases with $\frac{\overline{Y_{\min}}}{Y_m}$. Intuitively, social preferences are more oriented towards social protection services in societies with higher concentration in the lower tail of income distribution.

4 Eq. (24) can also be obtained from Eq. (18) or Eq. (19) putting R_1=R_2=R, l_1=l_2=l, p_1=p_2=p and α_1=α_2=1.

Claim 3. *The equilibrium level of g increases in the median voter's income, Y_m.*

Proof. The proof is straightforward by inspection of Eqs. (23) and (24). Note that $l = k^m Y^m = \frac{Y_m + \overline{Y_{\min}}}{2Y_m} Y_m = \frac{Y_m + \overline{Y_{\min}}}{2}$. An increase in Y_m has a composite effect on the amount of social protection $g^\star$. As the median income increases, k_m decreases, with a negative effect on $g^\star$ (Claim 2); however, there is also a positive direct effect. Let $k_m Y_m = z$. So, we have $z = \frac{Y_m + \overline{Y_{\min}}}{2Y_m} \cdot Y_m$. Thus, $\frac{\partial g}{\partial Y_m} = \frac{1}{2p} > 0$, which shows the direct positive effect prevails, thus generating a net increase of $g^\star$. This means that social protection is a normal good and the demand for it increases with income.[5]

4.3 The Inefficiency Case

To illustrate the effect of inefficiency on the equilibrium level of g, let us assume $\alpha_1 > 1$, $\alpha_2 > 1$ with $\alpha_1 \neq \alpha_2$.

Taking the (17) and (18) with $R_1{=}R_2{=}R$, $l_1{=}l_2{=}l$, $p_1{=}p_2{=}p$, we have the following reaction functions:

$$g_1 = \frac{h\left(Rl - \overline{N}\right)}{\alpha_1 + hRp} + \frac{\alpha_1}{2(\alpha_1 + hRp)} g_2 \tag{25}$$

for country 1 and:

$$g_2 = \frac{h\left(Rl - \overline{N}\right)}{\alpha_2 + hRp} + \frac{\alpha_2}{2(\alpha_2 + hRp)} g_1. \tag{26}$$

for country 2.

The coordinates of the Nash equilibrium become:[6]

$$g_1^* = 2\frac{h\left(Rl - \overline{N}\right)(2\alpha_2 + 2hRp + \alpha_1)}{4(\alpha_2 + hRp)(\alpha_1 + hRp) - \alpha_2\alpha_1} \tag{27}$$

$$g_2^* = 2\frac{h\left(Rl - \overline{N}\right)(2\alpha_1 + 2hRp + \alpha_2)}{4(\alpha_1 + hRp)(\alpha_2 + hRp) - \alpha_2\alpha_1}. \tag{28}$$

Claim 4. *The Nash equilibrium level of g is inversely correlated with the inefficiency parameter.*

5 Contrast this result with those in Meltzer and Richard (1981).

6 Eq. (27) and Eq. (28) directly derive from Eq. (18) and Eq. (19) putting $R_1{=}R_2{=}R$, $l_1{=}l_2{=}l$, $p_1{=}p_2{=}p$.

Proof. By differentiating the reaction function, one gets $\frac{\partial g_i}{\partial \alpha_i} < 0$ (see Appendix).

Inefficiency brings about a reduction in the equilibrium levels of g, as argued above.

5 An Empirical Test of Strategic Interaction Among European Countries

In this section we test for strategic interactions as for the choice of welfare services levels in 22 European countries[7] for which all necessary data are available. To this purpose we use data for the period 2009–2015 from the OECD and Eurostat databases. Given the biannual availability of some data – e.g., those on net social public expenditure-needed for the construction of indicators used in the empirical analysis, our dataset is a balanced panel of 88 observations for the years 2009–2011–2013–2015. See the Appendix for details on the sources of the data (Table A1).

Testing for the existence of strategic reactions would imply estimating a regression equation with national welfare benefits depending on the level of benefits in other countries, together with other explanatory variables.

The theoretical framework developed in Section 2 implies that the poor population of a country grows because of welfare migration as the amount of welfare services increases. Consequently, the tax burden to finance welfare expenditure rises more rapidly[8] than in the absence of welfare migration. Thus, countries set welfare benefits at a level that is lower than in the case the poor cannot migrate, generating a downward bias in benefits.

One way of estimating this effect is to test for the existence of strategic reactions among countries. Following the existing literature (Figlio et al. 1999; Brueckner 2000; Saavedra 2000), we consider a regression equation – representing an "empirical version" of the reaction functions – that relates the level of welfare services in one country to the welfare services levels in other countries, and to some socio-economic characteristics.

7 Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom.

8 Recall that in our framework the poor is a welfare recipient who does not contribute to the financing of public expenditure.

5.1 The Regression Equation is

$$g_{ti} = \varphi \sum \omega_{ij} g_{t-1j} + x_i \theta + \epsilon_i, \tag{29}$$

where g_{ti} is the level of welfare services in country i at time t, g_{t-1j} the level of welfare services in other countries j, $j \neq i$, at time $t - 1$; x_i is a vector of socio-economic characteristics for country i, with θ the associated coefficient vector, and ε_i is the error term. φ is the coefficient representing the slope of the reaction function, that we expect to be positive. The ω_{ij} are weights indicating the importance attached by country i to the welfare services of each of the other countries. We consider two alternative weighing schemes:

– An "economic neighbourhood" scheme based on cross-country GDP differences, on the assumption that a country is more concerned with the choices made by countries with similar economic conditions. This weight is calculated as $\mathrm{PROX_{ij}} = 1 - [(\mathrm{GDP_i} - \mathrm{GDP_j})^2/\mathrm{nvar}\ (\mathrm{GDP})]$ (model 1).
– A "neighbourhood" scheme based on migration flows (MIG_{22}), that is, the ratio between the number of immigrants from country j to country i and the total number of immigrants from all other countries in the sample to country i, as in Figlio et al. (1999). We consider only immigration flows in line with the assumption in our model; Figlio et al. also justify this choice to avoid the negative weights that could derive when considering net flows, as well as attaching equal weights to jurisdictions with low immigration and emigration flows and to jurisdictions with high, offsetting flows in both directions (model 2).

In the Appendix we also use two alternative specifications of the weights: a geographical contiguity weight, as in Saavedra (2000) (model 3) and an "enlarged" migration weight (model 4). Results are reported in Table A2.

The variable g, that is, the social services level, is represented by a composite indicator of the outcomes of social policies in the 22 countries under consideration, the *social protection performance index*, *SPPI*, as derived in Antonelli and De Bonis (2017, 2018, 2019). The index summarises the outcome indicators for seven sectors of social protection expenditure: family, health, labour market, elderly, disabled, unemployment, inequality. The expenditures sectors are those included in the SOCX database. These outcomes can be interpreted as the achievement's degree of the targets set out by policymakers for different social areas. Thus, differently from the existing literature on welfare migration, that adopts the amount of social spending, our strategic variable is an outcome index for social expenditure as a whole. This is in line with the theoretical framework of Section 2, the monetary value of benefits from welfare programmes being different from the amount of expenditure necessary to deliver them, given inefficiency.

Our regression equation is based on the hypothesis that the choice of g made by a country depends on the lagged values of g in the others, which appears plausible, given that we consider the outcome of welfare programmes as a whole as the strategic variable and this is not immediately observable by other countries.[9] We thus take the values of the *SPPI* as dependent variables and their one period lagged values as explanatory variables.

As for the socio-economic variables, we consider the following ones.

- Per capita GDP, as an indicator of the availability of resources to finance welfare services; we thus expect a positive sign of the coefficient of this variable.

The other variables we consider are inspired by our theoretical framework.

- The first term in the R.H.S. of the reaction functions shows that the choice of g depends not just on the relative size of rich residents and poor immigrants, but on the proportion of rich residents weighted by their preferences for welfare services ($Rl = Rk^m Y^m$) and that of poor migrants (N) within a country's population. Recalling that $k^m = \frac{Y_m + \overline{Y_{\min}}}{2}$, we use P10 (the upper bound level of the first decile, i.e., the 10% of people with lowest incomes) for $\overline{Y_{\min}}$. We thus consider the product between the number of residents and $\left(\frac{P10+Y^m}{2}\right)$, a measure of income distribution, and subtract from it the number of immigrants from the other countries in the sample, both as shares of total population. We call this new "redistributive" variable as KRM.
- The variable EFF – suggested by the theoretical framework of Section 2 is the efficiency of welfare expenditure, an indicator measuring the degree of proximity between the monetary value of benefits provided and the amount of taxes paid to finance them. We use the measure of the input and output efficiency of social expenditure by the DEA method (Charnes et al. 1978; Farrell 1957)[10] calculated in Antonelli and De Bonis (2017). In our framework, the *SPPI*

9 Using the lagged values of g_j avoids the endogeneity of the regressor (see, among others, Smith 1997).

10 The Data Envelopment Analysis (DEA) was originated by Farrell (1957) and revised by Charnes et al. (1978). See the Appendix (Table A1) for our calculations of the DEA efficiency scores.

is the output, while net social expenditure *NPSE* (in PPP US dollars) is the input. The DEA method allows constructing a production possibility frontier, against which one can rank the individual countries' efficiency performances. Countries on the frontier exhibit the highest possible level of performance, given the level of social expenditure (alternatively, they use the lowest level of expenditure to achieve a given level of performance); in other words, no other country obtains the same level of performance with a lower level of expenditure. Countries on the frontier are assigned input and output efficiency scores of 1; against them, one can measure the relative input and output inefficiency of countries that lie inside the frontier, thus obtaining a relative ranking (countries on the frontier being all ranked in the first place).

– The variable SEL represents the selectivity degree of the welfare system. Adema et al. (2014) report that governments are increasingly resorting to income and/or means testing in the face of budgetary pressures. Means testing is commonly considered to improve the performance of social policies, thus positively affecting g. Part of the literature is, however, doubtful, given that selectivity is not always successful (Gouyette and Pestieau 1999). We calculate the selectivity index as the ratio between the means tested benefits and total social benefits (cash and in kind).[11]

Descriptive statistics are summarized in Table 1.

Table 1: Descriptive statistics.

	Descriptive statistics				
Variables	**Obs**	**Mean**	**Std Dev**	**Min**	**Max**
PROX$g_{t-1,j}$	88	0.094534	0.532874	1.409959	3.900921
MIG$_{22}g_{t-1,j}$	88	0.161307	0.048241	0.001249	0.255630
KRM	88	16212.41	4749.79	7590.75	27257.90
GDP	88	41800.15	16449.06	20418.09	102556.27
EFF	88	0.796071	0.190298	0.406941	1
SEL	88	0.09	0.09	0.01	0.36

We estimate Eq. (29) using ordinary Pooled OLS and panel fixed effects (P-FE) estimators.

11 To our knowledge, no selectivity index is available in the databases or in surveys data.

The pooled OLS regression results are summarized in Table 2.

Table 2: Pooled OLS results.

Pooled OLS dependent variable: g_{ti}	Model 1	Model 2
PROX$g_{t\text{-}1,j}$	−0.0853872 (0.141056)	
MIG$_{22}g_{t\text{-}1,j}$		−4.71070 (0.951516)***
KRM	0.000170504 (1.77959e-05)***	0.000171461 (1.29645e-05)***
GDP	0.0000157962 (5.60557e-06)***	0.0000183288 (3.42634e-06)***
EFF	2.88072 (0.296771) ***	2.88048 (0.253581)***
SELECTIVITY	−0.109154 (0.666484)	0.168166 (0.588715)
CONST	−1.21408 (0.596333)**	−0.888887 (0.268195)***
Adj R sq	0.868114	0.89801
Obs	88	88

Notes: Std. errors in brackets. *, **, ***Are significant at the 10, 5 and 1% levels, respectively.

They seem to contradict the hypothesis of a positive strategic welfare interaction among countries. However, the pooled OLS estimators might suffer from an omitted variable bias due to an unobserved cross-country heterogeneity. To control for this, we also use the panel fixed effects method.

The regression results are summarized in Table 3; they do not contradict our hypotheses and the consequent choice of variables. The test for differing group intercepts confirms the need for considering country-specific effects.

We find that the coefficient of $g_{t\text{-}1,j}$ is positive, as expected, and statistically significant; the result is robust to the choice of the weighing scheme (model 1a and model 2a)[12] and to the introduction of other explanatory variables (specifications (b) and (c) of the two models). This suggests the existence of a downward bias in the choice of the benefits levels because of welfare competition.

GDP is found to affect g in a positive way, as in the existing literature.

In addition, the new variables that we introduce in the regression have the sign suggested by the theoretical framework of Section 2.

The redistributive variable positively affects the level of g: the intuition is that the larger the number of (rich) residents and their attitude towards redistribution is relatively to the number of (poor) immigrants, the larger the number of resources that are devoted to welfare spending will be.

12 Note that the magnitude of the coefficient of the weighted sum of the $g_{t\text{-}1,j}$ is quite smaller in Model 2 than in Model 1, due to the different weighing scheme. This obviously reflects itself in the different magnitude of the coefficients.

Table 3: Panel FE results.

	Panel fixed effects dependent variable: $g_{t,i}$			
	Model 1			
	A	**B**	**C**	**D**
PROX$g_{t-1,j}$	0.140889 (0.0791245)*	0.000093 (3.58188e-05)**	0.15476 (0.0797802)*	0.153258 (0.0800793)*
KRM	0.00013192 (2.95553e-05)***	0.203974 (0.0847991)**	0.00007768 (3.34452e-05)**	0.000074398 (3.38379e-05)**
GDP		0.0000503 (2.71568e-05)*	0.0000489345 (2.51299e-05)*	0.0000541601 (2.61403e-05)**
EFF			1.66949 (0.490357)***	1.69565 (0.493252) ***
SEL				2.22086 (2.92759)
LSDV R sq	0.978562	0.979669	0.9828720	0.9830320
Within R Sq	0.443591	0.472340	0.5554530	0.5596080
F test for differing group intercepts	37.446 (*p*-value = 3.96339e-028)	38.8137 (*p*-value = 2.91539e-028)	18.481 (*p*-value = 2.9402e-019)	18.3749 (*p*-value = 5.33594e-019)
Obs	88	88	88	88
	Model 2			
	A	**B**	**C**	**D**
MIG$_{22}g_{t-1,j}$	2.46469 (1.3638)*	3.46021 (1.4496)**	2.79744 (1.3482)**	2.74508 (1.35594)**
KRM	0.000128798 (3.04476e-05)***	0.0000908635 (3.65768e-05)**	0.0000724836 (3.40876e-05)**	0.0000699882 (3.44183e-05)**
GDP		0.0000485449 (2.69145e-05)*	0.0000489021 (2.47847e-05)*	0.0000534906 (2.57490e-05)**
EFF			1.70072 (0.485056)***	1.72576 (0,488419)***
SEL				2.03091 (2.92139)
LSDV R sq	0.978592	0.979643	0.983012	0.983145
Within R Sq	0.444381	0.471664	0.55909	0.562556
F test for differing group intercepts	39.2008 (*p*-value = 1.05187e-28)	35.5579 (*p*-value = 3.52839e-27	13.7704 (*p*-value = 4.2362e-16)	13,6622 (*p*-value = 7.25842e-16)
Obs	88	88	88	88

Notes: Std. errors in brackets. *, **, *** Are significant at the 10, 5 and 1% levels, respectively.

Also, efficiency, that corresponds to the inverse of α in the theoretical framework, positively affects *g*, a relatively lower level of taxes being necessary to finance a given social protection output as efficiency increases.

Selectivity, instead, does not appear to affect the level of *g* in a significant way.

Our results suggest the existence of a welfare magnet effect for the European countries (for a recent, analogous result, see Razin and Wahba 2015)[13] and a role of the new variables introduced in the traditional theoretical framework in explaining the level of welfare services.

6 Conclusions

In this paper we have developed a strategic model of welfare policies with migration. Differently from most of the existing literature, we have considered welfare services, intended as the output of welfare expenditure, not the poor's income or social expenditure, as the strategic variable. This makes the countries' reaction functions unambiguously positively sloped, with the Nash equilibrium of the welfare policy game resulting in a level of social protection lower than in the absence of welfare migration.

In the theoretical model we have also assumed that social preferences depend on the position of the median voter in the income distribution. Therefore, the equilibrium amount of welfare services depends not just on the number of (rich) residents vis-à-vis that of (poor) immigrants, the number of rich residents being weighted by their preferences for welfare services. As a result, the level of social protection increases as the median voter moves down along the income distribution.

Our framework also allows the total amount of welfare services to differ from the amount needed to finance it, because of inefficiencies in the transfer process. We obtain that, as one would expect, inefficiency brings about a reduction in the equilibrium levels of social protection.

We also test the model for the choice of welfare services levels in 22 European countries, estimating a regression equation with national welfare benefits depending on the level of benefits in other countries, together with other explanatory variables.

The strategic variable, that is, the social services level, is represented by a composite indicator of the outcomes of social policies in the 22 countries under consideration.

Our findings confirm the existence of a welfare magnet effect in the European countries. The level of social protection also positively depends on the GDP level,

13 Their sample includes all EU countries plus Norway and Switzerland.

the redistributive attitudes of residents and their relative weight in the population, and the efficiency of social expenditure.

Appendix

Calculation of the reaction function Eq. (16)

Substituting $V' = l_1 - p_1 g_1$ into the (15), we have:

$$R_1 l_1 - R_1 p_1 g_1 = \alpha_1 \frac{g_1 - g_2}{2h} + \overline{N} + \frac{\alpha_1 g_1}{2h}$$

With some calculations, we have:

$$2g_1 (\alpha_1 + hR_1 p_1) = 2hR_1 l_1 + \alpha_1 g_2 - 2h\overline{N}$$

Finally:

$$g_1 = \frac{h\left(R_1 l_1 - \overline{N}\right)}{\alpha_1 + hR_1 p_1} + \frac{\alpha_1}{2(\alpha_1 + hR_1 p_1)} g_2.$$

The Nash equilibrium

Given the reaction functions (16) and (17), the Nash equilibrium is:

$$g_1 = \frac{h\left(R_1 l_1 - \overline{N}\right)}{\alpha_1 + hR_1 p_1} + \frac{\alpha_1}{2(\alpha_1 + hR_1 p_1)} \left[\frac{h\left(R_2 l_2 - \overline{N}\right)}{\alpha_2 + hR_2 p_2} + \frac{\alpha_2}{2(\alpha_2 + hR_2 p_2)} \cdot g_1\right]$$

$$g_1 \left[1 - \frac{\alpha_1 \alpha_2}{4(\alpha_1 + hR_1 p_1)(\alpha_2 + hR_2 p_2)}\right] = \frac{h\left(R_1 l_1 - \overline{N}\right)}{\alpha_1 + hR_1 p_1} + \frac{\alpha_1 h\left(R_2 l_2 - \overline{N}\right)}{2(\alpha_1 + hR_1 p_1)(\alpha_2 + hR_2 p_2)}$$

$$g_1 \left[\frac{4(\alpha_1 + hR_1 p_1)(\alpha_2 + hR_2 p_2) - \alpha_1 \alpha_2}{4(\alpha_1 + hR_1 p_1)(\alpha_2 + hR_2 p_2)}\right] = \frac{4h\left(R_1 l_1 - \overline{N}\right)(\alpha_2 + hR_2 p_2) + 2\alpha_1 h\left(R_2 l_2 - \overline{N}\right)}{4(\alpha_1 + hR_1 p_1)(\alpha_2 + hR_2 p_2)}$$

Finally, we obtain the (18) in the text:

$$g_1^* = \frac{4h\left(R_1 l_1 - \overline{N}\right)(\alpha_2 + hR_2 p_2) + 2\alpha_1 h\left(R_2 l_2 - \overline{N}\right)}{4(\alpha_1 + hR_1 p_1)(\alpha_2 + hR_2 p_2) - \alpha_1 \alpha_2}$$

Analogously, for g_2^* (19) we have:

$$g_2^* = \frac{4h\left(R_2\, l_2 - \overline{N}\right)\left(\alpha_1 + hR_1\, p_1\right) + 2\alpha_2 h\left(R_1\, l_1 - \overline{N}\right)}{4\left(\alpha_1 + hR_1\, p_1\right)\left(\alpha_2 + hR_2\, p_2\right) - \alpha_1\, \alpha_2}$$

Inefficiency and the equilibrium level of g (Claim 4)

By differentiating Eq. (27) or Eq. (28) one gets:

$$\frac{\partial g_i}{\partial \alpha_i} = \frac{2h\,(Rl - N)\left[4\,(\alpha_i + hRp)\,(\alpha_j + hRp) - \alpha_j\,\alpha_i\right] - \left[4\,(\alpha_j + hRp) - \alpha_j\right]\left[2h\,(Rl - N)\,(2\alpha_j + 2hRp + \alpha_i)\right]}{\left[4\,(\alpha_j + hRp)\,(\alpha_i + hRp) - \alpha_j\,\alpha_i\right.}$$

$$< 0$$

Table A1: Source of primary data and reference period.

Variable	Primary data and source	Reference years
g (SPPI)	Composite indicators (for primary data see Antonelli and De Bonis 2017, 2018) Source: OECD and Eurostat data	2009–2011–2013–2015 for lagged value: 2007–2009–2011–2013
PROX	Primary data: GDP in PPP US dollars Source: OECD	Biannual average values for GDP (2008–2009; 2010–2011; 2012–2013; 2014–2015)
MIG_{22}	Primary data: Immigrants Source: OECD International Migration Database	(Average values 2008–2009; 2010–2011; 2012–2013; 2014–2015)
KRM	Primary data: Immigrants source: OECD International Migration Database residents source: OECD P10 source: OECD Median income source: OECD	Biannual average values for all primary data (2008–2009; 2010–2011; 2012–2013; 2014–2015)
GDP per capita	GDP (PPP US dollars) source: OECD Population source: OECD	Average values: 2005–2009; 2007–2011; 2009–2013; 2011–2015
EFF	Index *g* for the output (see Antonelli and De Bonis 2017, 2018, 2019) for primary data. Source: OECD and Eurostat data	For *g* 2009–2011–2013–2015
	Net social public expenditure for the input. Source: SOCX OECD database	For net social public expenditure only biannual data available in OECD database (average values 2005–2009; 2007–2011; 2009–2013; 2011–2015
SEL	Primary data: means tested social benefits and total social benefits source: Eurostat	2009–2011–2013–2015

Alternative weighing schemes

The alternative weighing scheme considered are:

(a) A "neighbourhood" scheme based on geographical contiguity, assigning a weight, W, of $\frac{1}{n_i}$ to each of the n_i countries sharing a border with country i, as in Saavedra (2000) – this attaches a zero weight to non-bordering countries (model 3). Geographical contiguity might be related to the importance attached by country i to the welfare services of each of the other countries, for instance because it facilitates mobility. Even if in line with the previous ones, the coefficient of the gi is just above the significance level. Actually, given our sample, inter-country geographical distances do not appear so relevant as to deter migration.

(b) A "neighbourhood" scheme based on migration flows, that is, the ratio between the number of immigrants from country j to country i and the total number of immigrants from all other countries in the sample to country i, Mtot. We consider only immigration flows in line with the assumption in our model; Figlio et al. (1999) also justify this choice to avoid the negative weights that could derive when considering net flows, as well as attaching equal weights to jurisdictions with low immigration and emigration flows and to jurisdictions with high, offsetting flows in both directions (model 4). The results confirm what previously found for the MIG_{22} weight.

Table A2: Panel FE with alternative weights.

Panel fixed effects dependent variable: g_{ti}		
	Model 3	**Model 4**
$Wg_{t-1,j}$	2.51937 (1.53727)	
$Mtotg_{t-1,j}$		9.16628 (3.95086)**
KRM	0.0000568445 (3.35610e-05)*	0.0000658045 (3.42689e-05)*
GDP	0.0000507884 (2.24078e-05)**	0.0000432521 (2.35314e-05)*
EFF	2.55211 (0.517754)***	1.72334 (0.479140)***
LSDV R sq	0.985299	0.983283
Within R sq	0.618461	0.566139
F test for differing group intercepts	22.0652 (*p*-value = 2.99575e-021)	16.8069 (*p*-value = 3.23006e-018)
Obs	88	88

Notes: Std. errors in brackets. *, **, ***Are significant at the 10, 5 and 1% levels, respectively.

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