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Individual attitudes towards migration: A reexamination of the evidence

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Abstract. In the literature about the determinants of attitudes towards immigration, some authors emphasize the role of economic factors, while others argue that attitudes are mostly determined by noneconomic factors. This paper evaluates the relative importance of the two. We estimate a structural model of individual attitudes towards immigration, accounting for unobserved individual factors, and use this model to carry out a decomposition analysis of attitudes in 20 European countries. We find that economic mechanisms are significant determinants of attitudes, but that other (noneconomic) factors play a more decisive role in the relation between individual education levels and attitudes to immigration.

Résumé.

JEL classification: F22, J61

1. Introduction

Migration has become a central issue in the public debate in most developed countries, and it has played an important role in recent elections in Europe and the US. Public opinion does not seem very favorable to further immigration

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in many European countries. For policy makers, it is crucial to understand the determinants of individual attitudes towards immigration.[1]

Are individual attitudes mainly driven by the impact of immigration on the labor market, as the arrival of immigrants puts pressure on wages of similarly skilled natives? Could the burden that low-skilled migrants represent for the welfare state in destination countries be a cause for negative attitudes towards immigration? Or are these attitudes predominantly explained by factors that are unrelated to the economic consequences of immigration, such as cultural factors or ethnocentrism?

One strand of the literature emphasizes the role of economic factors and distinguishes labor-market and welfare-state channels. According to the first channel, the skill level of immigrants relative to that of natives influences the natives' receptiveness toward immigration (Scheve and Slaughter 2001, Mayda 2006, O'Rourke and Sinnott 2006). Natives are more receptive to immigrants whose skills are complementary to their own (e.g., high-skill natives are in favor of low-skill immigration). The analysis of the second channel was pioneered by Hanson et al. (2007) and Facchini and Mayda (2009) who argue that individual attitudes also depend on the expected impact of immigration on the tax-benefit system in modern welfare states. In particular, low-skill immigrants represent a burden especially for high-income natives in a redistributive system where a certain level of assistance is guaranteed by the state.[2]

Another strand of the literature argues that attitudes toward immigration are mostly determined by noneconomic factors (Citrin et al. 1997, Hainmueller and Hiscox 2007; 2010). According to this view, the correlation between education and individual attitudes is predominantly explained by the fact that more educated individuals value cultural diversity and tolerance and exhibit lower levels of ethnocentrism. Using new survey data for the U.S., Hainmueller et al. (2015) argue that the labor-market mechanism does not seem to play a role in the explanation of attitudes towards immigration since high-skilled immigration is preferred over low-skilled immigration by natives of all skill levels. In a recent survey of the literature, Hainmueller and Hopkins (2014, p. 227) state more generally that "there is little accumulated evidence

1 Individual attitudes to immigration are an important ingredient in political economy models of immigration. If people vote about immigration policy in a direct democracy, individual attitudes matter greatly although factors that influence turnout also play a crucial role (Krishnakumar and Müller 2012). In representative democracies, individual attitudes have a more indirect influence on political outcomes and their restrictive stance seems to be counteracted by lobbies (Facchini and Mayda 2008).

2 For a more recent contribution that examines the labor-market channel by considering the role of occupations, see Ortega and Polavieja (2012). Murard (2017) considers the labor-market and welfare-state channels in his analysis of attitudes based on variation of immigration over time at the regional level in Europe.

that citizens primarily form attitudes about immigration based on its effects on their personal economic situation".

Our paper proposes a novel approach that evaluates the relative importance of economic and noneconomic factors. We estimate a model of individual attitudes toward immigration which accounts for economic determinants and unobserved individual factors. These estimates are consistent with a simple structural model that relates individual attitudes to labor-market and welfare-state effects. We then use this model to carry out a decomposition analysis of attitudes towards immigration and evaluate the relative importance of economic factors.

The paper contributes to the literature in three respects. First, we address the concerns of the second strand of the literature by controlling for unobserved individual-specific factors in our empirical analysis. As the same individual answers different questions on the desirability of immigration in the first wave of the European Social Survey (2002), we are able to take account of an individual-specific effect, capturing unobserved sentiments about immigration *in general*. Thus we are able to obtain consistent estimates of the economic mechanisms determining individual attitudes toward (different types of) immigration, ensuring that these estimates are not contaminated by the fact that more educated individuals are more tolerant toward other cultures. Second, our econometric estimates are consistent with a simple structural model that accounts for labor-market and welfare-state effects of immigration.[3] We also measure immigrants' relative skill levels and marginal tax rates in a way that is consistent with this model. This approach enables us to recover a structural parameter (the elasticity of substitution between human capital and raw labor) which governs the labor-market effects of immigration. Comparing the estimated substitution elasticity with other estimates from the empirical literature on the labor-market effects of immigration provides a consistency check of our results. Third, we use the structural model to decompose the relationship between education levels and attitudes towards immigration into three components: labor-market effects, welfare-state effects and other (noneconomic) effects. This decomposition method enables us to evaluate the relative importance of the economic and noneconomic determinants of attitudes.

We use data for 20 European countries from the first wave of the European Social Survey (2002) which included a special module on immigration.[4] The

3 We also discuss how to interpret our empirical results without referring to our specific structural model.

4 Round 7 of the European Social Survey (ESS), which was carried out in 2014, also included a module on immigration. Unfortunately, the questions on the desirability of immigration from different regions of origin, which we use in our analysis, were not repeated in 2014. A descriptive comparison of Rounds 1 and 7 of the ESS arrives at the conclusion that the "overall pattern in public attitudes is one of stability" (Heath and Richards 2016, p. 12). Therefore there is not much reason to believe that there have

economic model predicts that the relation between an individual's level of education and her attitudes depends on the relative skill level of immigrants (labor-market mechanism) and its interaction with the marginal tax rate (welfare-state mechanism). Our empirical test of these economic mechanisms exploits the fact that in our dataset, each individual answers four questions on the desirability of immigration from different regions of origin (rich or poor countries in Europe or outside Europe). This particular feature of the data enables us to account for unobserved individual-specific views about the desirability of immigration by using random-effects and fixed-effects models. In the latter, the economic mechanisms are identified solely by the *within-individual* variations of attitudes towards immigrants from different origins. This test of the relevance of the economic mechanisms is much more demanding than the tests carried out in other contributions (Hanson et al. 2007, Facchini and Mayda 2009, Murard 2017).[5]

Our model describes how natives form their attitudes toward immigration and integrates a labor-market and a welfare-state channel. It relies on an aggregate production function with raw labor and human capital as inputs. Each individual supplies one unit of raw labor but natives (and migrants) are heterogeneous with respect to the amount of human capital they are endowed with. We further assume that there is a linear tax-benefit scheme that redistributes income under a balanced-budget constraint. Whether the marginal tax rate or the individual benefit adjusts to balance the government's budget can be tested empirically.[6]

Our results are consistent with the two strands of the literature and confirm that economic mechanisms play a significant role in the explanation of attitudes. On the one hand, we find that labor-market threats and worries about the welfare state both matter for individual attitudes towards immigration, even if we account for unobserved individual factors in a fixed-

been important structural changes in the determinants of attitudes to immigration between 2002 and 2014.

5 Our paper differs from past contributions also in another respect. We use OECD data (OECD 2008a) about the education levels of immigrants and natives in European countries, which allows us to measure the relative skill levels of immigrants (for the four immigrant groups in each destination country) with greater precision. Moreover, the relative skill ratios are defined in a way that is consistent with the theoretical model. Similarly, marginal tax rates are measured in a manner that is consistent with the linear tax-benefit scheme of the model.

6 Our model is closely related to the models proposed by Dustmann and Preston (2006) and Facchini and Mayda (2009). Dustmann and Preston (2006) analyze the consequences of immigration in a model with two types of labor and a linear tax-benefit scheme. Whereas they focus on the aggregate impact of immigration on natives and distinguish between skilled and unskilled labor, we emphasize the impact at the individual level and distinguish between raw labor and human capital, which allows us to take individual heterogeneity into account (we consider four levels of human capital in the empirical application). The assumption that the government budget can be balanced in two different ways follows Facchini and Mayda (2009).

effects logit model. Moreover, our estimate of the elasticity of substitution between human capital and raw labor is consistent with other estimates of the labor-market impact of immigration in the literature. These results lead us to conclude that economic mechanisms matter for attitudes towards immigration, especially when individuals are asked to choose between different types of immigration.

On the other hand, the results of our decomposition analysis also lend support to the argument that other (noneconomic) factors play a more decisive role in the relation between individual education levels and attitudes to immigration. Three factors seem to be at play. First, there is a strong relationship between the level of education and individual sentiments about immigration that is not explained by economic mechanisms but strongly correlated with noneconomic factors. Quantitatively this effect seems to dominate. Second, the labor-market mechanism turns out to have a small impact on attitudes since human capital and labor are estimated to be close substitutes, a result which is consistent with the empirical evidence on the (small) impact of immigration on wages. Third, our decomposition analysis shows that the labor-market and welfare-state mechanisms tend to compensate each other. This phenomenon might explain why some papers that concentrate only on the labor-market effect fail to identify these economic mechanisms.

Why do labor-market and welfare-state mechanisms tend to compensate each other? Our economic model allows for the possibility that governments adjust either the benefit level or the marginal tax rate when new immigrants arrive (as in Facchini and Mayda (2009)). The empirical test clearly rejects the former adjustment mechanism in favor of the latter. As a result, the welfare-state channel tends to attenuate labor-market effects: the arrival of low-skilled immigrants increases the return to human capital and leads the government to raise the marginal tax rate. Hence the *net* return to human capital varies relatively little.

As our benchmark model has a simple structure, we carry out three important robustness checks. First, the quality of education varies widely between countries and hence the education levels of migrants do not necessarily provide a good measure of their human capital level or productivity. Akin to Razin and Wahba (2015), we adjust the relative education levels of migrants using Hanushek and Woessmann's (2012) measures of cognitive ability by country, taking differences between countries' educational systems into account. Second, and somehow related to this point, several authors have observed that highly skilled immigrants often work in occupations that do not correspond to their observed education level (e.g., Mattoo et al. 2008, Dustmann et al. 2013). The downgrading of immigrant skills (which might be due to differences in education quality but also to other factors such as discrimination) implies that these immigrants are competing for jobs with less skilled natives. To evaluate the importance of

this phenomenon in our case, we adjust the education level of migrants by accounting for their occupations in the host country. It turns out that our main results are robust to both types of adjustment. Third, we consider the possibility that natives and immigrants are imperfect substitutes within a skill category, as argued by Ottaviano and Peri (2012), Manacorda et al. (2012), Peri and Sparber (2009). If we extend our model by assuming that native and migrant human capital are imperfect substitutes, it appears that our empirical results are also consistent with this extended model.

Our empirical approach, which relies on variations at the individual level (heterogeneity of human capital) and country level (tax rates), is in the spirit of Facchini and Mayda (2009). The downside of the structural approach is that the labor-market channel is represented in a simple manner. Therefore our results are usefully complemented by empirical studies that explore in more detail the question how natives are exposed to competition by immigrants in the labor market. Ortega and Polavieja (2012) find that natives who are employed in occupations that are intensive in communication tasks are more favorable to immigration than those who work in manual-task intensive occupations. They also test if job-specific human capital provides protection from labor-market competition by immigrants and their econometric results suggest that this mechanism only applies for highly skilled natives. By contrast, Pardos-Prado and Xena (2019) find that natives with high levels of occupation-specific skills that are difficult to transfer to other jobs tend to feel threatened by immigration.

Our paper is also related to Card et al. (2012) who rely on the same dataset (ESS 2002), but their decomposition of attitudes towards immigration differs from ours in two crucial respects. First, although they distinguish "economic concerns" from "compositional amenities" (worries about potential externalities associated with the local composition of population), their definition of "economic concerns" is different from our definition of economic factors. Whereas we adopt the assumption that individual attitudes to immigration are influenced by the impact of immigration on the individual's personal economic situation (as, e.g. in Facchini and Mayda (2009)), Card et al. (2002) consider an individual's view of the effect of immigration on the economy as a whole ("sociotropic economic concerns"). Second, our empirical analysis allows the unobserved individual factors to be correlated with the economic factors whereas they use a latent factor model which relies on the assumption that the error components of the latent factors are uncorrelated with explanatory variables. Due to these differences in approach it is difficult to compare our results to their finding that "economic concerns" explain a smaller share of variation in attitudes to immigration than "compositional amenities".

The remainder of the paper is structured as follows. Section 2 presents the theoretical model by introducing progressively the different mechanisms

at work. Section 3 describes the data and gives some descriptive evidence. Section 4 reports on the empirical findings and Section 5 concludes.

2. The Model

This section describes the model that will help us determine how labor-market and welfare-state mechanisms influence attitudes towards immigrants, taking other (noneconomic) factors into account. Our model is developed in three steps. First, we present a simple model of the labor market with heterogeneous human capital, where immigrants and natives can be either substitutes or complements. Second, we consider the welfare-state channel by introducing a linear tax-benefit schedule in the model. Because of the assumption of a balanced government budget, the tax-benefit schedule has to adapt to the arrival of new immigrants. Following Facchini and Mayda (2009), we consider two polar cases: either the benefit changes (at constant marginal tax rates) or the marginal tax rate varies (at constant per capita benefits). Third, we discuss the role of other factors that may influence attitudes towards immigrants. Our approach consists in accounting for as many (unobservable) factors as possible, in order to improve the identification of the economic mechanisms.

2.1. The Labor Market

In our model, the population of each country is divided into natives and different groups of immigrants, m (characterized by their region of origin and their skill level). In each country c, there are L_c^N natives and L_c^m immigrants of group m. Each individual i living in country c supplies one unit of "raw" labor and h_{ic} units of human capital. Aggregate output is given by $Y_c = F(H_c, L_c)$, where $L_c = L_c^N + \sum_m L_c^m$ and $H_c = \sum_i h_{ic}$ and F is an aggregate production function exhibiting constant returns to scale. Per capita output can be written as $y_c \equiv Y_c/L_c = F(H_c/L_c, 1) \equiv f(h_c)$, where $h_c = H_c/L_c$ is the per capita human capital stock in country c.[7]

With perfectly competitive factor markets and profit maximization by the representative firm, prices and marginal products of production factors are equalized. Marginal products are given by $f'(h_c)$ (human capital) and $f(h_c) - h_c f'(h_c)$ (raw labor). Earnings of individual i (holding h_{ic} units of human capital and 1 unit of raw labor) can therefore be written as

7 Physical capital can be added to the model without changing the qualitative conclusions if perfect international mobility of capital is assumed. To see this, define aggregate output as $Y_c = G(K_c, H_c, L_c)$, where G is an aggregate production function with constant returns to scale. A factor-price constrained revenue function (Neary 1985) can be defined as $\tilde{G}(r_c, H_c, L_c) = \max_{K_c}\{G(K_c, H_c, L_c) - r_c K_c\}$. With the world rental rate of capital r^* given, the optimal stock of physical capital is defined implicitly by $\partial G/\partial K_c = r^*$ and $\tilde{G}$ has the same properties as an unconstrained revenue (or aggregate production) function, as shown by Neary (1985). Moreover, $\tilde{G}$ is linearly homogeneous with respect to H_c and L_c. Therefore, if we assume that r^* does not change with immigration, we can redefine f as follows: $f(h_c) = \tilde{G}_c(r^*, H_c/L_c, 1)$.

$$y_{ic} = f(h_c) - h_c f'(h_c) + h_{ic} f'(h_{ic}) = f(h_c) + (h_{ic} - h_c) f'(h_c). \quad (1)$$

We assume that individuals consider small changes in the average human capital h_c of their country when they are asked about their immigration preferences. A small change in human capital has the following impact on an individual's income: $dy_{ic} = (h_{ic} - h_c) f''(h_c) dh_c$. The country's average human capital stock h_c increases (decreases) with immigration if immigrants are on average more (less) skilled than current residents. Denote H_c^m the total human capital of immigrants of group m and $h_c^m = H_c^m / L_c^m$ the average human capital of this group. Assuming that new immigrants of group m hold on average the same level of human capital than "old" immigrants of that group, we have $dh_c = (h_c^m - h_c)(dL_c^m / L_c)$.[8] Combining these elements, we can express the influence of immigration (from group m) on individual i's income as follows:

$$z_{ic}^m \equiv \frac{dy_{ic}/y_c}{dL_c^m/L_c} = \left(\frac{h_{ic}}{h_c} - 1\right)\left(1 - \frac{h_c^m}{h_c}\right)\frac{1}{\sigma}\theta_H \theta_L, \quad (2)$$

where σ is the elasticity of substitution between the inputs raw labor and human capital and θ_H and θ_L are the share of human capital and of raw labor in aggregate income.[9]

2.2. Adding the Welfare State

The labor-market model can be extended to incorporate welfare-state considerations by introducing income redistribution, which is accomplished using a linear tax-benefit schedule. A constant marginal tax rate t_c is applied to each individual's income and each individual in country c receives an identical benefit b_c. We require that the government's budget in country c is balanced, which implies: $t_c f(h_c) = b_c$. Earnings of an individual i can now be rewritten as: $y_{ic} = (1 - t_c)[f(h_c) + (h_{ic} - h_c) f'(h_c)] + b_c$.

With immigration, the tax-benefit schedule has to be adjusted in order to ensure a balanced budget of the government. Following Facchini and Mayda (2009), we focus on the two extreme cases where either the taxation level t_c remains constant and the benefit b_c adjusts, or the benefit remains constant and the marginal tax rate adjusts. The next paragraphs detail these two cases.

8 This result is obtained as follows. Denoting H_c^N the total human capital of natives, we have

$$h_c = (1/L_c)\sum_i h_{ic} = (H_c^N + \sum_m H_c^m)/L_c = (H_c^N + \sum_m h_c^m L_c^m)/(L_c^N + \sum_m L_c^m).$$

Deriving the last expression with respect to L_c^m yields this intermediate result.

9 Note that $[-h_c f''(h_c) f(h_c)]/[f'(h_c)(f(h_c) - h_c f'(h_c))]$ equals the inverse of the elasticity of substitution σ.

If we consider a constant marginal tax rate, a shock in tax revenues would lead to an adjustment in the level of the benefit, b_c. Therefore we have $t_c f'(h_c)dh_c = db_c$ and equation (2) becomes:

$$z_{ic}^m = \frac{dy_{ic}/y_c}{dL_c^m/L_c} = \left(\frac{h_{ic}}{h_c} - 1\right)\left(1 - \frac{h_c^m}{h_c}\right)\frac{1}{\sigma}\theta_H\theta_L(1-t_c) - \left(1 - \frac{h_c^m}{h_c}\right)t_c\theta_H. \quad (3)$$

How does the introduction of the welfare state change the relation between individual human capital and attitudes towards immigration? In Figure 1, we consider the case of low-skill immigration where the benefit level adjusts to ensure a balanced government budget. This figure compares the pure labor-market model (dashed line) with the complete model which includes income redistribution. Two changes stand out. First, low-skill immigration represents a net cost for the tax-benefit system and entails therefore a decrease in the income of all natives. This is reflected by a parallel downward shift of the schedule in figure 1. Second, taxation lowers the return to human capital and decreases therefore the slope in figure 1. It should be emphasized, however, that the slope does not change sign, compared to the pure labor-market model, if benefits adjust and the marginal tax rate is constant.

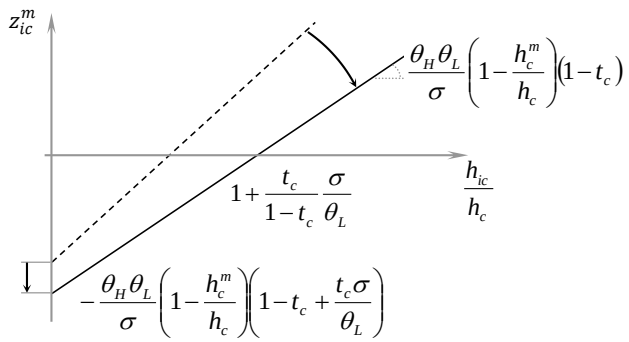

FIGURE 1 Welfare Mechanism - Benefit Adjustment (Low-Skill Immigration, $h^m < h$)

In view of the estimation, we can rewrite equation (3) as

$$z_{ic}^m = \frac{h_{ic}}{h_c}\left(1 - \frac{h_c^m}{h_c}\right)\frac{1}{\sigma}\theta_H\theta_L - t_c\frac{h_{ic}}{h_c}\left(1 - \frac{h_c^m}{h_c}\right)\frac{1}{\sigma}\theta_H\theta_L + \omega_c^m, \quad (4)$$

where $\omega_c^m = \left(1 - \frac{h_c^m}{h_c}\right)\left(\frac{t_c}{\sigma}\theta_H\theta_L - \frac{1}{\sigma}\theta_H\theta_L - t_c\theta_H\right)$ collects all terms that are specific by country and by immigrant group.

Turn now to the alternative case where the marginal tax rate t_c adjusts to compensate a variation in government revenues. If the benefit b_c is constant, the change in the marginal tax rate t_c is given by $t_c f'(h_c)dh_c + f(h_c)dt_c = 0$,

and equation (2) becomes:

$$z_{ic}^{m} = \frac{dy_{ic}/y_c}{dL_c^m/L_c} = \left(\frac{h_{ic}}{h_c} - 1\right)\left(1 - \frac{h_c^m}{h_c}\right)\left(\frac{1}{\sigma}\theta_H\theta_L(1-t_c) - t_c\theta_H^2\right) - \left(1 - \frac{h_c^m}{h_c}\right)t_c\theta_H. \quad (5)$$

In the case of low-skill immigration, the marginal tax rate has to increase in order to ensure a balanced government budget. As a consequence, highly skilled natives have to bear a greater share of the welfare cost from immigration than unskilled natives. This adjustment is reflected by a large change in the slope in figure 2. As the analytical expression makes clear, the rotation is much larger than in the previous case and individual human capital and attitudes towards immigration may even become negatively related if the fiscal costs of low-skill immigration are higher than the complementarity advantages in the labor market.[10] The latter outcome will be observed in countries with a large welfare state (i.e. a large initial t_c). As the benefit level is kept constant in this case, low-skill natives are better protected than in the benefit-adjustment case (the downward shift in figure 2 is less pronounced).

Note that in the case of high-skill immigration these relationships are simply reversed. Without a welfare state, there is a decreasing relationship between human capital and attitudes towards migration. Adding the welfare state, the plotted line rotates counterclockwise and countries with large welfare states present a positive relation between human capital and attitudes towards immigration.

In view of the estimation, we can rewrite equation (5) as

$$z_{ic}^{m} = \frac{h_{ic}}{h_c}\left(1 - \frac{h_c^m}{h_c}\right)\frac{1}{\sigma}\theta_H\theta_L - t_c\frac{h_{ic}}{h_c}\left(1 - \frac{h_c^m}{h_c}\right)\left(\theta_H^2 + \frac{1}{\sigma}\theta_H\theta_L\right) + \kappa_c^m, \quad (6)$$

where $\kappa_c^m = \left(1 - \frac{h_c^m}{h_c}\right)\left(\frac{t_c}{\sigma}\theta_H\theta_L - \frac{1}{\sigma}\theta_H\theta_L - t_c\theta_H + t_c\theta_H^2\right)$ collects all terms that are specific by country and by immigrant group.

2.3. Education and Other Factors

In the economic model spelled out above, the impact of immigration on an individual's economic situation, working through the labor market and the welfare state, are the only determinants of the individual's attitudes toward immigrants. In contrast, Hainmueller and Hopkins (2014) argue that noneconomic factors play a more important role in the explanation of these attitudes although they recognize that these "sociopsychological approaches"

10 The critical value of $t_{slope=0}$ calculated with the estimated parameters is 29%: $t_{slope=0} = \theta_L/(\theta_L + \sigma\theta_H) = 0.5461/(0.5461 + 2.98 * 0.4539) = 0.29$. Seven countries in the sample present marginal tax below this level (see Table A.3): Austria, Czech Republic, France, Greece, Poland, Portugal, Spain and Switzerland.

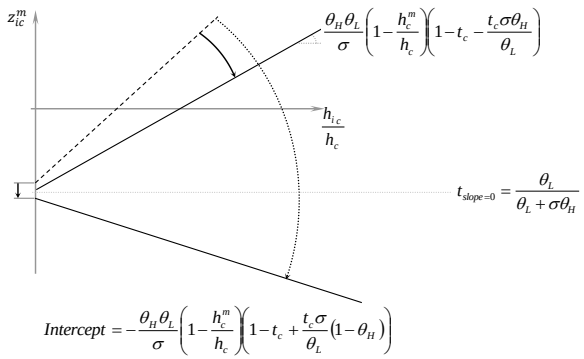

FIGURE 2 Welfare Mechanism - Tax Adjustment (Low-Skill Immigration, $h^m < h$)

(focusing on e.g. cultural factors, ethnocentrism or sociotropic explanations) provide a less unified framework to the explanation of attitudes toward immigration.

We do not attempt to model these noneconomic factors in a detailed manner, but our empirical analysis takes them into account in several ways. First, education plays a central role in several of these mechanisms: more educated individuals tend to be more tolerant towards other cultures and ethnic groups and less concerned about sociotropic impacts of immigration (Hainmueller and Hopkins 2014). Therefore we include education as an explanatory variable in our regressions. Second, although education is an important determinant of attitudes, there is an important idiosyncratic component in these noneconomic factors. Some individuals appreciate cultural diversity whereas others consider that immigration threatens their country's culture. Similarly, ethnic or racial prejudice also has an idiosyncratic dimension which cannot be entirely captured by socio-economic variables available in the survey. We control for these unobserved individual factors in our regressions in several ways that will be discussed in more detail in Section 2.4. Third, there might be systematic differences in attitudes between countries. For example, historical ties between countries might influence attitudes towards immigration from specific origin countries. We control for this possibility in our empirical analysis.

As education or human capital is crucial for our decomposition analysis carried out in Section 4.4, it should be emphasized that we interpret an individual's *level* of education as a noneconomic factor, whereas the *interactions* between an individual's level of human capital with the relative skill level of immigrants (and with the marginal tax rate) are interpreted as economic factors.

2.4. Estimating Equation and Parameter Identification

Our complete model is obtained by adding the controls for noneconomic factors described in section 2.3 to the economic framework spelled out in equations (4) and (6). We define a latent variable $\tilde{z}_{ic}^m$ capturing attitudes of individual i in country c towards immigrant group m and assume that the economic component of attitudes is proportional to the impact of immigration on income, by a factor β:[11]

$$\tilde{z}_{ic}^m = \beta z_{ic}^m + g_c(h_{ic}) + v_c^m + \mu_{ic}^{r(m)} + u_{ic}^m, \tag{7}$$

where z_{ic}^m represents the impact of immigration on individual income of natives as described by equations (4) and (6). The function $g_c(h_{ic})$ describes the (noneconomic) influence of education on attitudes, v_c^m captures factors that vary by country and immigrant groups, such as historical ties between countries, and the term $\mu_{ic}^{r(m)}$ accounts for idiosyncratic factors, capturing those individual determinants of attitudes that are not observable in the survey. For this individual effect, our identifying assumption is that each individual might hold different (unobservable) views about immigration from different regions of origin r ('Europe' or 'Rest of the world') but that these views do not depend on the fact whether the immigrant comes from a rich or poor country of that region.[12] This individual effect will be estimated using fixed or random effects in the econometric implementation of our model. Finally, the term u_{ic}^m accounts for individual heterogeneity in attitudes.

To proceed, it is useful to distinguish the two polar cases of budget adjustment. If the benefit level adjusts to balance the government's budget (equation (4)), attitudes towards immigrants of group m are summarized by

$$\tilde{z}_{ic}^m = \underbrace{\frac{h_{ic}}{h_c}\left(1-\frac{h_c^m}{h_c}\right)\frac{\beta}{\sigma}\theta_H\theta_L - t_c\frac{h_{ic}}{h_c}\left(1-\frac{h_c^m}{h_c}\right)\frac{\beta}{\sigma}\theta_H\theta_L + \beta\omega_c^m}_{\text{economic factors}} + \underbrace{g_c(h_{ic}) + v_c^m + \mu_{ic}^{r(m)}}_{\text{other factors}} + u_{ic}^m. \tag{8}$$

11 This proportionality assumption is introduced in order to clarify the problem of identification of the structural parameters, in particular σ. In the ESS, the variables describing attitudes towards immigration are coded as qualitative variables whereas the economic framework spelled out above defines the effect of immigration on an individual's income. Because of the normalization assumption in econometric models of discrete dependent variables, the structural parameters can only be defined up to a factor of proportionality in the estimations.

12 In our dataset, we have two regions ('Europe' or 'Rest of the world') and four groups of immigrants (from poor and rich countries in each of the two regions).

By contrast, if the marginal tax rate adjusts to balance the government's budget (equation (6)), the model becomes

$$\tilde{z}_{ic}^m = \underbrace{\frac{h_{ic}}{h_c}\left(1-\frac{h_c^m}{h_c}\right)\frac{\beta}{\sigma}\theta_H\theta_L - t_c\frac{h_{ic}}{h_c}\left(1-\frac{h_c^m}{h_c}\right)\left(\beta\theta_H^2+\frac{\beta}{\sigma}\theta_H\theta_L\right)+\beta\kappa_c^m}_{\text{economic factors}} + \underbrace{g_c(h_{ic})+v_c^m+\mu_{ic}^{r(m)}}_{\text{other factors}} + u_{ic}^m. \tag{9}$$

We can now define an estimating equation that captures both cases, (8) and (9), of the theoretical model. We assume that individual heterogeneity has an observed and an unobserved component and can be written as: $u_{ic}^m = \delta' X_{ic} + \epsilon_{ic}^m$, where X_{ic} is a vector of personal characteristics. The latent variable capturing attitudes towards immigrants is given by

$$\tilde{z}_{ic}^m = \lambda_0 + \lambda_1 A_{ic} + \lambda_2 A_{ic} R_c^m + \lambda_3 t_c A_{ic} R_c^m + \delta' X_{ic} + \zeta_c^m + \mu_{ic}^{r(m)} + \epsilon_{ic}^m, \tag{10}$$

where $A_{ic} = h_{ic}/h_c$ and $R_c^m = 1 - h_c^m/h_c$. Furthermore, we assume that g_c is a linear function of an individual's relative stock of human capital: $g_c(h_{ic}) = \lambda_1 A_{ic}$.[13] Our observed variable is Z_{ic}^m which is equal to 1 if $\tilde{z}_{ic}^m > 0$ and equal to 0 otherwise.

The two versions of the economic model can be distinguished as follows. If the benefit level b is endogenous, the theoretical model predicts that

$$\lambda_2 = -\lambda_3 = \theta_H\theta_L\beta/\sigma, \qquad \zeta_c^m = \beta\omega_c^m + v_c^m.$$

The restriction $\lambda_2 = -\lambda_3$ can be easily tested. By contrast, if the marginal tax rate t is endogenous, the theoretical model predicts that

$$\lambda_2 = \theta_H\theta_L\beta/\sigma, \qquad \lambda_3 = -\beta(\theta_H^2 + \theta_H\theta_L/\sigma), \qquad \zeta_c^m = \beta\kappa_c^m + v_c^m$$

To choose the relevant version of the model, we proceed as follows. First, we test the restriction $\lambda_2 + \lambda_3 = 0$. If this restriction cannot be rejected, we conclude that the benefit level b_c adjusts endogenously. Note that the elasticity of substitution σ between raw labor and human capital cannot be identified in this case (even if θ_H and θ_L are known) because of the normalization assumption which is necessary in a model with a qualitative

13 To ensure consistency with our measures of human capital in the economic part of the model, we chose to measure educational status in relative terms (the individual's human capital relative to the country's average human capital). As the model also includes fixed country-immigrant group effects, the fact that we use a relative (rather than an absolute) measure of education does not make a difference in terms of the empirical results.

dependent variable.[14] By contrast, if the restriction $\lambda_2 + \lambda_3 = 0$ is rejected and if λ_2 and λ_3 have the signs predicted by the theoretical model, we conclude that the marginal tax rate t_c adjusts endogenously. In this case, the elasticity of substitution σ between raw labor and human capital can be identified assuming that θ_H and θ_L are known:[15]

$$\sigma = -\frac{\theta_L}{\theta_H}\left(\frac{\lambda_3}{\lambda_2} + 1\right). \tag{11}$$

3. Data

In this section, we first provide an overview of the data on attitudes towards migration. In particular, we give descriptive evidence that motivates our assumption that the idiosyncratic component of attitudes depends on the region of origin of immigrants but not on the fact whether the origin country is rich or poor. Then we describe the construction of our indicators of (relative) human capital levels. These indicators are defined in a way that is consistent with our model. We use detailed OECD data to measure the relative skill levels of the four immigrant groups in each destination country. Finally, we use two different methods to estimate marginal tax rates in all destination countries.

3.1. Attitudes Towards Immigrants

Data on attitudes are taken from the first round of the European Social Survey (ESS) which covers the period 2002-2003 (ESS 2002).[16] This round of the ESS included a rotating module with detailed questions about attitudes to immigration, referring to immigrants from different origins. Using a scale from 1 (few) to 4 (many)[17], a respondent living in country c answers different versions of the question: "to what extent do you think country c should allow people from [region of origin] to come and live here?". The four regions of origin (and the corresponding answers) are the following:

Europe_rich: allow many/few immigrants from richer countries in Europe

14 In the case where the benefit adjusts to balance the government's budget constraint, only the ratio β/σ can be identified from the estimations of λ_i.

15 The cost share parameters θ_H and θ_L can be calculated using the raw data and assumptions on the return to human capital (see Section 3).

16 We use edition 6.6 of ESS Round 1 (see http://www.europeansocialsurvey.org/). We include all European countries for which detailed data on education levels of immigrants and natives are available, i.e. all 22 countries included in ESS Round 1 except Israel and Slovenia. The DIOC database (OECD 2008a) that we use to calculate relative human capital levels for the four immigrant groups does not contain data for these two countries. A list of (destination) countries included in our sample can be found in Table A.4, which provides also sample sizes and descriptive statistics for all these countries.

17 Original questions use an inverted scale.

Europe_poor: allow many/few immigrants from poorer countries in Europe

RoW_rich: allow many/few immigrants from richer countries outside Europe

RoW_poor: allow many/few immigrants from poorer countries outside Europe

Figure 3 indicates the average opinions expressed by natives in each destination country.[18] These attitudes exhibit little variability with respect to the origin of the immigrants. It may seem that respondents are either receptive or hostile to immigration regardless of the immigrants' origin (from Europe or not, from a rich country or not). At first glance this observation gives some support to the arguments of Hainmueller and Hiscox (2007) who point out that individuals' attitudes toward immigration are mostly explained by noneconomic factors. On the other hand, the aggregate data also suggests that the labor-market mechanism might be at work. The descriptive evidence suggests that the average difference between attitudes towards immigration from rich countries and attitudes towards immigration from poor countries decreases with the average human capital of the host country (see Figure A.3 in Appendix A).

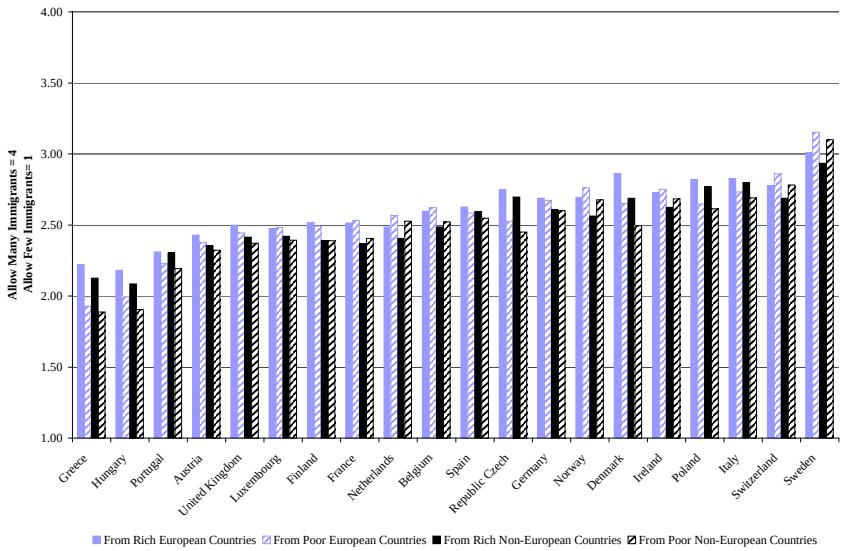

FIGURE 3 Average Attitudes by Destination Country

18 Our sample only includes individuals who were born in the country of the survey. Detailed descriptive statistics of average attitudes and average human capital levels by country of origin and destination are given in Appendix A (available online).

A crucial assumption in our estimation strategy is that the idiosyncratic component of attitudes depends on the region of origin of immigrants but not on the fact whether the origin country is rich or poor. The large number of questions contained in the ESS enables us to check whether noneconomic factors are mainly related to the regions of origin of immigrants, regardless of the income level of their origin countries. Thus, we decompose the answer to each of the four questions into a regional component (Europe or Rest of the world) and a component which is specific to the income level of the immigrants' origin country (rich or poor countries). The general component of attitudes is measured as the average attitude toward immigrants regardless whether they come from poor or rich countries. The specific attitude is the deviation of the attitudes regarding each category of immigrant (poor or rich) from the average. If the argument of Hainmueller and Hiscox (2007) stands, one would expect that natives' concerns related to culture and ethnicity are more correlated with the regional component than with specific attitudes. The ESS survey provides several questions that refer to concerns related to culture, crime and the ethnic composition of immigration flows (e.g."Is the country's cultural life undermined or enriched by immigrants?"). We decompose the correlation between a question on cultural concerns ($Culture$) and a question on attitudes towards immigrants (e.g. from poor countries in Europe, $Europe\_poor$) as follows:

$$Cov(Culture, Europe\_poor) = Cov(Culture, Europe\_avg) + Cov(Culture, \Delta Europe\_poor)$$

where $Europe\_avg = (Europe\_poor + Europe\_rich)/2$
and $\Delta Europe\_poor = Europe\_poor - Europe\_avg$.

Table 1 presents the decomposition of the covariances between the four questions on attitudes towards immigrants and several questions that refer to (noneconomic) factors related to culture, crime and ethnicity. One can see that these items are mostly correlated with the regional component of attitudes. Specific attitudes to immigrants from poor countries (or from rich countries) are only weakly correlated to these noneconomic concerns. More than 90% of the covariance between the opinion that "immigrants undermine a country's culture" and attitudes toward immigrants from poor countries can be attributed to the regional component of attitudes. This result, and the other decompositions in Table 1, lend support to our assumption that the idiosyncratic component of individual attitudes is related to the regional dimension of immigration.

3.2. Measure of Human Capital

In our model, two indicators play a crucial role: the ratio between a native's human capital and his country's average human capital (h_{ic}/h_c), and the

TABLE 1
Decomposition of the Covariances between Questions on Attitudes Toward Immigrants

	Europe				RoW			
	allow poor immig?		allow rich immig.?		allow poor immig?		allow rich immig?	
Immigrants:	average	deviation	average	deviation	average	deviation	average	deviation
1. should belong to the majority's race?	96.4%	3.6%	103.9%	-3.9%	96.8%	3.2%	103.4%	-3.4%
2. undermine country's culture?	90.7%	9.3%	111.5%	-11.5%	90.1%	9.9%	112.4%	-12.4%
3. get crime problem worse?	89.2%	10.8%	113.8%	-13.8%	87.2%	12.8%	117.2%	-17.2%
4. should be Christian?	88.4%	11.6%	115.1%	-15.1%	86.6%	13.4%	118.3%	-18.3%
5. should be white?	86.9%	13.1%	117.7%	-17.7%	84.6%	15.4%	122.2%	-22.2%

Original questions are: 1. allow many/few immigrants of same race/ethnic group as majority, 2. country's cultural life undermined or enriched by immigrants, 3. immigrants make country's crime problems worse or better, 4. qualification for immigration: Christian background, 5. qualification for immigration: be white.

ratio between immigrants' human capital and the host country's average human capital (h_c^m/h_c). To ensure consistent measurement, we will use a single data source for each of the two ratios (ESS for the former, OECD 2008a for the latter) and define a measure of human capital that is consistent with our theoretical framework. Our measure of human capital is inspired by the empirical growth literature (Klenow and Rodriguez-Clare 2005) where human capital per capita is defined as a Mincerian function of schooling.[19]

Our model differs from the aggregate production function used in these growth models because we distinguish "raw" labor from human capital. Therefore, our measure of human capital should exclude the return to raw labor. In our model, individual income is given by $y_i = F_L + F_H h_i$ whereas the Mincer model states that $y_i = ce^{\rho s_i}$, where ρ is the return to schooling and s_i denotes years of schooling attainment. To ensure consistency between the two, we define individual human capital as $h_i = (ce^{\rho s_i} - F_L^0)/(F_H^0)$ where superscript 0 denotes values at the initial equilibrium. Defining the marginal productivity of "raw labor" as $F_L^0 = ce^{\rho s_{min}}$ (and assuming that $F_H^0 = F_L^0$ by choice of units) yields the following measure of individual human capital:

$$h_i = e^{\rho(s_i - s_{min})} - 1, \tag{12}$$

where s_{min} denotes "minimum" years of schooling which correspond to our definition of raw labor. The return to schooling ρ is set to 8.5%, following Klenow and Rodriguez-Clare (2005) who rely on the returns estimated by Psacharopoulos and Patrinos (2004) for a large set of countries. To identify the elasticity of substitution σ, we estimate the cost share of raw labor ($\theta_L = 1 - \theta_H$) as follows. For an individual i, we have $\theta_{Li} = e^{\rho(s_{min} - s_i)}$. The average cost share of raw labor is obtained as the average of θ_{Li} on the entire sample: $\theta_L = 0.5461$.

Now turn to the measure of the ratio h_{ic}/h_c. The ESS includes two main variables concerning native individual education. The variable *edulvla* provides the level of education according to five categories.[20] The variable *eduyrs* provides the years of education for each individual. We want to translate the different education levels into years of schooling attainment, regardless of how many years it takes an individual to reach a given education level. Therefore

19 A more complete version of the Mincer model would include individuals' work experience in addition to schooling. We do not include years of experience in our measure of human capital. First, experience could only be measured as *potential* experience using data on age (e.g., experience=age-schooling years-6), involving important measurement errors especially for women. Second, the literature agrees on the fact that substitution across experience groups is much easier than substitution between education levels. Our measure of human capital should reflect primarily differences between education levels since in our model, human capital and raw labor are imperfect substitutes.

20 The seven education categories are: Less than lower secondary education, Lower secondary education completed, Upper secondary education completed, Post-secondary non-tertiary education completed, Tertiary education completed.

our measure of the individual years of schooling s_i of natives is defined as the median (in the entire sample) of *eduyrs* within each education level (*edulvla*). Individual human capital is then calculated using (12) and h_c is obtained by averaging over all individuals of country c in the ESS. As the lowest education level in our sample corresponds to 6 years of schooling, we set s_{min} to 6.

The average human capital of immigrant group m is calculated in an analogous way, using aggregate data at the country level on immigrants' education from the OECD DIOC database (OECD 2008a).[21] The DIOC database provides data on the level of education for natives and immigrants by categories following the International Standard Classification of Education (ISCED) 1997. In the data, four categories gather the six levels of ISCED classification, namely: primary level (ISCED 0/1/2), secondary level (ISCED 3/4), tertiary level 1 (ISCED 5A/5B) and tertiary level 2 (ISCED 6). Following the ISCED definitions and according to the educational system of European countries, we attributed a certain number of years (s^e) to each education category e.[22] Following the definition of human capital given in equation (12), we calculate the human capital level $h^e = e^{\rho(s^e - s_{min})} - 1$ for each education category e. Finally, the human capital of immigrant group m (h_c^m) and the host country's average human capital (h_c) are obtained as averages of h^e for the respective groups.

To define the four group of immigrants that appear in the ESS questions, we have to distinguish "poorer countries" from "richer countries" in Europe and in the Rest of the world. In both regions, we classify countries with a GDP per capita higher than $10,000 as "rich countries" and all others as "poor countries" (source: *World Development Indicators* for the year 2003). This classification yields country groups that seem to correspond to the general perception of rich and poor countries. For example, Hungary and Gabon are considered to be poor countries. Our classification of rich countries is also very close to the category of "high income" countries established by the World Bank.[23] As the threshold between "poorer" and "richer" countries is not precisely defined in the ESS questionnaire, we carry out robustness checks for different thresholds. In particular in Europe a country might be perceived as relatively poor even if its GDP per capita is higher than $10,000 (e.g. Portugal, Slovenia, Greece). Therefore we test a wide range of thresholds ($15,000 and $26,000) which classify these countries as "richer" (see Appendix C).

21 We prefer the original DIOC database to the extended DIOC database (DIOC-E) and to the widely used database by Docquier et al. (2009) because the breakdown of education levels is finer in the former (four levels instead of three in the two other databases). A fine breakdown of education categories allows us to obtain a more precise measure of human capital, which is at the heart of our analysis.

22 We attribute 8 years to the primary level, 12 years to the secondary level, 15 years to the tertiary level 1 and 17 years to the tertiary level 2.

23 In 2003, the World Bank defined the limit between high-income and upper-middle income countries at a level of GNI per capita of $9,076.

3.3. Marginal Tax Rates

In our model, the welfare state is represented by a simple linear tax-benefit system with a constant marginal tax rate. To measure the degree of redistribution in all destination countries, we rely on indicators published by the OECD (2008b) in the *"Taxing Wages"* series. For all 20 destination countries, we estimate (constant) marginal tax rates that are representative of the real income tax paid by wage earners. The OECD provides average and marginal tax rates at four different points of the wage distribution for adult, full-time workers in manufacturing sectors: at 67%, 100%, 133% and 167% of average earnings.

We use two simple methods to estimate a marginal tax rate for each country, based on the tax schedule for single wage earners.[24] First, we calculate a simple average of *marginal* tax rates at the four points of the income distribution. Second, we adjust a linear tax-benefit schedule to the *average* tax rates at the four points of the wage distribution.[25] Reassuringly, the two simple methods yield very similar results (see Table A.3 in Appendix A). In the following section, we report estimation results using the tax data obtained from the first method, but none of our results change significantly if we use the alternative set of marginal tax rates.

4. Estimation and Results

We begin this section by describing the econometric methods used to estimate the model. We then report estimation results and discuss how our empirical results can be interpreted without necessarily referring to the economic model presented in Section 2. Finally, we use the model to decompose predicted attitudes into economic (labor-market and welfare-state effects) and non economic components.

4.1. Estimation Methods

It is useful to reproduce here the estimating equation (10), which corresponds to the complete version of the model. Individual i's attitude towards the immigration of group m is given by

24 For Switzerland, tax rates are differentiated further at the regional level since direct tax rates vary strongly from Canton to Canton. We use information on marginal tax rates at the Canton level (AFC 2003) to calculate (population-weighted) average marginal tax rates for the six regions that are distinguished in the ESS data for Switzerland. These regional tax rates are then used to differentiate at the regional level the marginal tax rate estimated by OECD (2008b) for Switzerland.

25 Denote the tax paid by the individual by $T = tY - b$, where t is the constant marginal tax rate and Y is the individual's income. The average tax rate is $T/Y = t - b(1/Y)$. For each country, we regress the average tax rate (T/Y) on the inverse of income $(1/Y)$, using the four observations provided by OECD (2008b), at 67%, 100%, 133% and 167% of average earnings. The constant term of this regression is the estimated constant marginal tax rate t for the country. See Appendix A for details.

$$\tilde{z}_{ic}^{m} = \lambda_0 + \lambda_1 A_{ic} + \lambda_2 A_{ic} R_c^m + \lambda_3 t_c A_{ic} R_c^m + \delta' X_{ic} + \zeta_c^m + \mu_{ic}^{r(m)} + \epsilon_{ic}^m,$$

Economic factors (labor-market and welfare-state mechanisms) are captured by the two interaction terms $A_{ic}R_c^m$ and $t_c A_{ic} R_c^m$, whereas the other terms capture the observed and unobserved components of noneconomic factors.[26] Recall that A_{ic} denotes an individual's relative human capital, R_c^m measures country c's average human capital relative to immigrant group m and X_{ic} is a vector of personal characteristics. The ζ_c^m are fixed effects depending on the country c and the immigrant group m and $\mu_{ic}^{r(m)}$ is an unobserved individual effect, capturing individual views related to immigrants from region r. We discuss below in detail how this effect is estimated, using random-effects or fixed-effects models. The dependent variable of equation (10), $\tilde{z}_{ic}^m$, is a latent variable capturing attitudes towards immigration whereas the observed variable Z_{ic}^m is dichotomic, coded such that 1 indicates more open attitudes towards immigration.[27] Note that our estimation results can also be interpreted without referring to our specific economic model. We will discuss this issue at the end of this section.

The approach in past research (Scheve and Slaughter 2001, Mayda 2006, O'Rourke and Sinnott 2006, Hanson et al. 2007, Facchini and Mayda 2009, Murard 2017) was to estimate equation (10) using probit or linear probability models, without taking the unobserved individual effect $\mu_{ic}^{r(m)}$ into account. This approach is problematic if, as seems to be the case, important noneconomic factors are unobserved and therefore included in $\mu_{ic}^{r(m)}$. First, Hainmueller and Hiscox (2007) argue forcefully that noneconomic factors are correlated with education and therefore possibly with some of the explanatory variables in (10). In this case, these variables are endogenous and the probit model leads to inconsistent estimates. Second, even if $\mu_{ic}^{r(m)}$ is not correlated with the explanatory variables, the probit maximum likelihood estimator is not consistent (Greene 2003, p. 679). In this omitted variable case, the inconsistency of the ML-estimator stems from the non-linearity of the model. In practice, this might be a smaller problem than the first one.

To address these problems, we estimate the model using four different methods. First, as a benchmark, we estimate equation (10) separately for each question involving one of the four immigrant groups (rich/poor countries in Europe/Rest of the World) using *probit* models (specifications (1) to (4) in

26 In fact, the term ζ_c^m contains an "economic" element, as spelled out in Section 2.4. This element is taken into account in the decomposition analysis below.

27 The original variable in the ESS takes four (ordered) values. To dichotomize this variable, we recode the answers as follows: "allow many to come and live here" and "allow some" are coded as 1, whereas " allow a few" and "allow none" are coded as 0. To check the robustness of our results to this dichotomization, we also run ordered probit models using all the information available on the endogenous variables. Results are reported in Appendix C. They hardly differ from the coefficients of the probit specifications in Table B.1 and Table 2 below.

Tables B.1 and 2). This is the approach used in past research and it fails to address the problems of omitted variables and endogeneity by ignoring $\mu_{ic}^{r(m)}$.

Second, we estimate equation (10) jointly for all four immigrant groups using a *random-effects logit* model (specification (5) in Table 2). We assume that there is a common random effect $\mu_{ic}^{r(m)}$ for rich and poor countries within a region r (Europe or RoW) but that the random effect may differ between regions. We also estimate this model separately for each region (specifications (6) and (7) in Table 2). This model accounts for omitted individual factors by treating $\mu_{ic}^{r(m)}$ as an unobserved random variable which is assumed to follow a normal distribution. Note that the random-effects logit estimator is consistent only if the individual-specific effect $\mu_{ic}^{r(m)}$ is not correlated with the regressors, which is admittedly a restrictive assumption.

There are two ways to allow for correlation between unobserved random effects and regressors. Either we can specify explicitly the relationship between $\mu_{ic}^{r(m)}$ and the relevant explanatory variables (correlated random effects model) or we can allow for arbitrary correlation between the two (fixed-effects model). Our third estimation method adopts the former approach and follows Chamberlain (1984). We allow for correlation between μ_{ic}^{r} and the economic factors $A_{ic}R_c^m$ and $t_cA_{ic}R_c^m$ by assuming that the conditional distribution of μ_{ic}^{r} is normal with linear expectation and constant variance. More precisely, we assume that μ_{ic}^{r} is given by $\mu_{ic}^{r} = \nu_1 A_{ic}R_c^{r,poor} + \nu_2 A_{ic}R_c^{r,rich} + \xi_1 t_c A_{ic}R_c^{r,poor} + \xi_2 t_c A_{ic}R_c^{r,rich} + \eta_{ic}^{r}$, where $r = r(m)$ is the origin region of migrant group m and η_{ic}^{r} is a normally distributed error term which is uncorrelated with the economic factors.[28] The results from the estimation of (10) with this parameterization of μ_{ic}^{r} are given in column (8) of Tables B.1 and 2. Specifications (9) and (10) report the results of separate estimations for each region.

In our fourth method, we allow for the possibility that $\mu_{ic}^{r(m)}$ is arbitrarily correlated with explanatory variables by using a *fixed-effects logit* model. The estimation of this model relies on conditional maximum likelihood, where the incidental parameters problem does not arise. Only observations for individuals whose attitudes differ between immigration from poor countries, on the one hand, and immigration from rich countries, on the other hand, are taken into account for the estimation. It should be emphasized that this method (and the preceding) fully address Hainmueller and Hiscox's (2007) criticisms of the economic literature since the estimated relationship between

28 Note that the explanatory variables that only vary at the individual level, such as education, were not included in the conditional expectation of μ_{ic}^{r}. They could be included (without changing the results of the regression) but their impact on μ_{ic}^{r} could not be distinguished from their direct effect on $\tilde{z}_{ic}^{m}$. This implies that we can only estimate the total impact of education (A_{ic}) on attitudes, without distinguishing the direct effect from the effect going through $\mu_{ic}^{r(m)}$. This is not a problem for the purposes of our decomposition since we interpret both effects as noneconomic.

human capital and immigration preferences is purged from all unobserved individual factors that influence attitudes towards immigration from a given region.

Before we turn to the presentation of estimation results based on equation (10), it is useful to discuss if they can also be interpreted without referring to our specific economic model. Economic intuition for the expected signs of λ_2 and λ_3 can be gained from other models of the labor-market and welfare-state mechanisms (Facchini and Mayda 2009, Dustmann and Preston 2006). In these models, one would expect the labor-market mechanism to dominate in countries where the tax rate is low. According to this mechanism, natives are opposed to immigrants with similar skill levels and favorable to immigrants with different skill levels. Therefore λ_2 is expected to be positive since natives' attitudes towards immigration should be increasing in their own human capital if immigrants are less skilled than natives ($R_c^m > 0$) and decreasing if immigrants are more skilled than natives ($R_c^m < 0$). The redistribution of income tends to attenuate this effect since the (after-tax) return to human capital is lower in countries with a large welfare state. Therefore λ_3 can be expected to be negative.

In the absence of a structural model, econometric practice suggests to control for all interactions between the variables A_{ic}, R_c^m and t_c in the regression. Is this the case in all our regressions? The variables R_c^m, t_c and the interaction $R_c^m t_c$ are absorbed by the fixed effects ζ_c^m. In the fixed-effects logit specification, the interaction $A_{ic}t_c$ is fully absorbed by the (fixed) effects $\mu_{ic}^{r(m)}$, so this specification is entirely consistent with a nonstructural interpretation. The same cannot be said for the random-effects specifications. To see if this omission matters, we reestimate the two random-effects specifications including the interaction $A_{ic}t_c$ and report the results in Appendix C, Table C.4. It is striking that the estimates for the effects of the economic factors (λ_2 and λ_3) in this "nonstructural" version of the model are close to identical to the original results of Table 2, especially for the Chamberlain version of the random-effects logit. This provides another indication that the Chamberlain random-effects logit, whose results are also very close to the fixed-effects logit, yields consistent estimates of the economic mechanisms.

When carrying out the decomposition of attitudes in Section 4.4, we will use our estimates to predict the latent variable of attitudes, $\tilde{z}_{ic}^m$. Among our two preferred specifications in Table 2, we choose the Chamberlain random-effects logit rather than the fixed effects logit because the former includes the entire sample of individuals and allows to consider the role of education in the decomposition analysis (as a noneconomic factor). Moreover, the estimates

of the parameters λ_2 and λ_3, crucial for the identification of the economic mechanism, are similar to those of the fixed effects model.[29]

4.2. Estimation Results

Estimation results for all four econometric methods are presented in Table 2.[30] If we use an ordered probit estimator for all four questions separately (specifications (1) to (4)), the main finding is that individual education plays a significant role in all specifications, as predicted by those authors who stress the role of cultural factors. Economic mechanisms seem to matter for all questions except the one about immigrants from poor countries in Europe: in specifications (1),(2) and (4) the parameters λ_2 and λ_3 have the expected signs and are significantly different from zero. By contrast, the ordered probit estimates in regression (3) do not yield significant results for these two parameters which are relevant from an economic point of view.

If we take unobserved individual heterogeneity into account using the random effects logit estimator, the parameters capturing economic mechanisms become highly significant and have the expected signs (specifications (5) to (7)). The results also point to the importance of unobserved individual factors in the formation of attitudes towards immigration from a given region: a large proportion of the residual variance can be attributed to the individual-specific unobserved effect (the fraction of variance due to $\mu_{ic}^{r(m)}$ is close to 80% and highly significant).

The results hold up even if we relax the assumption that the individual-specific effects are uncorrelated with the independent variables in the regression, using either the Chamberlain version of the random-effects logit (specifications (8) to (10)) or fixed-effects logit (specifications (11) to (13) in Table 2). The main coefficients of the model remain highly significant and the estimated values of the ratio $-\lambda_3/\lambda_2$ (which matters from a structural viewpoint) increase by about 20%. The hypothesis of absence of correlation between random-effects and other regressors is clearly rejected.[31] Therefore

29 Another way to include the entire sample while using individual fixed effects would be to use a linear probability model. The parameters λ_2 and λ_3 are hardly significant when using the entire sample, but the point estimates of the structural parameter σ are not very different from the fixed-effects logit estimates (they are 23–26% higher). The problem with this model is that if we use it to predict the probability to accept more immigration, about 40% of the predictions in the sample lie outside the [0,1] interval. As we use predictions for our decomposition, this is a major disadvantage. If we limit the sample to those individuals who express different attitudes toward immigrants from poor or rich countries of a region, this problem does not arise and the estimated coefficients are significant and closer to the fixed-effects logit model.

30 In all estimations (except random-effects logit), standard errors are corrected for heteroscedasticity and clustering at the country level using White's (1980) method.

31 We test this hypothesis by testing jointly the hypotheses $\nu_1 = \nu_2 = 0$ and $\xi_1 = \xi_2 = 0$. Moreover, the Hausman test of the standard logit model (vs. fixed-effects logit model) clearly rejects the former.

we retain the RE-Chamberlain and fixed-effects models as our preferred specifications. Note that the fixed-effects logit specification only uses the information on individuals who change their opinion across questions.

What do these results tell us about the way the government budget adjusts to immigration? The restriction $\lambda_2 + \lambda_3 = 0$ is rejected in specifications (5) to (13) at the 1 percent level. Moreover, λ_2 and λ_3 have the signs predicted by the second version of the model where the tax rate adjusts endogenously. Hence, the impact of immigration on government revenues seems to be predominantly absorbed by a rise in marginal tax rates instead of a reduction in the benefit level.[32]

As discussed in Section 2.4, we are able to identify the elasticity of substitution (σ) between raw labor and human capital in this version of the model. Remarkably, the ratio $-\lambda_3/\lambda_2$ does not vary much across the different regressions. This implies that our model yields a rather robust estimate of the elasticity of substitution between raw labor and human capital. For our preferred estimation methods (random-effects-Chamberlain logit and fixed effects logit), the values for σ vary between 2.89 and 3.08. In the context of our theoretical framework, these rather high elasticities indicate that natives perceive a small impact of immigration on relative wages, a result which seems consistent with the empirical literature on the labor-market consequences of immigration.

To put our estimates of the elasticity of substitution into perspective, it is useful to compare the implied wage effects of immigration with other estimates in the literature. A first comparison can be made in terms of direct partial wage elasticities.[33] Following Borjas (2003, Section IV), this elasticity is measured as the percent change in wages of native workers (of a given skill group) associated with a percent change in labor supply of the same skill group.[34] In our model, the wage elasticity of an unskilled individual who does not hold any human capital is $-\theta_H/\sigma = -0.15$ (taking the fixed-effects specification (11) in Table 2 as a reference).[35] According to this estimate, if the arrival of unskilled immigrants increases total labor supply of raw labor by 10%, the

32 It is worth mentioning that the labor-market mechanism alone does not provide a satisfactory explanation of attitudes towards immigration. If we estimate model (10) under the restriction $\lambda_3 = 0$, we find that the results depend on the estimation method used. Simple probit models yield significant results but these are not robust to the use of more general estimation methods that account for unobserved individual factors (random-effects Chamberlain, fixed-effects logit). See Appendix B for details.

33 The elasticity of substitution between raw labor and human capital in our model cannot be compared directly with the elasticity of substitution between low-skilled and high-skilled workers. For this reason, we prefer to carry out the comparison on the basis of wage elasticities.

34 Borjas (2014) gives an overview of recent estimates of this elasticity for different countries. The terminology *direct partial wage elasticities* is due to Ottaviano and Peri (2012).

35 In equation (2), the partial wage elasticity for an unskilled individual is

TABLE 2
Determinants of Attitudes - Complete Model

Specification		Probit				R.E. Logit			R.E. Logit Chamberlain			F.E. Logit		
Origin Region		Europe	RoW	Europe	RoW	Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW
Poor/Rich/Pooled		Rich	Rich	Poor	Poor	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P
Variable	*Coeff.*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A_{ic}	λ_1	0.41***	0.42***	0.31***	0.35***	1.37***	1.34***	1.41***	1.51***	1.44***	1.77***			
		(0.025)	(0.041)	(0.033)	(0.033)	(0.033)	(0.043)	(0.052)	(0.047)	(0.058)	(0.094)			
$A_{ic}R_c^m$	λ_2	1.44***	0.95***	0.30	1.17***	3.18***	3.69***	2.74***	1.59***	2.98***	1.04**	1.48***	3.27***	0.95**
		(0.305)	(0.158)	(0.298)	(0.283)	(0.263)	(0.469)	(0.340)	(0.353)	(0.683)	(0.428)	(0.545)	(0.770)	(0.388)
$t_c A_{ic}R_c^m$	λ_3	-3.71***	-2.39***	-0.21	-2.45***	-9.21***	-10.40***	-8.15***	-5.40***	-10.29***	-3.68***	-5.15***	-11.55***	-3.38***
		(1.117)	(0.542)	(1.086)	(0.907)	(0.884)	(1.705)	(1.102)	(1.150)	(2.367)	(1.367)	(1.715)	(2.659)	(1.161)
$-\lambda_3/\lambda_2$		2.58	2.52		2.09	2.90	2.82	2.97	3.40	3.45	3.54	3.48	3.53	3.56
σ		1.90	1.83		1.31	2.29	2.19	2.37	2.89	2.95	3.06	2.98	3.04	3.08
Observations		32719	32719	32719	32719	130876	65438	65438	130876	65438	65438	24204	12818	11386
N groups (id-ctry)						65438	32719	32719	65438	32719	32719			
Fraction of variance						0.81	0.78	0.78	0.81	0.78	0.83			
due to $\mu_{ic}^{r(m)}$						(0.0031)	(0.0049)	(0.0039)	(0.0031)	(0.0049)	(0.0039)			
log likelihood						-69502	-35163	-34298	-69438	-35132	-34251			

The dependent variable is the answer to the question "to what extent do you think country c should allow people from [origin region/poor or rich country] to come and live here?". In all specifications, the answer is coded as a dummy variable (1 indicates attitudes favorable to immigration). In specifications (5) to (13), the answer is coded as a binary variable. Regressions (5), (8) and (11) include fixed effects for country-immigrant's origin location (either Europe or Rest of the World). All the other regressions include simple country fixed effects. In both case these fixed effects are interacted with group of immigrants (poor or rich countries). Dummy variables control for gender and political orientation. Continuous variables control for individual age and individual age squared. Robust standard errors are country clustered in regressions (1)-(4) and (11)-(13). ***, **, * denote significance at the 1%, 5%, 10% levels.

The hypothesis of absence of correlation between random-effects and other regressors is clearly rejected in equations (8) to (10), we test this hypothesis by testing jointly the hypotheses $\nu_1 = \nu_2 = 0$ and $\xi_1 = \xi_2 = 0$. Moreover, Hausman test of the standard logit model (vs. fixed-effects logit model) clearly rejects the former. Hausman tests for regressions (11) to (13) reject H0: zero individual effects at the 1% level.

wage of unskilled workers decreases by 1.5%. At the other extreme of the skill spectrum, the direct partial wage elasticity for university graduates is −0.10. These elasticities are well in the range of estimates for Germany (around −0.1) reported by Borjas (2014) but they are lower than the estimate for Norway (−0.27), the only other European country included in the Borjas' (2014) survey. In our model, partial wage elasticities are lower (in absolute value) for medium-skilled individuals, especially if their skill level is close to the average skill level of the destination country. However, these small wage elasticities are not in contradiction with estimates obtained using other empirical approaches, as argued below.

These direct partial wage effects only give an incomplete picture of the reaction of wages to immigration, as has been emphasized by Ottaviano and Peri (2012). A more meaningful measure of the impact of immigration can be obtained by simulating the wage effects of immigration in a structural model whose parameters are estimated econometrically. This approach, which was initiated by Borjas (2003, Section VII), emphasizes the role of complementarity effects between workers with different skill levels. The models used in this strand of the literature distinguish more segments of the labor market (in terms of education and experience) and contain a larger set of parameters than what can be identified with data on attitudes to immigration.[36] Even if these models are more complex than ours, it is the simulated impact of immigration on native wages that matters for the comparison.

Recent studies on the UK and Germany confirm that the impact of immigration on the relative wage of high to low-skilled natives is very small. In the UK, the share of immigrants in the total workforce increased from 7% in 1975 to 12% in 2005 while the share of immigrants among high-skilled workers rose more than proportionally. According to the simulations of Manacorda et al. (2012), immigration caused the relative wage of university graduates vs. secondary educated to decline by only 0.04% per year for natives workers (or 1.2% over the period of 30 years).[37] The case of Germany is different

$$\frac{dy_c^0/y_c^0}{dL_c^m/L_c} = z_{ic}^m \frac{y_c}{y_c^0} = -\frac{\theta_H \theta_L}{\sigma} \frac{y_c}{y_c^0} = -\frac{\theta_H}{\sigma}$$

where y_c^0 denotes income of an individual with zero human capital ($h_{ic} = 0$), immigrants are assumed to be unskilled ($h_c^m = 0$), and $y_c^0/y_c = \theta_L$ is the share of raw labor in average income.

36 Among many other references, see Ottaviano and Peri (2012) for the US, Manacorda et al. (2012) for the UK, Felbermayr et al. (2010) and Brücker and Jahn (2011) for Germany. Some of these contributions also assume that natives and immigrants are imperfect substitutes within a skill group. The latter question is also relevant in the context of our model and we will discuss in the next section how our empirical results can be re-interpreted in this case.

37 See Manacorda et al. (2012, Table 8). Their simulation results show clearly to what extent the imperfect substitutability between natives and migrants (within a skill cell)

since immigrants are less skilled than natives. According to Brücker and Jahn (2011), a one percent increase in the labor force due to immigration decreases the relative wage of natives (university graduates vs. high-school graduates) by 0.14% in the long run. Felbermayr et al. (2010) simulate the effect of immigration flows that would have been observed if Germany had not restricted immigration from Eastern Europe during a transition period. These immigration flows would have resulted in an increase of the German labor force by 2.1% and an increase in the relative wage of high-skilled vs. low-skilled natives by 0.18% in the long run (or by only 0.03% in a version of the model that accounts for rigid wages and unemployment). The results of these studies confirm that the impact of immigration on wages of native workers seems to be very small in European countries. Our estimate of the perceived elasticity of substitution between raw labor and human capital is consistent with this evidence.

4.3. Robustness

The recent literature on the labor-market effects of immigration has emphasized three issues related to the situation of immigrants in the labor market. First, the education levels of migrants do not necessarily provide a good measure of their human capital level since education quality varies widely between countries (Razin and Wahba 2015). Second, and related to the first point, highly skilled immigrants often work in occupations that do not correspond to their observed education level (Mattoo et al. 2008). The "downgrading" of immigrant skills implies that these immigrants are competing for jobs with less skilled natives, as Dustmann et al. (2013) find in the case of the UK. Third, some authors argue that natives and immigrants are imperfect substitutes within a given skill group (Ottaviano and Peri 2012). As a consequence, natives are partially shielded from the competition with immigrants and the impact of immigration on natives' wages is attenuated. We deal with the two first issues by adjusting the data on human capital and re-estimating the model whereas we discuss the third issue by reinterpreting our original estimation results within a modified theoretical model.[38]

As the first two issues are related, we follow a similar procedure in both cases. What matters in our model is whether immigrants tend to increase

shields native workers (but not "older" immigrants) from labor-market competition by immigrants: immigration caused the relative wage of university graduates vs. secondary educated to decline by 0.89% per year *for migrants* (a decline of almost 24% over 30 years).

38 As mentioned in Section 3, we also test the robustness of our results to the classification of migrants' origin country as "rich" or "poor". We reestimate the fixed-effects logit model using different thresholds ($10,000, $15,000 and $26,000) to delimit the two types of countries. Results are reported in Appendix C, Table C.1. It turns out that this change in classification has very little impact on the estimate of σ, which remains in the range of 3.04–3.20 (compared to 2.98–3.08 for the original estimations).

or decrease the return to human capital. Therefore we need to determine immigrants' average skills relative to natives', using a measure of skills that takes the quality of education (in the first case) or the actual occupations (in the second case) into account. In each of these two cases, the improved measure of human capital comes at a cost: due to the limited availability of the data, we loose either observations on origin countries or on destination countries of migrants.

In our first robustness check, we use measures of cognitive skills to adjust the relative human capital level of immigrants, $R_c^m = 1 - h_c^m/h_c$, for quality of education. Hanushek and Woessmann (2012) compiled international assessments of student achievement for 77 countries and defined a common metric in order to construct internationally comparable measures of cognitive skills. The latter are a good indicator of the quality of primary and secondary education in each country. We use them to calculate an "adjusted relative human capital level" for each origin country (relative to a destination country) by multiplying the relative human capital level by the ratio of cognitive scores of the two countries. Aggregating over origin countries, we obtain an adjusted measure $\tilde{R}_c^m$ for the four groups of immigrants m in each destination country c.[39]

To check if the differences in education quality affect our results, we reestimate our preferred fixed-effect specifications (corresponding to regressions (11), (12) and (13) in Table 2) using the adjusted measure $\tilde{R}_c^m$. Results are reported in columns (1), (2) and (3) of Table 3. The coefficients λ_2 and λ_3 related to the economic mechanism remain significant. Although the estimated coefficients are somehow different, the values of the elasticity of substitution σ are very similar to the original estimates. Therefore the impact of the economic factors on attitudes can be expected to be almost unchanged.

Second, we address the problem of downgrading within the framework of our model by adjusting the measurement of immigrants' relative human capital, taking their actual occupations into account. Two approaches have been proposed to address the problem of downgrading (or over-qualification). Dustmann et al. (2013) allocate immigrants to skill groups according to their position in the native wage distribution whereas Mattoo et al. (2008) use immigrants' occupations as indicators of skill. In the absence of information on immigrants' wages in the ESS, we use immigrants' occupations and compare them to the occupations of natives. To do this, we use the mapping of major occupation groups (ISCO-88) to skill levels proposed by ILO (1990) and calculate the average years of schooling for each occupation group in the entire

39 Unfortunately these test scores are only available for a subset of origin countries (72 countries of our sample), corresponding to 75% of immigrants in our database. In the calculation of $\tilde{R}_c^m$, we do not take account of migrants from countries that are not in Hanushek and Woessmann's (2012) database.

sample of all destination countries.[40] Then we attribute to each immigrant the average schooling years of her occupation and recalculate the average human capital for the four groups of immigrants and for the country's entire working population. This enables us to calculate the occupation-adjusted relative human capital of immigrants, $R_c^m = 1 - h_c^m/h_c$, for each immigrant group m and destination country c.[41]

Interestingly, the downgrading of immigrants affects destination countries to different degrees. It seems to be most pronounced in the UK, Italy, Spain and Portugal, where immigrants are more likely to hold jobs that do not correspond to their educational qualifications than natives. By contrast, downgrading does not seem to occur to a similar degree in countries such as Germany and France where some "under-qualification" of immigrants can be observed. This occurs in particular in low-skilled occupations and might be due to the fact the number of years of compulsory schooling is lower in the migrants' origin countries than in the destination countries.

Do the estimation results of our model change if we take the downgrading of immigrants into account? It turns out that the estimates of the complete model remain significant and the estimate of the structural parameter σ is hardly affected by the adjusted measures of education. Table 3 shows the estimation results for the fixed-effects logit specification of the model and compares the results obtained using the "original" human capital indicators (in columns (4) to (6)) with the results obtained using the "occupation-adjusted" measures (in columns (7) to (9)). The first differ slightly from specifications (11) to (13) in Table 2 since they are based on a smaller sample (excluding data from Belgium, Netherlands and Norway) and the latter yield similar (slightly smaller) estimates for σ: all estimates of σ fall within a narrow band between 2.67 and 3.02.

Turn now to the third issue: the imperfect substitutability between migrants and natives within skill groups. Peri and Sparber (2009) give a rationale for this assumption, arguing that natives tend to shift to occupations that are intensive in communication tasks when immigrants arrive. Here we will simply discuss how the interpretation of our estimates (and simulations carried out in the next section) are affected if we assume that natives and

40 Due to lack of data, the following three countries had to be dropped from the sample: Belgium, Netherlands and Norway. See Appendix C for details on this calculation.

41 More precisely, we use the data on occupations (available in a separate file D of the OECD DIOC database including only employed individuals) in order to calculate adjustment factors for each country and immigrant group. These adjustment factors are then applied to the original DIOC data (file A), assuming that the adjustment affects the entire population of the country in the same way. We proceed in this way in order to minimize problems of endogeneity that could be caused by the fact that an omitted variable (e.g. discrimination) influences both attitudes towards immigration and the employment of immigrants. See Appendix C for details.

TABLE 3
Robustness Check - Human Capital Adjustments

Specification		Hanushek & Woessmann (2012) Human Capital Adjustment			F.E. Logit (No Adjustment)			Occupation Human Capital Adjustment		
Origin Region		Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW
Poor/Rich/Pooled		R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P
Variable	*Coeff.*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$A_{ic}R_c^m$	λ_2	1.11***	2.79***	0.66**	1.61**	3.51***	1.02*	2.59**	3.55**	2.07**
		(0.406)	(0.483)	(0.280)	(0.778)	(0.878)	(0.539)	(1.177)	(1.746)	(0.988)
$t_c A_{ic}R_c^m$	λ_3	-3.93***	-9.84***	-2.45***	-5.69**	-12.71***	-3.67**	-8.69**	-12.46***	-6.66**
		(1.324)	(1.832)	(0.887)	(2.780)	(3.263)	(1.857)	(4.025)	(6.409)	(3.018)
$-\lambda_3/\lambda_2$		3.54	3.53	3.71	3.53	3.62	3.60	3.36	3.51	3.22
σ		3.06	3.04	3.26	3.04	3.15	3.13	2.84	3.02	2.67
Observations		24204	12818	11386	19612	10404	9208	19612	10404	9208

The dependent variable is the answer to the question "to what extent do you think country c should allow people from [origin region/poor or rich country] to come and live here?". In all specifications, the answer is coded as a binary variable. Regressions (1), (4) and (7) include fixed effects for country-immigrant's origin location (either Europe or Rest of the World), and these fixed effects are interacted with group of immigrants (poor or rich countries). For the sake of comparison, columns (4), (5) and (6) respectively replicate our preferred fixed-effects estimations from columns (11), (12) and (13) in Table 2, with the number of observations limited to those of columns (7), (8) and (9) of this table. Robust standard errors are country clustered. ***, **, * denote significance at the 1%, 5%, 10% levels.

immigrants are imperfect substitutes within a skill category (i.e. raw labor and human capital in our model), following Ottaviano and Peri (2012).

As above, aggregate output of a country c is given by $Y_c = F(H_c, L_c)$ but now we assume that human capital H_c is an aggregate of native and migrant human capital, $H_c = \mathcal{H}(H_c^N, H_c^M)$, and raw labor L_c is an aggregate of native and migrant labor, $L_c = \mathcal{L}(L_c^N, L_c^M)$. Furthermore, we denote the elasticity of substitution between human capital and raw labor by σ_E, the elasticity of substitution between native and migrant raw labor by σ_L and elasticity of substitution between native and migrant human capital by σ_H.

It turns out that this model is compatible with the fixed-effects logit estimates in Table 2 (specifications (11) to (13)) from an empirical point of view (see Appendix C). In contrast to the original model, the elasticities of substitution σ_E, σ_H and σ_L are not identified in this extended model. Nevertheless, we can establish the following relationship between the elasticity σ estimated in Table 2 and the elasticities of substitution in the extended model (see Appendix C):

$$\sigma = \left(\frac{1}{\sigma_E} - \frac{1}{\theta_L \sigma_H} \right)^{-1}$$

This relationship establishes that the estimate of σ provides an upper bound for the elasticity of substitution between raw labor and human capital in the extended model, σ_E. This indicates that our econometric estimates are consistent with an elasticity of substitution between raw labor and human capital that is lower than 3 (our preferred estimates in Tables 2 and 3). To take a numerical example, if we consider our estimates $\sigma = 3$ and $\theta_L = 0.55$, and if we assume $\sigma_H = 10$, we obtain $\sigma_E = 1.94$.[42]

It is important to emphasize that it does not matter for the simulations carried out in the next section whether the underlying model is the original or the extended model. In the context of our analysis of natives' attitudes, both models are observationally equivalent. The relevant effect is the impact of immigration on natives, which is determined by σ. The difference between the two models resides in the effect of immigration on immigrants already present in the host country, which is not part of our analysis.

4.4. Economic and Noneconomic Determinants: a Decomposition

The econometric evidence discussed so far allows us to confirm that the economic channels play a significant role in the formation of attitudes. In

42 There are several estimates in the literature of the elasticity of substitution between natives and migrants (within narrow skill groups, defined by education and experience). Three studies based on European data find an elasticity of 7 for Germany (Felbermayr et al. (2010); Brücker and Jahn (2011) and for the UK (Manacorda et al. 2012). Ottaviano and Peri's (2012) estimate for the US is higher, around 20. If $\sigma_H = 7$ we obtain $\sigma_E = 1.69$ whereas with $\sigma_H = 20$ we have $\sigma_E = 2.36$.

this section, we go a step further and compare the relative importance of economic and noneconomic factors by simulating the econometric model with different configurations of parameters. This simulation exercise relies on the benchmark model (10) which includes the labor-market and welfare-state mechanisms. We use the Chamberlain version of the random-effects logit corresponding to regressions (9) and (10) from Table 2 to predict (latent) attitudes towards immigrants.[43] These predicted attitudes are the starting point for our decomposition ("total attitudes").[44]

The contribution of the welfare-state mechanism to attitudes can then be calculated as follows. Setting marginal tax rates equals to zero, we recalculate predicted attitudes of the model. This provides a measure of attitudes in the absence of a welfare state, including only labor-market and noneconomic determinants.[45] The difference between "total attitudes" and the latter predicted attitudes represents the contribution of the welfare-state mechanism. Analogously, we obtain the predicted values of attitudes determined by the labor-market mechanism. In the absence of the labor-market mechanism, raw labor and human capital would be perfect substitutes and immigration would have no impact on relatives wages ($\sigma = \infty$ and $\lambda_2 = 0$). Finally, the difference between "total attitudes" (obtained from the complete model) and the prediction determined by the economic mechanisms is attributed to noneconomic factors.[46]

43 The (Chamberlain) RE logit enables us to account for the role of individual education, which is part of the noneconomic component of attitudes. We prefer to use the Chamberlain RE logit rather than the fixed effects estimates because the impact of individual education on attitudes cannot be estimated in the fixed effects specification. The role of the economic mechanisms in the decomposition should not be affected by that choice since both specifications yield very similar estimates of the impact of the economic variables on attitudes.

44 As our decomposition analysis focuses on the link between individual education (human capital) and attitudes towards immigration, we "neutralize" the influence of other variables (age, gender, political orientation) by calculating predictions at the mean of those variables.

45 In practice, this amounts to setting $\lambda_3 = 0$. We also correct the fixed country effects in order to account for the fact that $t_c = 0$ changes the value of κ_c^m in equation (6). A detailed description of this procedure is provided in Appendix D.

46 This is arguably a strong assumption which is discussed further below.

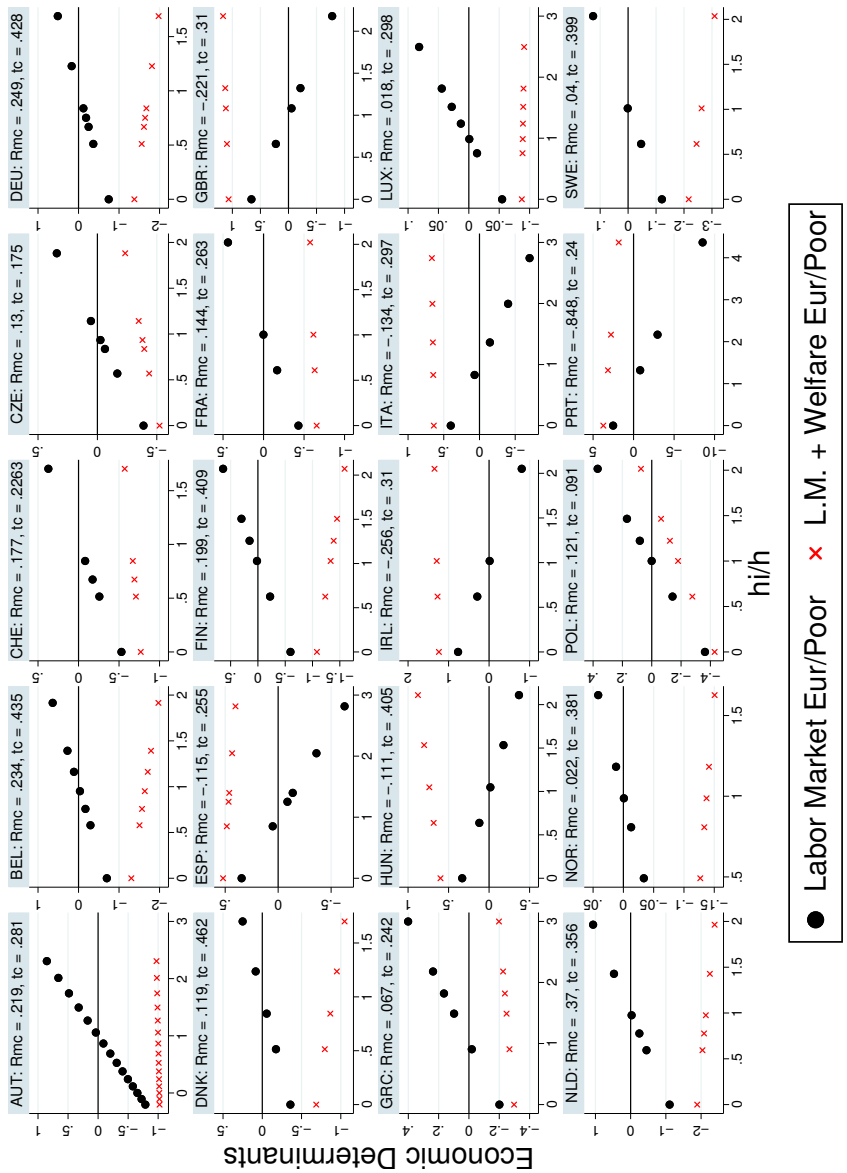

FIGURE 4 Simulation - Economic Determinants, Immigrants from Poor European Countries

We consider first the role of economic determinants. Figure 4 shows the impact of the economic determinants on (predicted) attitudes regarding immigrants from poor European countries.[47] To remain consistent with the theoretical model, we plot these predicted values against the relative education of natives (h_i/h). Figure 4 depicts the predicted values determined by the labor-market mechanism (black dots) and the sum of the predicted values determined by the labor-market mechanism and the tax-benefit mechanism (red crosses). The theoretical mechanisms can be illustrated using the example of Belgium, where immigrants are less educated than the average resident ($R_c^m > 0$). In this case, the labor-market mechanism is harmful to low skilled natives and beneficial for high skilled natives (captured in Figure 4 by the black dots with a positive slope and a negative intercept). From the tax-benefit point of view, less educated immigrants would represent a burden for all natives, reducing the slope according to the level of the taxes (t_c). We expect that the slope changes sign if the marginal tax rate is higher than 29%[48], which is indeed the case for Belgium: the cumulated effect of economic mechanisms is that natives are against immigration, and this negative attitude is stronger for skilled natives. This exercise can be carried out for all countries of our sample, giving a detailed panorama of attitudes according to the economic determinants.

Turn now to the role of noneconomic factors. Figure 5 depicts predicted noneconomic factors related to immigrants from poor European countries and compares them to the prediction of the complete model. Two observations are in order regarding Figure 5. First, attitudes towards immigration seem to be mostly determined by noneconomic factors whereas economic determinants, taken together, play a minor role. Second, noneconomic factors are positively correlated with the level of the respondent's education: better educated natives are more open to immigration. This result, which is robust across all groups of immigrants, seems to confirm Hainmueller and Hiscox's (2007) argument that noneconomic factors are predominant in explaining attitudes towards immigration.

47 The decomposition of attitudes towards immigrants from rich European countries, poor countries in the rest of the world and rich countries in the rest of the world yield similar results. The corresponding figures can be found in Appendix D.

48 This critical value for tax is obtained from Figure 2, where $t_{slope=0} = \theta_L/(\theta_L + \sigma\theta_H) = 0.5461/(0.5461 + 2.95 * 0.4539) = 0.29$.

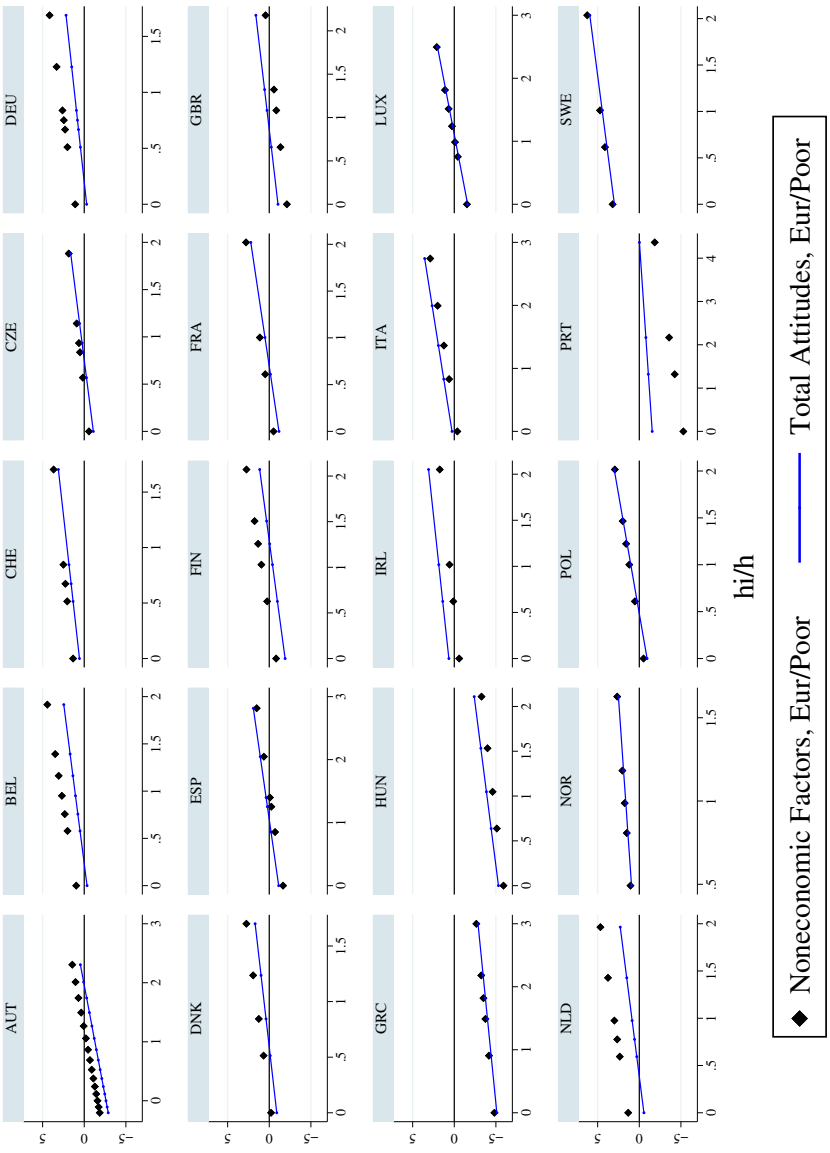

FIGURE 5 Simulation - Noneconomic Factors and Predicted Attitudes, Immigrants from Poor European Countries

A more systematic view of the relative importance of each factor can be gained by decomposing the variance of predicted attitudes towards immigrants into its three components: labor-market channel, welfare-state effect, noneconomic factors (see Table D.1 in the Appendix D).[49] Two observations stand out. First, the economic determinants play an important role but the labor-market and the welfare-state channels tend to compensate each other. Taken together, the two economic channels are much less correlated with predicted attitudes than each channel taken separately. Second, noneconomic factors explain a much larger share of predicted attitudes than the economic mechanisms.

How robust are these results with respect to the omission of other economic or noneconomic determinants? It could be argued that the model only accounts for the two main economic channels that have been discussed in the literature but neglects other economic mechanisms that possibly influence attitudes towards immigrants. For example, natives might fear that rental costs or housing prices increase with immigration. If the housing market is segmented by income (or skill), natives tend to oppose the arrival of immigrants that have similar earnings and compete for the same type of apartments or houses. In this case, the fear of increasing housing costs would be captured by the labor-market mechanism in our empirical analysis.[50]

More generally, the labor-market channel captures all phenomena where immigrants compete with similarly skilled natives in the demand for goods or the supply of factors. On the other hand, phenomena where high-skill (or high-income) natives are disproportionately affected by the arrival of low-skill immigrants are captured by the welfare-state mechanism (with an exogenous benefit level). However, there might be other economic mechanisms that do not follow one of these patterns and that are omitted from the model. If these mechanisms involve a dependence on natives' education level alone (independently of immigrants' education), our decomposition overestimates the role of noneconomic factors.

Another related issue is that natives' beliefs about the economic impact of immigration might differ from the predictions of our model. The fact that we find a significant effect of economic factors in our estimations suggests that these beliefs are at least partially aligned with the mechanisms of our model. However, this qualitative result does not preclude the possibility that there

49 We use the decomposition described above where total predicted attitudes (A) are the sum of the labor-market channel (L), welfare-state channel (W) and noneconomic factors (N). The variance of total predicted attitudes is then decomposed as follows: $Var(A) = Cov(A, L + W + N) = Cov(A, L) + Cov(A, W) + Cov(A, N)$. This decomposition is carried out for each country separately in order to neutralize the influence of unobserved factors at the country level.

50 Obviously, current house- or land-owners would generally benefit from immigration but this factor is controlled for by the individual fixed effects in our empirical analysis (specifications (11) to (13) in Table 2).

is some divergence between our model and the economic model respondents have in mind. In this case, our decomposition would underestimate the relative importance of factors that are perceived as economic by respondents. As discussed throughout the paper, we adopt the traditional economic approach, which analyzes the role of objective economic mechanisms but does not take subjective beliefs about these mechanisms into account. In terms of policy implications, our approach cannot speak to the question whether better information about the (true) economic impact of immigration could influence attitudes (see Facchini et al. (2016) for a large-scale experiment that addresses this question). However, it can give some indication whether policies that mitigate the economic impact of immigration have the potential to change attitudes towards immigration. Our results point to the fact that policies that dampen the effect of immigration on wages or on the government budget might have an impact (albeit limited) on natives' attitudes.

5. Conclusion

This paper develops and estimates a structural model of attitudes toward immigration and assesses the relative importance of economic and noneconomic determinants. Using data for 20 European countries in 2002, we find a significant impact of the labor-market and welfare-state mechanisms on attitudes towards immigration. By contrast to previous contributions, our results are obtained by controlling for unobserved individual factors about immigration in general. Finally, simulations with our structural model indicate that although these two economic mechanisms matter, their net effect is much smaller than the impact of noneconomic factors on attitudes towards immigration.

Our results are consistent with the two strands of the literature that are represented by Hainmueller and Hopkins (2014) and Facchini and Mayda (2009). On the one hand, most respondents express identical attitudes towards immigration from different origin countries. This indicates that there are individual-specific factors that determine overall attitudes towards all types of immigration. Here our results are in agreement with Hainmueller and Hopkins (2014) and confirm that this individual component of attitudes strongly depends on education levels and is highly correlated with noneconomic factors.

On the other hand, our results lend support to the importance of economic mechanisms in explaining attitudes towards different types of immigration. Our estimates of the role of economic mechanisms are driven by individuals who express different attitudes towards immigration from rich or poor countries of a same region. Although this minority of respondents only play a small role in the determination of overall attitudes towards immigration, their preferences are crucial when decisions about the *type* of immigration are taken. In this context we find a significant effect of economic mechanisms, confirming the results originally obtained by Facchini and Mayda (2009).

Hence, our results seem to be in disagreement with Hainmueller and Hopkins' (2014) statement that personal economic circumstances do not matter for the formation of attitudes towards immigration. How can these divergent conclusions be explained? First, our estimates show that the labor-market mechanism has to be combined with the welfare-state mechanism in order to provide a satisfactory explanation of individual attitudes towards immigration. Our results confirm that, taken alone, the labor-market mechanism is not a significant determinant of attitudes.

Second, the two economic mechanisms tend to neutralize each other. Our theoretical model shows that the welfare-state mechanism tends to attenuate (or even reverse) the impact of human capital on attitudes predicted by the labor-market mechanism. It might therefore not be surprising that many studies fail to identify the labor-market channel if they do not take the welfare-state mechanism into account. For example, Hainmueller et al.'s (2015) finding that high-skilled natives tend to prefer high-skilled to low-skilled immigrants would in principle be consistent with a tax-adjustment model, as spelled out in Section 2.2 above.

Third, the combined effect of the two economic mechanisms can only be properly identified in a comparative setting with cross-country variation in immigrants' relative human capital and in the degree of taxation and redistribution. The specific predictions of economic theory in this context provide a more complete and meaningful test of economic mechanisms than what is possible in single-country studies.

Supporting information

Supporting information is available in the online version of this article.

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Online Appendix to:

Individual attitudes towards migration: a reexamination of the evidence

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Appendix A: Data

Education Levels in OECD and ESS Data

For the benchmark model we use files A1 and A2 of the DIOC database with 2000/01 as reference years. This data includes individuals aged 15 years and over, and provides data on the level of education for natives and immigrants by categories following the International Standard Classification of Education (ISCED) through two variables. We give priority to the most detailed variable, *edu_cen*, which provides education levels in five categories. We attribute 8 years to the primary level (category 1: ISCED 0-1-2), 12 years to the secondary level (category 2: ISCED 3-4), 15 years to the tertiary level 1 (category 3: ISCED 5), 17 years to the tertiary level 2 (category 4: ISCED 6) and 16 years to tertiary level (category 34: ISCED 5-6). When the detailed education is not reported, we use the variable *edu_lfs*, which provides education levels in three catogories. We attribute 8 years to primary level (category 1: ISCED 0-1-2), 12 years to the secondary level (category 2: ISCED 3-4) and 16 years to tertiary level (category 3: ISCED 5-6).

Then we calculate the human capital level $h^e = e^{\rho(s^e - s_{min})} - 1$ for each education category e, where s^e represents the number of years attributed. The human capital of immigrant group m (h_c^m) and the host country's average human capital (h_c) are obtained as averages of h^e of the respective groups.

Figure A.1 plots the relative level of human capital ($h_c^m/h_c - 1$) of immigrants from poor countries of Europe against the relative level of immigrants from rich countries of Europe (Figure A.2 does the same for countries outside Europe). In both figures the first quadrant includes destination countries where immigrants from rich and poor countries have a higher level of education than the total population. Here we find countries as diverse as Great Britain, Ireland, Hungary, Italy, Portugal and Spain. In the second quadrant immigrants from rich countries are more educated than total population while immigrants from poor countries are less educated than total population. Finally, the third quadrant indicates destination countries where immigrants from rich and poor countries have a lower level of education than the total population. The only clear pattern that seems to emerge from these two figures is that most countries can be found above the 45 degree line. This indicates that in most host countries, immigrants from rich countries are more educated than immigrants from poor countries.

The ESS database collects data on individuals older than 14 years. We retain only the individuals that were born in country c, through the variable *brncntr*. This database provides a variable with the individual years of schooling (*eduyrs*) and with the individual level of education according to ISCED (*edulvla*). In the ESS, the following education levels are distinguished: ISCED 0-1, ISCED 2, ISCED 3, ISCED 4 and ISCED 5-6. We take s_i as the median (in the entire sample) of *eduyrs* within each education level (*edulvla*).

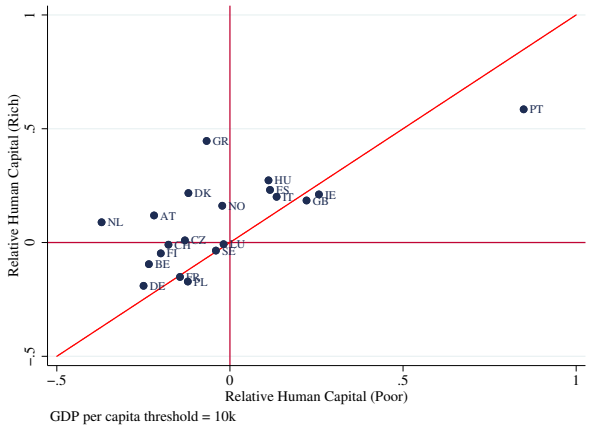


FIGURE A.1 Immigrants' Human Capital from European Countries (threshold=10k)

Individual human capital is then calculated using (12) and h_c is obtained by averaging over all individuals of country c in the ESS.

Table A.1 compares the years of schooling attributed to ISCED categories in the ESS database and the DIOC database.

Marginal Tax Rates

We use two methods to estimate a (constant) marginal tax rate for each country. All our calculations use the OECD "Taxing Wages" dataset and are based on the personal income tax (*combined central and sub-central government income tax*) for single wage earners without dependents. OECD (2008b) provides marginal tax rates in Table I.4 and average tax rates in Table

TABLE A.1
Attributed Years of Schooling

edulvla	ESS	DIOC-OECD
Less than lower secondary education (ISCED 0-1)	6	8
Lower secondary education completed (ISCED 2)	10	8
Upper secondary education completed (ISCED 3)	12	12
Post-secondary non-tertiary education completed (ISCED 4)	14	12
Tertiary education completed (ISCED 5)	16	15
Tertiary education completed (ISCED 6)	16	17

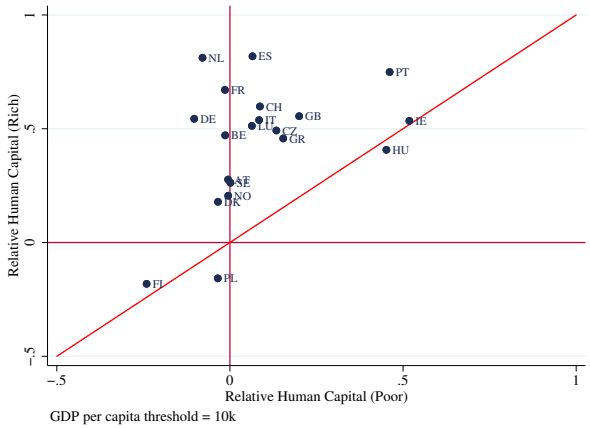


FIGURE A.2 Immigrants' Human Capital from RoW Countries (threshold=10k)

I.5 at four different points of the wage distribution for adult, full-time workers in manufacturing sectors: at 67%, 100%, 133% and 167% of average earnings.[1]

In our first method, we calculate a simple average of *marginal* tax rates provided in OECD (2008b), Table I.4 at the four points of the income distribution. The second method uses the information provided by OECD (2008b), Table I.5 on *average* tax rates and adjusts, for each country, a linear tax-benefit schedule to the average tax rates evaluated at the four points of the wage distribution.

More formally, the second method can be described as follows. Denote the amount of tax paid by the individual by $T = tY - b$, where t is the constant marginal tax rate and Y is the individual's income. The average tax rate is $T/Y = t - b(1/Y)$. If we regress the average tax rate T/Y on the inverse of income, $(1/Y)$, the constant of this regression is the estimated (constant) marginal tax rate, t. For each country, we use the four observations provided by OECD (2008b), at 67%, 100%, 133% and 167% of average earnings.

An example for one country might clarify the procedure. The first two rows of Table A.2 contain the data from OECD (2008b) for Belgium. The

1 For Switzerland, we differentiate tax rates further at the regional level since direct tax rates vary strongly from Canton to Canton. We use information on marginal tax rates for intermediate levels of income (i.e. 60,000–80,000 CHF) in 2002 at the Canton level (AFC 2003) to calculate (population-weighted) average marginal tax rates for the six regions that are distinguished in the ESS data for Switzerland. These regional tax rates are then used to differentiate at the regional level the marginal tax rate estimated by OECD (2008b) for Switzerland. More precisely, as the OECD tax schedule is calculated for the canton of Zurich, the difference between each region's marginal tax rate and the marginal tax rate of the canton of Zurich is added to the OECD (2008b) marginal tax rate for Switzerland.

TABLE A.2
Average and marginal tax rates for Belgium (2002)

	Share of average earnings 67%	100%	133%	167%	
	Data from OECD (2008b)				Average
Marginal tax rate	40.6	40.6	45.5	47.4	**43.5**[a]
Average tax rate	22.8	28.7	32.9	35.6	
	Predicted and estimated tax rates				
Predicted average tax rate	22.5	29.4	32.9	35.1	
Estimated marginal tax rate					**43.6**[b]

[a] Estimate of marginal tax rate (method 1); [b] Estimate of marginal tax rate (method 2).

unweighted average of marginal tax rates (last column of second row) is our first estimate of the constant marginal tax rate for Belgium. The second estimate is obtained by regressing the average tax rates on the inverse of income (or a normalized measure of income).[2] The constant of this regression is reported in the last row and column of Table A.2. It turns out that the two estimates are almost identical. Moreover, the predicted average tax rates from the regression are close to the observed values, suggesting that a linear tax schedule is a good approximation for the Belgian tax schedule.

The estimated marginal tax rates obtained by the two methods are reported in Table A.3 for all countries in our sample. The two methods yield very similar results. The only noticeable differences between the two methods appear when there is a large jump in marginal tax rates at one point of the income distribution (Greece, United Kingdom). We use the tax data obtained from the first method in our estimations.

Descriptive Statistics

Table A.4 reports average attitudes towards immigrants (which are also shown in Figure 3 in the main text), and details average human capital levels of the four immigrant groups, as well as average human capital levels and tax rates in destination countries. Note that average human capital seems positively

2 As we are not interested in estimating b, we can use a normalized measure of income (which is proportional to Y). In particular, we can normalize income by the average wage $\bar{W}$ and regress the average tax rate on the inverse of the normalized wage, $\bar{W}/Y$. This amounts to regress the four observations of average tax rates on the vector $[1/0.67, 1, 1/1.33, 1/1.67]$.

TABLE A.3
Marginal Income Tax Rates (Percentages)

Country	Average of Marginal Rates	Regression on Average Rates
Austria	28.1	29.2
Belgium	43.5	43.6
Czech Republic	17.5	16.4
Denmark	46.2	47.8
Finland	40.9	41.7
France	26.3	26.0
Germany	42.8	42.0
Greece	24.2	20.8
Hungary	40.5	41.0
Ireland	31.0	30.3
Italy	29.7	30.8
Luxembourg	29.8	30.7
Netherlands	35.6	35.9
Norway	38.1	37.0
Poland	9.1	9.2
Portugal	24.0	23.8
Spain	25.5	24.7
Sweden	39.9	39.7
Switzerland	20.7	20.0
United Kingdom	31.0	26.6

Note: Reference year 2002.

correlated to attitudes towards immigration. Moreover, closer inspection of average human capital levels in origin countries (which are also plotted in Figures A.1 and A.2) reveals that immigrants from rich countries are more educated than immigrants from poor countries.

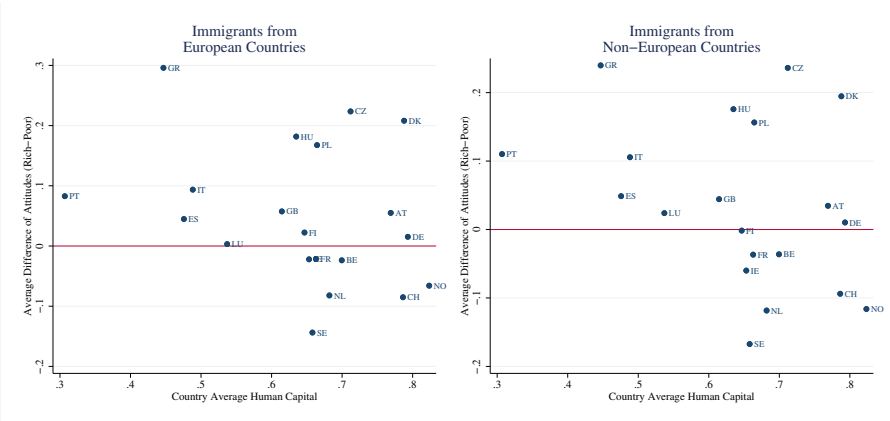
In most countries, natives are more welcoming to immigrants from rich countries than to immigrants from poor countries. However, this pattern is not observed in seven countries (Belgium, France, Ireland, Netherlands, Norway, Switzerland and Sweden). Figure A.3 suggests that the average difference between attitudes towards immigrants from rich countries and attitudes towards immigrants from poor countries decreases with the average human capital of the host country. This observation seems at first glance consistent with the hypothesis of labor-market competition and is in line with Facchini and Mayda (2009) who point out that more developed countries, in terms of GDP per capita, have a relative abundance of skilled labor and can therefore be expected to prefer unskilled immigrants.

TABLE A.4
Descriptive Statistics of Main Variables

Country		Greece	Hungary	Portugal	Austria	United Kingdom	Luxem-bourg	Finland	France	Nether-lands	Belgium
Attitudes of Natives toward Immigrants from countries:	Rich & European	2.220	2.180	2.310	2.430	2.498	2.477	2.518	2.513	2.486	2.596
		(0.017)	(0.021)	(0.025)	(0.019)	(0.020)	(0.029)	(0.019)	(0.023)	(0.018)	(0.022)
	Poor & European	1.927	1.994	2.229	2.378	2.443	2.481	2.492	2.533	2.568	2.623
		(0.014)	(0.018)	(0.023)	(0.018)	(0.019)	(0.028)	(0.017)	(0.021)	(0.016)	(0.021)
	Rich & Non-Eur.	2.124	2.085	2.303	2.355	2.414	2.420	2.388	2.367	2.406	2.486
		(0.016)	(0.020)	(0.025)	(0.018)	(0.020)	(0.029)	(0.019)	(0.023)	(0.017)	(0.022)
	Poor & Non-Eur.	1.886	1.905	2.192	2.322	2.372	2.394	2.388	2.405	2.526	2.521
		(0.014)	(0.017)	(0.023)	(0.018)	(0.020)	(0.028)	(0.018)	(0.022)	(0.016)	(0.021)
Tax		0.242	0.405	0.240	0.281	0.31	0.298	0.409	0.263	0.356	0.435
Average Human Capital of Destination Country		0.489	0.523	0.332	0.568	0.570	0.591	0.586	0.555	0.594	0.552
Average Human Capital of Immigrants from countries:	Rich & European	0.707	0.666	0.527	0.636	0.675	0.586	0.558	0.471	0.647	0.499
	Poor & European	0.456	0.582	0.614	0.444	0.696	0.580	0.469	0.475	0.374	0.423
	Rich & Non-European	0.712	0.737	0.581	0.725	0.886	0.893	0.479	0.928	1.077	0.812
	Poor & Non-European	0.564	0.760	0.486	0.565	0.684	0.628	0.445	0.547	0.547	0.544
Observations		2193	1453	1311	1808	1803	917	1863	1298	2143	1588

Table A.4: Descriptive Statistics of Main Variables - Continued

Country		Spain	Czech Republic	Germany	Norway	Den-mark	Ireland	Poland	Italy	Switzer-land	Sweden
Attitudes of Natives toward Immigrants from countries:	Rich & European	2.626	2.747	2.688	2.694	2.862	2.729	2.819	2.826	2.776	3.008
		(0.023)	(0.026)	(0.017)	(0.018)	(0.021)	(0.019)	(0.018)	(0.028)	(0.018)	(0.019)
	Poor & European	2.584	2.527	2.672	2.761	2.651	2.752	2.647	2.733	2.861	3.152
		(0.023)	(0.024)	(0.015)	(0.017)	(0.021)	(0.017)	(0.017)	(0.026)	(0.017)	(0.017)
	Rich & Non-Eur.	2.595	2.696	2.607	2.562	2.688	2.623	2.769	2.798	2.688	2.935
		(0.023)	(0.025)	(0.016)	(0.018)	(0.021)	(0.019)	(0.018)	(0.027)	(0.018)	(0.019)
	Poor & Non-Eur.	2.549	2.450	2.600	2.678	2.495	2.683	2.613	2.691	2.782	3.100
		(0.023)	(0.025)	(0.015)	(0.017)	(0.021)	(0.018)	(0.017)	(0.026)	(0.017)	(0.017)
Tax		0.255	0.175	0.428	0.381	0.462	0.31	0.091	0.297	0.238	0.399
Average Human Capital of Destination Country		0.439	0.603	0.664	0.683	0.584	0.566	0.566	0.407	0.654	0.657
Average Human Capital of Immigrants from countries:	Rich & European	0.540	0.609	0.538	0.794	0.710	0.686	0.469	0.489	0.648	0.633
	Poor & European	0.490	0.525	0.498	0.668	0.513	0.712	0.497	0.462	0.538	0.630
	Rich & Non-European	0.798	0.900	1.025	0.824	0.688	0.869	0.477	0.626	1.046	0.829
	Poor & Non-European	0.467	0.684	0.596	0.680	0.563	0.860	0.546	0.441	0.711	0.658
Observations		1431	1089	2588	1878	1310	1782	1886	1090	1606	1682



Note: Vertical axis plots the difference between individual attitudes towards immigrants from non-European rich countries and individual attitudes towards immigrants from non-European poor countries, averaged by country.

FIGURE A.3 Average Difference of Attitudes towards Immigrants and Human Capital

Appendix B: Additional Estimation Results

As many papers in the literature limit their empirical analysis of economic mechanisms to the labor-market channel, it is useful to consider a model where the welfare-state mechanism is excluded. Table B.1 presents estimation results of model (10) under the restriction $\lambda_3 = 0$. The results are quite instructive because they depend on the estimation method used: our results reproduce those found in the economic literature (Mayda 2006) but show also that these results are not robust to the use of more general estimation methods that account for unobserved individual factors, confirming the criticism of Hainmueller et al. (2015).

First, the traditional econometric approach used in the literature is the (ordered) probit. In specifications (1) to (4) of Table B.1, the labor-market mechanism is found to be a significant determinant of attitudes towards immigration (λ_2 is significantly positive all four groups of immigrants). These results are similar to those found by Mayda (2006) although our definition of the relative skill composition is slightly different.

Second, these results hold up when a random-effects logit estimator is used (specifications (5) to (7) in Table B.1). This estimator crucially relies on the assumption that the unobserved individual effects are uncorrelated with the regressors. When we relax this assumption by modeling the correlation between regressors and individual effects using our third estimator (Chamberlain random-effects logit), we find no significant effect of the labor-market mechanism on attitudes toward immigrants. Interestingly, the

coefficient of individual education (λ_1) is highly significant in all specifications, suggesting that noneconomic factors play an important role in the formation of attitudes.

Finally, the fixed-effects logit estimator takes into account unobserved individual effects without any constraints on correlation with explanatory variables (specifications (11) to (13) in Table B.1). The signs of the estimated coefficients λ_2 of the labor-market mechanism are now reversed and one of them is marginally significant. These results are not consistent with the predictions of the theoretical model and are reminiscent of the findings of Hainmueller et al. (2015) for the U.S. regarding attitudes towards immigrants with different skill levels.

Appendix C: Robustness

Distinction between Rich and Poor Origin Countries

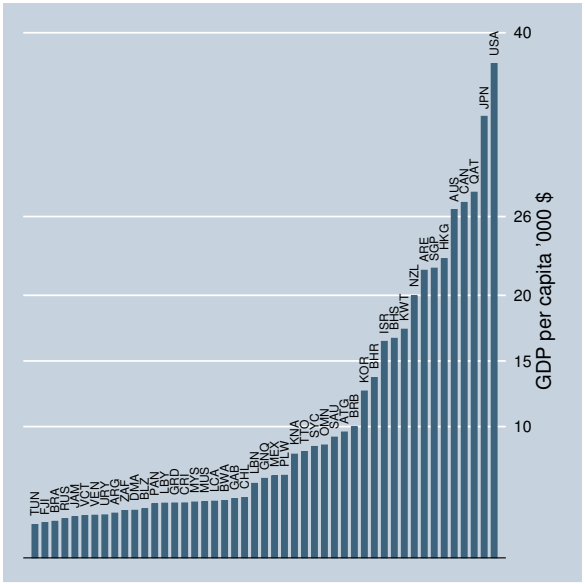
The European Social Survey does not provide a definition of "richer countries in Europe", "poorer countries in Europe", "richer countries outside Europe" and "poorer countries outside Europe" in the question "to what extent do you think country c should allow people from [region of origin] to come and live here?", which is used in the construction of our dependent variable. In our main estimations, we use a threshold of GDP per capita of $10,000 to distinguish between "richer" and "poorer" countries. To check the robustness of our results to this threshold, we test two alternative levels of GDP per capita as thresholds: $15,000 and $26,000. Figure C.1 shows the distribution of GDP per capita for non-European countries (with GDP per capita higher than $2,500). With a threshold of $10,000, Korea, Bahrain and Israel are classified as rich countries, and Antigua and Barbuda, Saudi Arabia and Oman as poor countries. In Europe, countries that are classified as rich with a threshold of $10,000, like Portugal and Greece, may be perceived by the respondent as poor when compared to other European countries. As can be seen in Figure C.2, a threshold of $15,000 classifies Portugal as poor and a threshold of $26,000 classifies Greece, Spain and Italy as poor.

To verify the sensitivity of the results with respect to this threshold, we begin by changing it only for Europe: $15,000 in columns (1) to (3) and $26,000 in columns (4) to (6) of Table C.1. Then we set the threshold to $15,000 for all countries (and not only for Europe) in columns (7) to (9), and to $26,000 in columns (10) to (12). We use our preferred logit fixed-effects specification, like in the three last columns of Table 2 in the main text. The estimation results using these alternative threshold are very similar to our original estimates using the threshold of $10,000. The parameter σ varies between 3.53 and 3.66 using combinations including the thresholds of $15,000 and $26,000, while this parameter varies between 3.48 and 3.56 using the threshold of $10,000. In conclusion, results are quite robust to the choice of GDP per capita threshold used in the definition of poor and rich countries.

TABLE B.1
Determinants of Attitudes - Labor-Market Model

Specification		Probit				R.E. Logit			R.E. Logit Chamberlain			F.E. Logit		
Origin Region		Europe	RoW	Europe	RoW	Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW
Poor/Rich/Pooled		Rich	Rich	Poor	Poor	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P
Variable	*Coeff.*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A_{ic}	λ_1	0.41***	0.44***	0.31***	0.33***	1.32***	1.28***	1.35***	1.53***	1.49***	1.82***			
		(0.029)	(0.070)	(0.026)	(0.032)	(0.033)	(0.041)	(0.052)	(0.044)	(0.053)	(0.091)			
$A_{ic}R_c^m$	λ_2	0.51***	0.31**	0.25***	0.45***	0.52***	0.89***	0.29***	-0.01	0.11	-0.08	-0.14	-0.19	-0.13*
		(0.063)	(0.121)	(0.035)	(0.091)	(0.061)	(0.095)	(0.081)	(0.076)	(0.150)	(0.090)	(0.114)	(0.322)	(0.076)
Observations		32719	32719	32719	32719	130876	65438	65438	130876	65438	65438	24204	12818	11386
N groups (id-ctry)						65438	32719	32719	65438	32719	32719			
Fraction of variance						0.81	0.78	0.83	0.81	0.78	0.83			
due to $\mu_{ic}^{r(m)}$						(0.0031)	(0.0049)	(0.0039)	(0.0031)	(0.0049)	(0.0039)			
log likelihood						-69558	-35181	-34325	-69486	-35152	-34270			

The dependent variable is the answer to the question "to what extent do you think country c should allow people from (origin region/poor or rich country) to come and live here?". In all specifications, the answer is coded as a dummy variable (1 indicates attitudes favorable to immigration). Regressions (5), (8) and (11) include fixed effects for country-immigrant's origin location (either Europe or Rest of the World). All the other regressions include simple country fixed effects. In both case these fixed effects are interacted with group of immigrants (poor or rich countries). Dummies variables control for gender and political orientation. Continuous variables control for individual age and individual age squared. Robust standard errors are country clustered in regressions (1)-(4) and (11)-(13). ***, **, * denote significance at the 1%, 5%, 10% levels.



Note: countries with GDP per capita below $2,500 are omitted.

FIGURE C.1 Distribution of Non-European Countries by GDP per capita

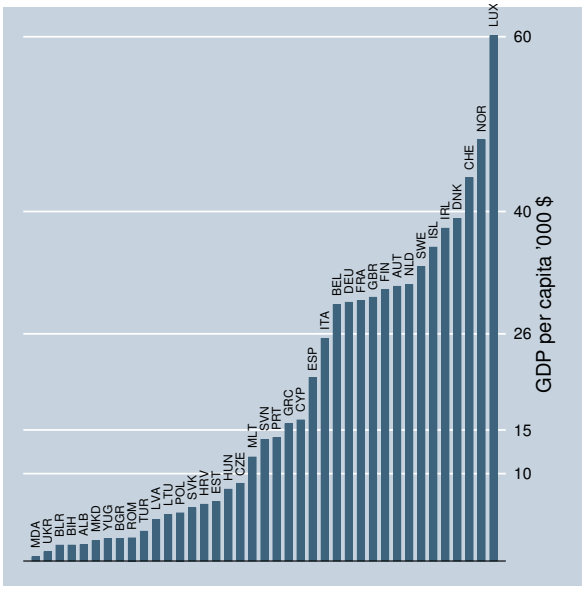


FIGURE C.2 Distribution of European Countries by GDP per capita

TABLE C.1
Robustness Check - Development Threshold

Specification		Europe Threshold: 15k RoW Threshold:10k			Europe Threshold: 26k RoW Threshold: 10k			Europe Threshold: 15k RoW Threshold:15k			Europe Threshold: 26k RoW Threshold: 26k		
Origin Region		Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW
Poor/Rich/Pooled		R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P	R+P
Variable	*Coeff.*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$A_{ic}R_c^m$	λ_2	1.39***	2.90***	0.95**	1.16**	1.46**	0.95**	1.41***	2.90***	1.00**	1.16**	1.46**	0.99**
		(0.526)	(0.748)	(0.388)	(0.463)	(0.625)	(0.388)	(0.531)	(0.748)	(0.412)	(0.452)	(0.625)	(0.404)
$t_c A_{ic} R_c^m$	λ_3	-4.95***	-10.60***	-3.38***	-4.13***	-5.18**	-3.38***	-5.04***	-10.60***	-3.57***	-4.10***	-5.18**	-3.49***
		(1.675)	(2.634)	(1.161)	(1.459)	(2.071)	(1.161)	(1.706)	(2.634)	(1.269)	(1.425)	(2.071)	(1.231)
$-\lambda_3/\lambda_2$		3.56	3.66	3.56	3.56	3.55	3.56	3.57	3.66	3.57	3.53	3.55	3.53
σ		3.08	3.20	3.08	3.08	3.07	3.08	3.09	3.20	3.09	3.04	3.07	3.04
Observations		24204	12818	11386	24204	12818	11386	24204	12818	11386	24204	12818	11386

The dependent variable is the answer to the question "to what extent do you think country c should allow people from [origin region/poor or rich country] to come and live here?". In all specifications, the answer is coded as a binary variable. Regressions (1), (4) and (7) include fixed effects for country-immigrant's origin location (either Europe or Rest of the World), and these fixed effects are interacted with group of immigrants (poor or rich countries). Robust standard errors are country clustered. ***, **, * denote significance at the 1%, 5%, 10% levels. For the sake of clarity, columns (3) and (6) replicate column (13) of Table 2. Column (8) replicates column (2), and column (11) replicates column (5).

Occupation-Adjustment of Human Capital Indicators

This section of the appendix describes how we adjust the data in order to account for occupations actually held by individuals when measuring the human capital level of immigrants relative to the average human capital level in the destination country. We use files A and D of the DIOC database (OECD 2008a). The latter contains information on education levels and occupations. We proceed in three steps.

First, we use the mapping of major occupation groups (ISCO-88) to four skill levels proposed by ILO (1990) and calculate the average years of schooling for each occupation group (see Table C.2), using all individuals contained in file D of the DIOC database. The average years of schooling for skill level 1 is 9.72 years, for skill level 2 it is 10.70 years, for skill level 3 it is 12.67 years and for skill level 4 it is 13.61 years. For all our calculations with data from file D, we had to exclude three countries (Belgium, Netherlands, Norway) for which the data was lacking or insufficient (i.e. origin countries aggregated by continent).

Second, we attribute to each immigrant the average schooling years of her occupation and recalculate the average human capital for the four groups of immigrants and for the country's entire working population in file D. This enables us to calculate occupation-corrected relative human capital of immigrants h_c^m/h_c for each immigrant group m and destination country c. We also compute the "unadjusted" relative human capital of immigrants for

TABLE C.2
Major occupation groups and skill levels (ILO (1990))

	Major group ISCO-88	Skill level
1	Legislators, senior officials and managers	4*
2	Professionals	4
3	Technicians and associate professionals	3
4	Clerks	2
5	Service workers and shop and market sales workers	2
6	Skill agricultural and fishery workers	2
7	Craft and related workers	2
8	Plant and machine operators and assemblers	2
9	Elementary occupations	1
0	Armed forces	excluded

Notes: * ILO (1990) does not attribute Occupation group 1 to a single skill level. In the absence of more detailed information in our database, we decided to allocate it to skill level 4.

all immigrant groups, using the data on education levels in file D.[3] The ratio of the former to the latter is then defined as the adjustment factor.

Third, we use this adjustment factor to adjust the relative human capital for all immigrants in our original dataset (file A). The reason for using all immigrants (and adjusting their human capital) is that we want to avoid an endogeneity bias that could arise if an omitted variable influences both attitudes towards immigration and the employment of immigrants.

Imperfect Substitution between Migrants and Natives

In the extended model, aggregate output of a country c is given by $Y_c = F(H_c, L_c)$ where human capital H_c is an aggregate of native and migrant human capital, $H_c = \mathcal{H}(H_c^N, H_c^M)$, and raw labor L_c is an aggregate of native and migrant labor, $L_c = \mathcal{L}(L_c^N, L_c^M)$. Migrants from different origins m are perfect substitutes within the overall category of migrants: $H_c^M = \sum_m H_c^m$ and $L_c^M = \sum_m L_c^m$. The functions $\mathcal{H}(\cdot)$ and $\mathcal{L}(\cdot)$ have the properties of constant-returns-to-scale production functions. We denote the partial derivatives by $\mathcal{H}_N \equiv \partial\mathcal{H}/\partial H_c^N$, $\mathcal{H}_M \equiv \partial\mathcal{H}/\partial H_c^M$, $\mathcal{L}_N \equiv \partial\mathcal{L}/\partial L_c^N$, $\mathcal{L}_M \equiv \partial\mathcal{L}/\partial L_c^M$. We assume for simplicity that measurement units are chosen such that the partial derivatives $\mathcal{H}_N$, $\mathcal{H}_M$, $\mathcal{L}\mathcal{H}_N$ and $\mathcal{L}_M$ are normalized to 1 in the base equilibrium.[4]

We consider first the version of the model without income redistribution. Per capita output can be written as $y_c = Y_c/L_c = F(H_c/L_c, 1) = f(h_c)$, where the per capita human capital stock is given by $h_c = H_c/L_c = \mathcal{H}(H_c^N, H_c^M)/\mathcal{L}(L_c^N, L_c^M)$. Marginal products of native human capital and native raw labor are given by $f'(h_c)\mathcal{H}_N$ and $[f(h_c) - h_c f'(h_c)]\mathcal{L}_N$. Earnings of native i (holding h_{ic} units of human capital and 1 unit of raw labor) can therefore be written as

$$y_{ic} = [f(h_c) - h_c f'(h_c)]\mathcal{L}_N + h_{ic} f'(h_{ic})\mathcal{H}_N \tag{C.1}$$

With the normalization of the partial derivatives in the base equilibrium, earnings can be written as $y_{ic} = f(h_c) + (h_{ic} - h_c)f'(h_c)$.

Assuming that new immigrants of group m hold on average the same level h_c^m of human capital than "old" immigrants of that group, the impact of

3 This "unadjusted" measure of relative human capital differs from the one used in the benchmark model only because the sample is different (file D contains only employed individuals).

4 This normalization is not entirely innocuous since it rules out wage differences between equally skilled natives and migrants at the initial equilibrium. However, it allows us to focus on the main issue — imperfect substitutability between migrants and natives — without complicating unnecessarily the exposition.

immigration on native i's income is:

$$dy_{ic} = (h_{ic}\mathcal{H}_N - h_c\mathcal{L}_N)f''(h_c)dh_c + [f(h_c) - h_c f'(h_c)]\mathcal{L}_{NM}dL_c^m + h_{ic}f'(h_{ic})\mathcal{H}_{NM}dH_c^m$$

where $dh_c = (h_c^m\mathcal{L}_M - h_c\mathcal{H}_M)(dL_c^m/L_c)$, $dH_c^m = h_c^m dL_c^m$ and $\mathcal{H}_{NM} \equiv \partial^2\mathcal{H}/\partial H_c^N \partial H_c^M$ and $\mathcal{L}_{NM} \equiv \partial^2\mathcal{L}/\partial L_c^N \partial L_c^M$. Combining these elements and using the normalization assumption for $\mathcal{H}_N$, $\mathcal{H}_M$, $\mathcal{L}_N$ and $\mathcal{L}_M$, we have in the base equilibrium:

$$dy_{ic} = (h_{ic} - h_c)f''(h_c)(h_c^m - h_c)(dL_c^m/L_c) + [f(h_c) - h_c f'(h_c)]\mathcal{L}_{NM}dL_c^m + h_{ic}f'(h_{ic})\mathcal{H}_{NM}h_c^m dL_c^m \quad \text{(C.2)}$$

This equation can be rearranged as follows:

$$\frac{dy_{ic}/y_c}{dL_c^m/L_c} = \left(\frac{h_{ic}}{h_c} - 1\right)\left(1 - \frac{h_c^m}{h_c}\right)\frac{h_c^2 f''(h_c)}{f(h_c)} + \left(1 - \frac{h_c f'(h_c)}{f(h_c)}\right)L_c\mathcal{L}_{NM} + \frac{h_{ic}h_c^m}{h_c}\frac{f'(h_c)}{f(h_c)}H_c\mathcal{H}_{NM} \quad \text{(C.3)}$$

The different elasticities of substitution are defined as follows:

- $\sigma_E = -[f'(h_c)(f(h_c) - h_c f'(h_c))]/[h_c f''(h_c)f(h_c)]$ is the elasticity of substitution between human capital and raw labor;
- $\sigma_H = -(\mathcal{H}_N\mathcal{H}_M)/(H_c\mathcal{H}_{NM})$ the elasticity of substitution between native and migrant human capital;
- $\sigma_L = -(\mathcal{L}_N\mathcal{L}_M)/(L_c\mathcal{L}_{NM})$ is the elasticity of substitution between native and migrant raw labor.

Therefore, equation (2) in the original model is now replaced by

$$z_{ic}^m \equiv \frac{dy_{ic}/y_c}{dL_c^m/L_c} = \left(\frac{h_{ic}}{h_c} - 1\right)\left(1 - \frac{h_c^m}{h_c}\right)\frac{1}{\sigma_E}\theta_H\theta_L + \frac{\theta_L}{\sigma_L} + \frac{h_{ic}h_c^m}{h_c}\frac{\theta_H}{\sigma_H}, \quad \text{(C.4)}$$

where the last two terms are due to the imperfect substitutability between migrants and natives. In view of reinterpreting the estimates of the original model in Table B.1, equation (C.4) can be rewritten as

$$z_{ic}^m = \underbrace{\frac{h_{ic}}{h_c}}_{A_{ic}}\underbrace{\left(1 - \frac{h_c^m}{h_c}\right)}_{R_c^m}\left(\frac{\theta_H\theta_L}{\sigma_E} - \frac{\theta_H}{\sigma_H}\right) + \xi_{ic} + \widetilde{\omega}_c^m, \quad \text{(C.5)}$$

where $\xi_{ic} = \frac{h_{ic}}{h_c}\frac{\theta_H}{\sigma_H} + \frac{\theta_L}{\sigma_L}$ contains terms that vary at the individual level and $\widetilde{\omega}_c^m = -\left(1 - \frac{h_c^m}{h_c}\right)\frac{\theta_H\theta_L}{\sigma_E}$ collects the terms that are specific by country and by immigrant group.

When comparing this model with the benchmark labor-market model (2) in Section 2.1, it is obvious that the imperfect substitutability between native

and migrant human capital dampens the impact of immigration on the return to human capital: the coefficient that applies to the interaction term $A_{ic}R_c^m$ is smaller than in the benchmark model. The coefficient could even become zero or negative if skilled natives and migrants are not close substitutes, i.e. if $\theta_L\sigma_H \leq \sigma_E$. Therefore this model could potentially be consistent with our empirical finding in Table B.1 where the labor-market effect is not significant in the specifications that control for unobserved individual effects.[5]

Consider now the version of the extended model with redistribution. There is a linear tax-benefit schedule with a constant marginal tax rate t_c. Each individual (natives or migrant) in country c receives an identical benefit b_c. The government's budget is balanced: $t_c f(h_c) = b_c$. Earnings of a native i can now be rewritten as:

$$y_{ic} = (1-t_c)\{[f(h_c) - h_c f'(h_c)]\mathcal{L}_N + h_{ic}f'(h_{ic})\mathcal{H}_N\} + b_c \tag{C.6}$$

We limit our discussion to the (empirically relevant) model where the marginal tax rate t_c adjusts to keep the benefit b_c constant. Differentiating equation (C.6) yields

$$\begin{aligned} dy_{ic} = (1-t_c)\{&(h_{ic}\mathcal{H}_N - h_c\mathcal{L}_N)f''(h_c)dh_c \\ &+ [f(h_c) - h_c f'(h_c)]\mathcal{L}_{NM}dL_c^m + h_{ic}f'(h_{ic})\mathcal{H}_{NM}dH_c^m\} \\ &- \{[f(h_c) - h_c f'(h_c)]\mathcal{L}_N + h_{ic}f'(h_{ic})\mathcal{H}_N\}dt_c \end{aligned}$$

where the change in the marginal tax rate is derived from the balanced budget constraint: $dt_c = -[t_c f'(h_c)/f(h_c)]dh_c$ and we have, as above, $dh_c = (h_c^m\mathcal{L}_M - h_c\mathcal{H}_M)(dL_c^m/L_c)$, $dH_c^m = h_c^m dL_c^m$. Using the normalization assumption and relying on previous results of the model without redistribution, we have

$$\begin{aligned} \frac{dy_{ic}/y_c}{dL_c^m/L_c} = \left.\frac{dy_{ic}/y_c}{dL_c^m/L_c}\right|_{labor} &(1-t_c) \\ &- t_c\left[1 + \left(\frac{h_{ic}}{h_c} - 1\right)\frac{h_c f'(h_c)}{f(h_c)}\right]\frac{h_c f'(h_c)}{f(h_c)}\left(1 - \frac{h_c^m}{h_c}\right) \end{aligned} \tag{C.7}$$

where $\left.\frac{dy_{ic}/y_c}{dL_c^m/L_c}\right|_{labor}$ denotes the effect in the labor-market model without redistribution (given by equation (C.3) or (C.4)). As $h_c f'(h_c)/f(h_c) = \theta_H$,

5 The alternative interpretation is that the estimates in Table B.1 are plagued by omitted-variable bias. This seems to remain the preferred interpretation when considering jointly the results in Tables B.1 and 2.

we can rearrange equation (C.7) as follows

$$z_{ic}^{m} = \left(\frac{h_{ic}}{h_c} - 1\right)\left(1 - \frac{h_c^m}{h_c}\right)\left(\frac{\theta_H\theta_L}{\sigma_E}(1-t_c) - t_c\theta_H^2\right) - \left(1 - \frac{h_c^m}{h_c}\right)t_c\theta_H + \left(\frac{\theta_L}{\sigma_L} + \frac{h_{ic}h_c^m}{h_c}\frac{\theta_H}{\sigma_H}\right)(1-t_c) \quad \text{(C.8)}$$

To facilitate the re-interpretation of the empirical results in Table 2, it is useful to rewrite this equation as follows:

$$z_{ic}^{m} = \underbrace{\frac{h_{ic}}{h_c}}_{A_{ic}}\underbrace{\left(1 - \frac{h_c^m}{h_c}\right)}_{R_c^m}\left(\frac{\theta_H\theta_L}{\sigma_E} - \frac{\theta_H}{\sigma_H}\right) - t_c\underbrace{\frac{h_{ic}}{h_c}}_{A_{ic}}\underbrace{\left(1 - \frac{h_c^m}{h_c}\right)}_{R_c^m}\left(\frac{\theta_H\theta_L}{\sigma_E} - \frac{\theta_H}{\sigma_H} + \theta_H^2\right) + \phi_{ic} + \kappa_c^m, \quad \text{(C.9)}$$

where $\phi_{ic} = \frac{h_{ic}}{h_c}\frac{\theta_H}{\sigma_H}(1-t_c) + \frac{\theta_L}{\sigma_L}$ contains terms that vary at the individual level, and $\widetilde{\kappa}_c^m = -\left(1 - \frac{h_c^m}{h_c}\right)\left[(1-t)\frac{\theta_H\theta_L}{\sigma_E} - t\theta_H\theta_L\right]$ collects all terms that are specific by country and by immigrant group. By comparing equation (C.9) with equation (6) in the main text we can establish the following relationship between the elasticity σ estimated in Table 2 and the elasticities of substitution in the extended model:

$$\frac{\theta_H\theta_L}{\sigma} = \frac{\theta_H\theta_L}{\sigma_E} - \frac{\theta_H}{\sigma_H} \qquad \text{or} \qquad \sigma = \left(\frac{1}{\sigma_E} - \frac{1}{\theta_L\sigma_H}\right)^{-1}.$$

Alternative Estimations

TABLE C.3
Ordered Probit Estimations

Specification		Labor-Market Model				Complete Model			
Origin Region		Europe	RoW	Europe	RoW	Europe	RoW	Europe	RoW
Poor/Rich		Rich	Rich	Poor	Poor	Rich	Rich	Poor	Poor
Variable	*Coeff.*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A_{ic}	λ_1	0.39***	0.41***	0.29***	0.32***	0.39***	0.38***	0.28***	0.34***
		(0.025)	(0.059)	(0.025)	(0.027)	(0.023)	(0.034)	(0.030)	(0.026)
$A_{ic}R_c^m$	λ_2	0.49***	0.25**	0.21***	0.40***	1.17***	0.95***	0.11	1.27***
		(0.049)	(0.101)	(0.037)	(0.085)	(0.284)	(0.150)	(0.315)	(0.224)
$t_c A_{ic} R_c^m$	λ_3					-2.74**	-2.59***	0.35	-2.93***
						(1.085)	(0.507)	(1.191)	(0.687)
Observations		32719	32719	32719	32719	32719	32719	32719	32719

The dependent variable is the answer to the question "to what extent do you think country c should allow people from (origin region/poor or rich country) to come and live here?". In all specifications , the answer is coded as an ordinal variable taking 4 values (higher values indicate attitudes favorable to immigration). All the regressions include simple country fixed effects. Dummies variables control for gender and political orientation. Continuous variables control for individual age and individual age squared. Robust standard errors are country clustered in all regressions. ***, **, * denote significance at the 1%, 5%, 10% levels.

TABLE C.4
Determinants of Attitudes - Complete Model - Nonstructural Estimation

Specification		Probit				R.E. Logit			R.E. Logit Chamberlain		
Origin Region		Europe	RoW	Europe	RoW	Eur+RoW	Europe	RoW	Eur+RoW	Europe	RoW
Poor/Rich/Pooled		Rich	Rich	Poor	Poor	R+P	R+P	R+P	R+P	R+P	R+P
Variable	*Coeff.*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A_{ic}	λ_1	0.34***	0.42***	0.42***	0.31**	0.78***	0.77***	1.41***	1.74***	1.67***	2.15***
		(0.109)	(0.112)	(0.143)	(0.150)	(0.120)	(0.160)	-0.052	(0.155)	(0.209)	(0.262)
$A_{ic}R_c^m$	λ_2	1.41***	0.95***	0.31	1.13***	2.83***	3.80***	2.18***	1.60***	2.99***	1.05**
		(0.309)	(0.149)	(0.285)	(0.369)	(0.272)	(0.470)	(0.368)	(0.353)	(0.683)	(0.428)
$t_cA_{ic}R_c^m$	λ_3	-3.71***	-2.40***	-0.24	-2.38**	-8.27***	-11.35***	-6.50***	-5.42***	-10.31***	-3.71***
		(1.115)	(0.491)	(1.140)	(1.065)	(0.903)	(1.729)	(1.179)	(1.150)	(2.367)	(1.367)
$A_{ic}t_c$		0.21	-0.00	0.02	0.11	1.89***	1.85***	2.32***	-0.74	-0.76	-1.16
		(0.297)	(0.296)	(0.428)	(0.384)	(0.368)	(0.501)	(0.579)	(0.479)	(0.666)	(0.761)
$-\lambda_3/\lambda_2$		2.63	2.53		2.11	2.92	2.82	2.98	3.39	3.45	3.53
σ		1.96	1.84		1.34	2.31	2.19	2.38	2.88	2.95	3.04
Observations		32719	32719	32719	32719	130876	65438	65438	130876	65438	65438
N groups (id-ctry)						65438	32719	32719	65438	32719	32719
log likelihood						-69490	-35156	-34290	-69437	-35131	-34250

The dependent variable is the answer to the question "to what extent do you think country c should allow people from [origin region/poor or rich country] to come and live here?". In all specifications, the answer is coded as a dummy variable (1 indicates attitudes favorable to immigration). In specifications (5) to (13), the answer is coded as a binary variable. Regressions (5) and (8) include fixed effects for country-immigrant's origin location (either Europe or Rest of the World). All the other regressions include simple country fixed effects. In both case these fixed effects are interacted with group of immigrants (poor or rich countries). Dummy variables control for gender and political orientation. Continuous variables control for individual age and individual age squared. Robust standard errors are country clustered in regressions (1)-(4). ***, **, * denote significance at the 1%, 5%, 10% levels.

Appendix D: Simulations

This appendix explains the simulation procedure which is based on equation (10):

$$\tilde{z}_{ic}^m = \lambda_0 + \lambda_1 A_{ic} + \lambda_2 A_{ic} R_c^m + \lambda_3 t_c A_{ic} R_c^m + \delta' X_{ic} + \zeta_c^m + \mu_{ic}^{r(m)} + \epsilon_{ic}^m, \quad \text{(D.1)}$$

where the fixed effects are related to the structural parameters as follows:

$$\zeta_c^m = \beta \kappa_c^m + v_c^m, \qquad \kappa_c^m = \left(1 - \frac{h_c^m}{h_c}\right)\left(\frac{t_c}{\sigma}\theta_H\theta_L - \frac{1}{\sigma}\theta_H\theta_L - t_c\theta_H + t_c\theta_H^2\right) \quad \text{(D.2)}$$

"Total" attitudes are based on the model

$$\begin{aligned} \tilde{z}_{ic}^m &= \lambda_0 + \lambda_1 A_{ic} + \lambda_2 A_{ic} R_c^m + \lambda_3 t_c A_{ic} R_c^m + \delta' X_{ic} + \zeta_c^m + \mu_{ic}^{r(m)} + \epsilon_{ic}^m, \quad \text{(D.3)} \\ \zeta_c^m &= \beta\left(1 - \frac{h_c^m}{h_c}\right)\left(\frac{t_c}{\sigma}\theta_H\theta_L - \frac{1}{\sigma}\theta_H\theta_L - t_c\theta_H + t_c\theta_H^2\right) + v_c^m \end{aligned}$$

In the absence of a welfare state ($t_c = 0$) the model becomes

$$\begin{aligned} \tilde{z}_{ic}^m &= \lambda_0 + \lambda_1 A_{ic} + \lambda_2 A_{ic} R_c^m + \delta' X_{ic} + \zeta_c^m + \mu_{ic}^{r(m)} + \epsilon_{ic}^m, \quad \text{(D.4)} \\ \zeta_c^m &= \beta\left(1 - \frac{h_c^m}{h_c}\right)\left(-\frac{1}{\sigma}\theta_H\theta_L\right) + v_c^m \end{aligned}$$

The part of attitudes due to the welfare-state (WS) mechanism is obtained by taking the difference between models (D.3) and (D.4):

$$\tilde{z}_{ic}^m \,|_{WS} = \lambda_3 t_c A_{ic} R_c^m + \beta\left(1 - \frac{h_c^m}{h_c}\right)\left(\frac{t_c}{\sigma}\theta_H\theta_L - t_c\theta_H + t_c\theta_H^2\right) \quad \text{(D.5)}$$

If the labor-market mechanism does not operate because human capital and raw labor are perfect substitutes ($\sigma = \infty$), we have $\lambda_2 = 0$ and the model becomes

$$\begin{aligned} \tilde{z}_{ic}^m &= \lambda_0 + \lambda_1 A_{ic} + \delta' X_{ic} + \zeta_c^m + \mu_{ic}^{r(m)} + \epsilon_{ic}^m, \quad \text{(D.6)} \\ \zeta_c^m &= v_c^m \end{aligned}$$

The part of attitudes due to the labor-market (LM) mechanism is obtained by taking the difference between models (D.4) and (D.6)

$$\tilde{z}_{ic}^m \,|_{LM} = \lambda_2 A_{ic} R_c^m + \beta\left(1 - \frac{h_c^m}{h_c}\right)\left(-\frac{1}{\sigma}\theta_H\theta_L\right) \quad \text{(D.7)}$$

The total contribution of economic mechanisms to attitudes is given by the sum of (D.5) and (D.7). Noneconomic factors (NE) are then measured as the difference between "total" attitudes and the contribution of economic mechanisms:

$$\tilde{z}_{ic}^m \,|_{NE} = \lambda_0 + \lambda_1 A_{ic} + \delta' X_{ic} + \zeta_c^m + \mu_{ic}^{r(m)} \quad \text{(D.8)}$$

where the error term ϵ_{ic}^m is omitted. As our analysis focuses on the relation between human capital and attitudes, we want to neutralize the influence of other personal characteristics (age, gender, politics) contained in X_{ic}. Therefore we replace X_{ic} by country averages $\bar{X}_c$ for the simulations.

All structural parameters in the decomposition equations (D.5),(D.7) and (D.8) can be identified from the estimation of equation (10):[6]

$$\hat{z}_{ic}^m = \hat{\lambda}_0 + \hat{\lambda}_1 A_{ic} + \hat{\lambda}_2 A_{ic} R_c^m + \hat{\lambda}_3 t_c A_{ic} R_c^m + \hat{\delta}' \bar{X}_c + \hat{\zeta}_c^m + \hat{\mu}_{ic}^{r(m)}, \qquad \text{(D.9)}$$

where $\hat{\mu}_{ic}^{r(m)}$ are the individual effects predicted by the Chamberlain random-effects model.[7] The remaining parameters are estimated as follows: $\hat{\sigma}$ can be estimated from equation (11), $\hat{\beta} = -(\hat{\lambda}_2 + \hat{\lambda}_3)/\theta_H^2$ and v_c^m is obtained as a residual ($v_c^m = \hat{\zeta}_c^m - \hat{\beta}\kappa_c^m$).

Finally, in terms of predicted variables our decomposition is given by:

$$\hat{z}_{ic}^m = \hat{z}_{ic}^m \mid_{LM} + \hat{z}_{ic}^m \mid_{WS} + \hat{z}_{ic}^m \mid_{NE} \qquad \text{(D.10)}$$

6 The model is estimated using individual characteristics X_{ic} but for the prediction of total attitudes $\hat{z}_{ic}^m$ we replace X_{ic} by country averages $\bar{X}_c$ as indicated above.

7 More precisely, they are the predicted effects from the specification $\mu_{ic}^r = \nu_1 A_{ic} R_c^{r,poor} + \nu_2 A_{ic} R_c^{r,rich} + \xi_1 t_c A_{ic} R_c^{r,poor} + \xi_2 t_c A_{ic} R_c^{r,rich} + \eta_{ic}^r$, where $r = r(m)$ is the origin region of migrant group m.

TABLE D.1
Decomposition of the Variances: Labor, Tax and Individual Effects

Country	Location	Labor	Tax	Individual
Austria	Europe	11.1%	12.6%	76.3%
(obs=3616)	Row	-8.7%	12.2%	96.4%
Belgium	Europe	30.3%	-48.2%	117.9%
(obs=3176)	Row	-12.7%	15.8%	96.8%
Czech Republic	Europe	5.8%	15.1%	79.0%
(obs=2178)	Row	-5.5%	22.5%	83.0%
Germany	Europe	42.9%	-60.4%	117.5%
(obs=5176)	Row	-12.1%	25.2%	86.9%
Denmark	Europe	-7.7%	83.5%	24.1%
(obs=2620)	Row	-2.6%	19.8%	82.8%
Finland	Europe	22.0%	-24.2%	102.2%
(obs=3726)	Row	10.9%	-15.5%	104.6%
France	Europe	26.2%	-23.7%	97.5%
(obs=2596)	Row	-26.0%	13.3%	112.8%
United Kingdom	Europe	-48.7%	50.8%	97.9%
(obs=3606)	Row	-30.8%	37.5%	93.2%
Greece	Europe	-14.7%	77.3%	37.5%
(obs=4386)	Row	-13.3%	20.6%	92.7%
Hungary	Europe	-18.5%	59.4%	59.1%
(obs=2906)	Row	-11.2%	12.6%	98.7%
Ireland	Europe	-58.9%	63.5%	95.4%
(obs=3564)	Row	-59.7%	64.9%	94.8%
Italy	Europe	-39.6%	44.5%	95.1%
(obs=2180)	Row	-21.7%	34.3%	87.4%
Luxembourg	Europe	2.6%	-2.7%	100.1%
(obs=1834)	Row	-21.2%	26.3%	94.9%
Netherlands	Europe	20.9%	-53.7%	132.8%
(obs=4286)	Row	-21.0%	0.5%	120.5%
Norway	Europe	-13.4%	-13.1%	126.5%
(obs=3756)	Row	-4.7%	-6.7%	111.5%
Poland	Europe	16.7%	-7.0%	90.3%
(obs=3772)	Row	3.5%	-2.6%	99.1%
Portugal	Europe	-376.0%	275.4%	200.7%
(obs=2622)	Row	-92.9%	94.7%	98.2%
Sweden	Europe	5.3%	-8.1%	102.8%
(obs=3364)	Row	-5.6%	-3.7%	109.3%
Spain	Europe	-46.8%	45.3%	101.6%
(obs=2862)	Row	-43.1%	53.2%	89.9%
Switzerland	Europe	20.1%	-22.6%	102.5%
(obs=3212)	Row	-32.7%	16.3%	116.4%

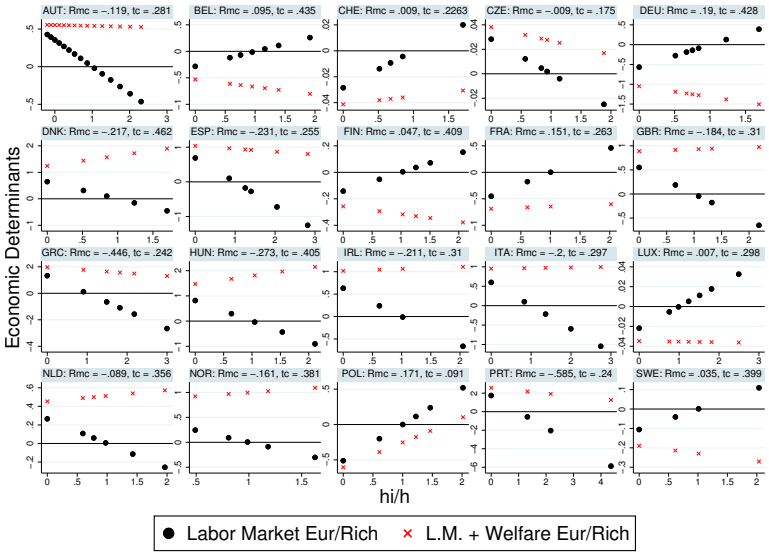


FIGURE D.1 Simulation - Economic Determinants, Immigrants from Rich European Countries

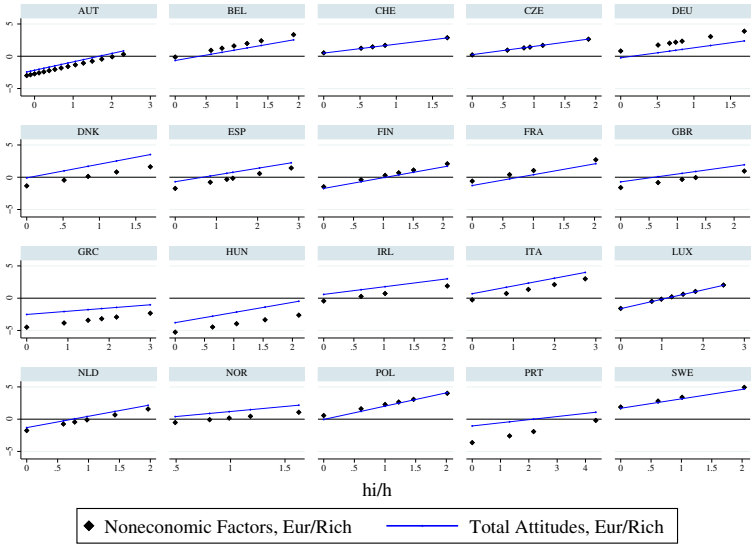


FIGURE D.2 Simulation - Noneconomic Factors and Predicted Attitudes, Immigrants from Rich European Countries

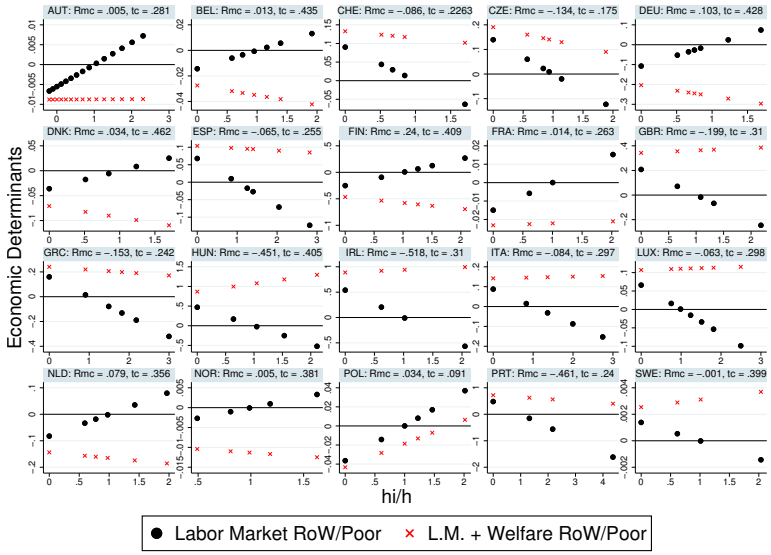


FIGURE D.3 Simulation - Economic Determinants, Immigrants from Poor R.o.W. Countries

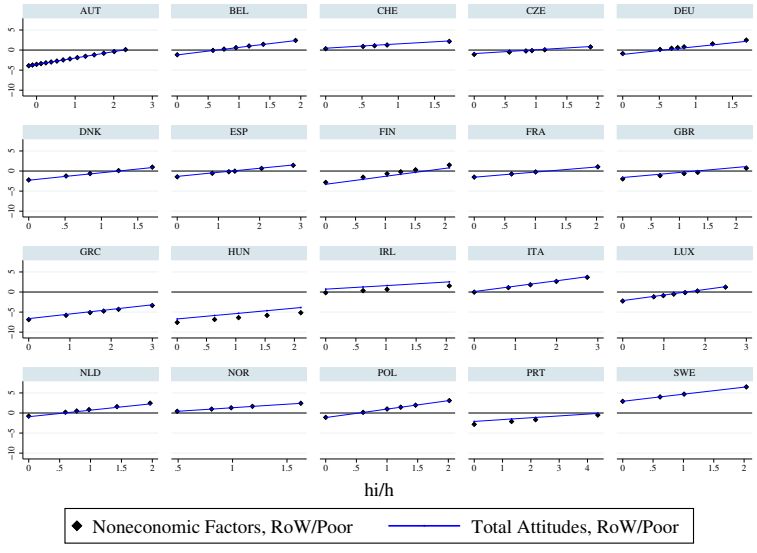


FIGURE D.4 Simulation - Noneconomic Factors and Predicted Attitudes, Immigrants from Poor R.o.W Countries

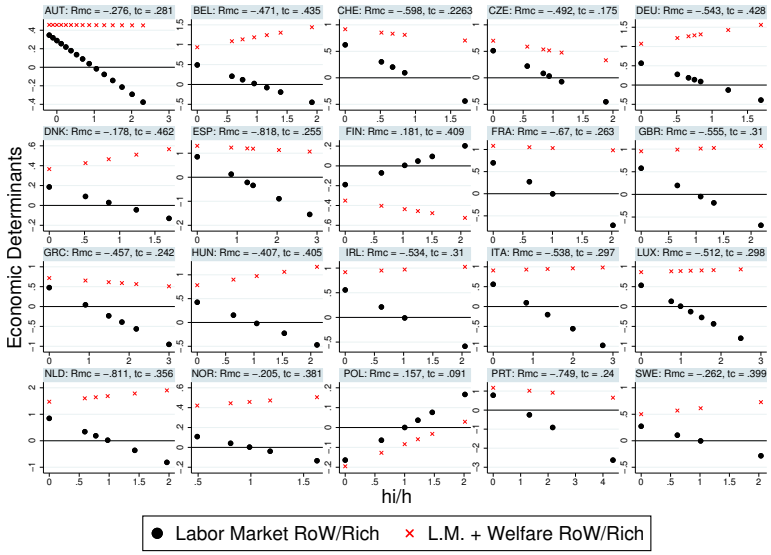


FIGURE D.5 Simulation - Economic Determinants, Immigrants from Rich R.o.W. Countries

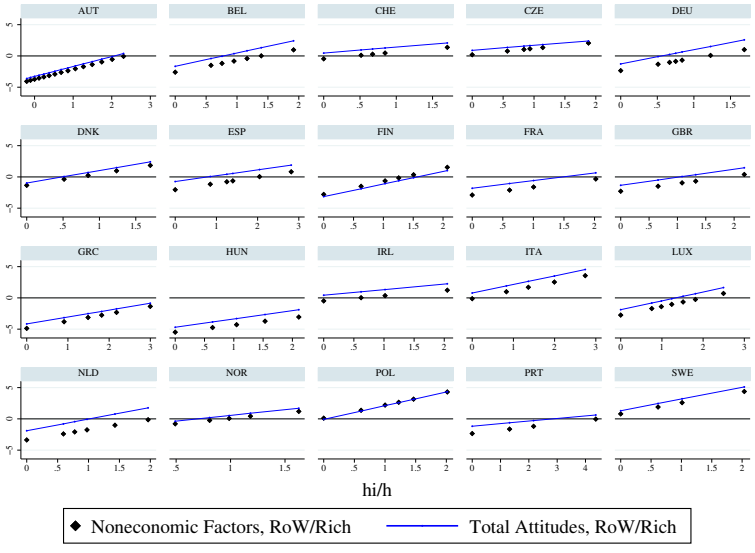


FIGURE D.6 Simulation - Noneconomic Factors and Predicted Attitudes, Immigrants from Rich R.o.W. Countries