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Immigration, Conflict and Redistribution[*]

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Abstract

We study how the possibility of a conflict between natives and immigrants shapes income redistribution in democracies. Conflict erupts when immigrants are given less than what they could obtain by resorting to confrontation. That in turn can make natives vote for lower tax rates and lower public spending. We show that income redistribution, both vertical (from the rich to the poor) and horizontal (from natives to migrants), decreases with the level of immigration. This is because the threat of conflict intensifies as the migrant population becomes bigger. Inequality softens the effect of immigration on tax rates but reduces horizontal redistribution. Despite the threat of conflict, the welfare of the native population unambiguously increases with the stock of migrants.

Keywords: Conflict, Income redistribution, Natives, Immigrants.

JEL codes: D72, D74, F22.

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1   Introduction

Immigration has become an extremely important issue in many developed countries. Citizens are very concerned about the consequences of the large-scale migration that has followed the globalization process. Immigration is considered the most important area of concern for citizens in the UK, Germany and Spain[1]. Immigration is also ranked as the top issue for citizens in US states such as California and Arizona.[2]

Some of these concerns are non-economic and fall under the wide term of xenophobia, such as fear of dilution of national identity, raise in crime rates or introduction of new diseases. Other concerns have an economic reasoning behind them. The two most recurrent ones are increased competition in the labour market and the fiscal burden of immigration. Increasing numbers of immigrants allegedly lower wages in unskilled jobs and create unemployment among the native population. Empirical evidence on this effect is mixed[3]. The second concern is that immigrants might heavily rely on unemployment and social benefits given that they are mostly unskilled and have lower incomes. Empirical evidence on this effect is also mixed. A major study sponsored by the US National Research Council concluded that the net fiscal cost of immigrants in California in 1994–1995 was about US$1,178 per native household (Smith and Edmonston, 1997). On the other hand, Storesletten (2000) shows that allowing a certain profile of migrants to enter the country may help to sustain fiscal policy.

In this paper we address how this second potential effect of immigration shapes income redistribution. More precisely, we aim to explain why host countries devote public expenditures to cover immigrants needs even though immigrants do not have the right to vote. We explore the idea that redistribution towards immigrants takes place because of the possibility of confrontation between natives and immigrants.

The possibility of such confrontation is very real. Tensions between natives and immigrants are commonplace in developed countries. About a 60% of Americans and a similar proportion of Europeans think that immigrants cost taxpayers too much because they overuse public services[4]. In addition, anti-immigration prejudices in European countries correlate positively with poorer overall economic conditions and the size of the migrant population[5]. On the other hand, marginalization of the migrant population drove the riots in the Paris metropolitan area in 2005, in Brussels in 2006, the recent strike of immigrants in Italy and the widespread demonstrations of the His-

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[1]Eurobarometer 66 (2006) and Centro de Investigacion Sociologicas #2654 (2006).

[2]Public Policy Institute of California (2007) and Great Canyon State Poll (2005).

[3]See for example Borjas (2003) and Card and Shleifer (2009) for two different results.

[4]Gallup Poll, June 5-July 6, 2008 (available at http://tinyurl.com/c2nzug), and the European Social Survey of 2002 (Dustmann and Preston, 2005).

[5]See Quillian (1995).

panic immigrant population in the US in 2006 and 2010. Our view is that at the heart of all this social unrest there is a competition between natives and immigrants to capture bigger shares of public resources.

We build up a very simple model in order to explore the role of conflict in this relation between immigration and redistribution. We suppose that the population is composed by immigrants and natives and that the native population is divided between skilled and unskilled individuals that differ in their income. There exists a conflict of interests between natives and immigrants because public funds can be used to pay lump-sum transfers that are group-specific. This conflict of interests is resolved through confrontation: Immigrants start conflict when the payoff they obtain under peace is smaller than the payoff they would obtain by resorting to confrontation. At the same time, income inequality within the native population creates another conflict of interests that is resolved through taxation. Hence, income taxation constitutes an instrument of *vertical redistribution*, from the rich to the poor, whereas the share of public funds devoted to migrants is an instrument of *horizontal redistribution*[6]. Both the tax rate and the share of tax revenues devoted to fund the group-specific transfers are chosen by majority voting. Given that unskilled natives are in the majority, their preferred policies constitute the policy outcome. Immigrants cannot vote and their only chance of altering the policy outcome is by contesting the share of public funds they receive.

In this simple set-up, the threat of conflict shapes policy outcomes despite it does not take place in equilibrium. In particular, we find that immigrants always receive a positive share of public expenditures. Natives prefer to give away the minimum share of public funds that is compatible with peace rather than precipitate a costly conflict by neglecting immigrants.

Our main result is that redistribution decreases with immigration. An increase in the stock of migrants increases the demand for income redistribution given that immigrants bring more resources to the economy. We call this the *tax base effect*. But as the size of the immigrant group becomes bigger, immigrants become more effective in case of conflict and that rises the share of public expenditures that they can obtain through confrontation. This in turn reduces natives' demand for income redistribution. We refer to this as the *conflict effect*. When the stock of immigrants is sufficiently large, the latter effect dominates and the majority of natives prefer lower levels of redistribution. This result is consistent with the available evidence. Alesina, Baqir and Easterly (1999) obtain that spending in public goods decreases with ethnic fragmentation in US cities. Alesina, Glaeser and Sacerdote (2001) and Alesina and Glaeser (2004) show for a cross-section of countries that the size of the public sector is negatively correlated with the size of poor (often racial) minorities. Razin, Sadka and Swagel (2002) show

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[6]We borrow these terms from Horowitz (1985).

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for a sample of European countries that a higher share of immigrants in the population leads to a lower tax rate on labor income. Finally, Soroka, Johnston and Banting (2006) show that OCDE countries with larger increases in migrant stock had smaller increases in social spending over the period 1970-1998.

We also show that the negative effect of immigration on redistribution is softened by the degree of income inequality. As the income gap increases, unskilled natives demand higher levels of vertical redistribution. More inequality makes natives, who are in average richer than immigrants, enjoy a relatively higher capacity in case of confrontation and that makes the conflict effect relatively less important. As a result, tax rates are higher but the degree of horizontal redistribution, measured as the immigrants' share of public expenditures, decreases. This suggests that we should observe a more restricted access of immigrants to public services in countries with higher levels of income inequality.[7]

Another result that we obtain is that the welfare of both skilled and unskilled natives increases with the stock of migrants. The reason for this is that the resulting increase in the public budget outweighs the conflict effect. For skilled natives, this increase in welfare is even stronger due to the lower levels of vertical redistribution that larger migrant populations generate. This also lends support to the empirical evidence showing that skilled natives are more pro-immigration than the unskilled ones (Dustman and Preston 2005, Mayda 2006) and suggests that negative attitudes against immigration, mostly held by the less wealthy, are groundless.

In the theoretical literature, Razin et al. (2002) and Lee, Roemer & Van der Straeten (2006) also obtain that redistribution decreases with the size of the migrant population. However, the mechanisms they consider are different from ours. In Razin et al. (2002), migrants qualify for all benefits in the host country. This "fiscal leakage" make natives vote for lower income taxes. In our case, such fiscal leakage is not assumed. Migrants can be totally excluded from benefits but they end up not being so because they can use conflict to alter policy outcomes. Lee et al. (2006) obtain this "anti-solidarity effect" in a model of political competition where natives have feelings of xenophobia against migrants. This makes natives vote for a smaller public sector despite the fact that the mean income is less than the median income. In our model we do not need to resort to a primordial distaste towards immigrants in order to obtain that natives prefer to reduce redistribution. The threat of conflict is enough to generate this result.

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[7]Access to many social benefits are quite restricted for immigrants. Eligibility criteria vary greatly across countries and they are subject to an intense political debate. In Germany and Sweden illegal immigrants do not have access to education whereas in the US and Spain they do. Undocumented immigrants in the US are not eligible for health care, Social Security or food stamps. In most EU countries, immigrants have some degree of access to public health care.

Our paper is also closely related with contributions that study ethnic conflict when there exists inequality within ethnic groups. Robinson (2001) and Esteban and Ray (2008) analyze models in which confrontation can erupt across ethnic or class lines and study the severity and likelihood of each of these two types of conflict. Members of the same ethnic group can ally against the other group regardless of class. Alternatively, poor members of each group can ally across ethnic groups against the rich. These papers obtain that ethnic conflict is more likely to arise and is more intense than class conflict. This result is aggravated by inequality. Esteban and Ray (2009) study more in detail the role of within-group heterogeneity in ethnic conflict. In these three models there is no welfare state, all income is contestable and thus there are no policy choices and no income redistribution as such. In our model, there is a welfare state (admittedly sketchy) and only tax revenues are contestable because we focus on how the threat of conflict shapes policy outcomes.

To the best of our knowledge, our paper is the first one in analyzing a model of conflict between social groups under policy making through majority voting. Ellman and Wantchekon (2000) study electoral competition when one of the parties controls a source of political unrest. That party can use this source to affect the result of the election and policy making if dissatisfied. Similarly, Acemoglu and Robinson's (2001) show that poor voters may prefer lower levels of redistribution in order to avoid a coup by the rich elites. In these two papers, all group distinctions are purely economic and conflict is not explicitly modelled. On the other hand, Gradstein and Schiff (2006) study exclusion of ethnic minorities from public education in a dynamic framework. The ethnic minority may start a rebellion when the level of exclusion is high enough. Our model is static but both conflict expenditures and the level of income redistribution are endogenous. Finally, Besley and Persson (2009) study the effect of a potential civil war on the state's choices of fiscal and legal capacity. They endogenize conflict expenditures but unlike in our case, confrontation takes place over the control of the government. That determines the incentives of rival social groups to invest in state building when they hold power.

The remainder of the paper is organized as follows: Next we describe the basic elements and assumptions of our model. In Section 3 we solve for the equilibrium of the conflict game that takes place when immigrants contest their share of public expenditures and in Section 4 we analyze the policy preferences of unskilled natives. Section 5 contains the main results of the paper. There we perform comparative statics on redistribution levels and welfare. In Section 6, we conclude and provide some additional remarks.

2 The Model

2.1 The case without immigrants: Consider a country populated by an exogenously determined mass of n natives and no immigrants. There are two types of natives, skilled (s) and unskilled (u). The size of these groups are n_s and n_u respectively, and such that $n_s + n_u = n$. The most populated group is the unskilled one, i.e. $n_u > n_s$. These groups differ in their pre-tax income levels, denoted by y_i for $i = s, u$. It is assumed that $y_u < y_s$. The skill premium $\frac{y_s}{y_u}$ measures the level of inequality in this society.

In addition there is a government that sets a proportional income tax τ that all individuals must pay. Tax revenues are used to finance lump-sum transfers. Native i's payoffs are given by

$$U_n^i = (1 - \tau)y_i + g_n \qquad i = s, u,$$

where g_n is the per-capita transfer to natives.

Government uses taxes to fund transfers. Assuming budget balance, the government budget constraint is just

$$(n_s + n_u)g_n = \tau Y,$$

where $Y = n_s y_s + n_u y_u$.

Notice that because of natives' utility functions are linear, the optimal tax rate for skilled natives is $\tau = 0$ whereas the optimal tax rate for unskilled natives is $\tau = 1$. Given the sizes of the two groups of natives, the majority of the population would prefer total redistribution. For simplicity, we will assume that such scenario is possible. The results of the paper still go through if we assume a cost of taxation or a cap on the maximum tax rate that can be set.

2.2 Immigrants: Now suppose that in addition to natives, an exogenously determined mass m of immigrants also populate the country. Our definition of an immigrant is a non-citizen who resides in the country either legally or illegally, and who pays taxes but does not have the right to vote. We assume that immigrants' level of income is the same as for unskilled natives and thus equal to y_u. For the sake of exposition we will assume for the time being that $m \leq n_s$. We will later relax this assumption.

When immigrants are present, tax revenues can also be used to finance group-specific lump-sum transfers to them. These transfers quantify enhanced access to employment or to jobs in sectors dominated by natives, affirmative action policies in public employment, facilities for religious practices, access to housing or access to health services and education when immigrants live in localized areas (ghettos or suburbs). Formally, payoffs for immigrants are

$$U_m = (1 - \tau)y_u + g_m,$$

where g_m is the lump-sum transfer targeted to them.

In the presence of immigrants, and assuming budget balance, the government budget constraint becomes

$$ng_n + mg_m = \tau Y,$$

where now $Y = n_s y_s + (m + n_u) y_u$.

2.3 The Government: The Government implements a pair of policy instruments $\{\tau, \alpha\}$, where $\alpha \in [0, 1]$ is the share of the total tax revenue devoted to immigrants. This pair is selected by majority rule.[8] Note that for any pair $\{\tau, \alpha\}$, the budget-balanced condition fully determines the lump-sum transfers that each group receives. That is, g_m and g_n are such that

$$mg_m = \alpha \tau Y \text{ and } ng_n = (1 - \alpha) \tau Y.$$

2.4 Conflict: After the pair of policies $\{\tau, \alpha\}$ has been implemented, immigrants can decide to contest the share of the tax revenue. None of our results would change if natives were also given the option to contest the peaceful share of the budget. Contesting the shares implies that natives and immigrants enter into a confrontation. Members of each group can expend resources aimed at altering in their favor the share of the revenue that their group receives. Examples of these activities include political demonstrations, lobbying, campaigning and low-scale violence.

Denote by a_i the expenditure in conflict by a native of type $i = s, u$, and by a_m the expenditure of an individual immigrant. We assume that agents cannot spend in conflict more than their after-tax income, that is, $a_i \leq (1 - \tau) y_i$ and $a_m \leq (1 - \tau) y_u$. We will assume that the cost of these expenditures is just linear.

The share of the total budget that a group can obtain through conflict depends on the total amount of resources each of them devotes to conflict. Denote as p_m the share of the budget obtained by immigrants through confrontation. We follow Esteban and Ray (1999) and assume that p_m takes the following functional form:[9]

$$p_m = \frac{ma_m}{n_u a_u + n_s a_s + ma_m}.$$

Note that we are assuming away the free-riding problem within groups, but only to a certain extent: unskilled and skilled natives pool their expenditures against immigrants, but they can potentially free-ride on each other's efforts. We do this partially because the focus of our analysis is

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not the free-riding problem and partially because we think of conflict as a situation fundamentally different from peace: when confrontation erupts, individual agents stop behaving non-cooperatively and choose their conflict expenditures in order to maximize the payoff of the typical individual in their group.

Then, the payoff for members if each group in case of conflict are just:

$$V_i(\tau) = (1 - \tau)y_i - a_i + (1 - p_m)\frac{\tau Y}{n} \qquad i = s, u, \tag{1}$$

$$V_m(\tau) = (1 - \tau)y_u - a_m + p_m\frac{\tau Y}{m}. \tag{2}$$

Notice that α does not affect agents' utilities under conflict.

2.5 Peace: If immigrants do not contest the shares of the total budget implemented by the government then each member of each group receives the following payoffs:

$$U_i(\tau, \alpha) = (1 - \tau)y_i + (1 - \alpha)\frac{\tau Y}{n} \qquad i = s, u,$$

$$U_m(\tau, \alpha) = (1 - \tau)y_u + \alpha\frac{\tau Y}{m}.$$

Note that natives and immigrants have opposite preferences over the share of the revenue transferred to immigrants α. In the absence of the threat of conflict, the optimal α for any native regardless of type is $\alpha = 0$.

2.6 Timing: We have so far laid down a game with the following timing: First, government implements the pair of policy instruments $\{\tau, \alpha\}$ preferred by majority voting. Given such a policy, immigrants decide whether to initiate conflict or not. If conflict erupts, each group decides the amount of resources to be spent in conflict. Otherwise, they obtain the payoffs corresponding to the peaceful scenario.

We will now solve the game backwards. First, we solve the conflict game given a certain pair of policy instruments already implemented and then we characterize the pair of policy instruments $\{\tau, \alpha\}$ preferred by the majority of the native population.

3 Equilibrium of the conflict stage

In this Section, we solve for the equilibrium of the conflict that takes place when immigrants contest the share of the total budget they receive. In that case, groups decide simultaneously the amount of resources they will spend in conflict activities. In other words, they maximize (1) and (2) with respect to a_i and a_m respectively. It is easy to show that interior best responses are uniquely determined by the following expressions:

$$a_i = p_m(1 - p_m)\frac{\tau Y}{n} - \frac{n_j a_j}{n_i} \qquad \text{for } i = s, u \text{ and } i \neq j, \qquad (3)$$

$$a_m = p_m(1 - p_m)\frac{\tau Y}{m}. \qquad (4)$$

Notice that efforts within the natives' group are strategic substitutes. It is not possible for all these equations to hold simultaneously. This system of equations will have at least one corner solution depending on the tax rate τ. The following Proposition fully characterizes the set of Nash equilibria of the conflict game.

Proposition 1 *The Nash Equilibrium levels of conflict effort are such that immigrants spend at least as much as unskilled natives. Moreover:*

(i) *For low and intermediate tax rates only unskilled natives and immigrants expend resources in conflict.*

(ii) *For high tax rates skilled natives expend a positive amount of effort whereas unskilled natives and immigrants expend their whole after tax income.*

(iii) *For very high tax rates all individuals expend their whole after tax income in conflict.*

Immigrants spend more resources in conflict than unskilled natives because they value public transfers more. Their group is smaller so their private benefit from capturing a bigger share of the public budget is higher.

This proposition also shows that different levels of the tax rate yield different conflict efforts within groups. As the tax rate increases, the capacity of groups in conflict decreases because their after tax income becomes smaller. On the other hand, the size of the budget increases as the tax revenue grows. That in turn fuels conflict effort. This implies that, for a sufficiently large tax rate, all groups end up spending their entire after tax income in conflict. However, as groups are different in terms of income and size, this critical level of the tax rate is different across groups.

Immigrants and unskilled natives participate in conflict for any positive tax rate whereas skilled natives enter into conflict only for higher levels of the tax rate. More precisely, they decide to enter into conflict once unskilled natives spend their whole after tax income in conflict. This free-riding behavior comes from the simple fact that skilled natives are richer than unskilled natives, and this make them value lump-transfers relatively less.

Hence, it is possible to define four thresholds and five intervals in the space of tax rates according to the pattern of equilibrium conflict expenditures across groups. This is illustrated in the figure below.
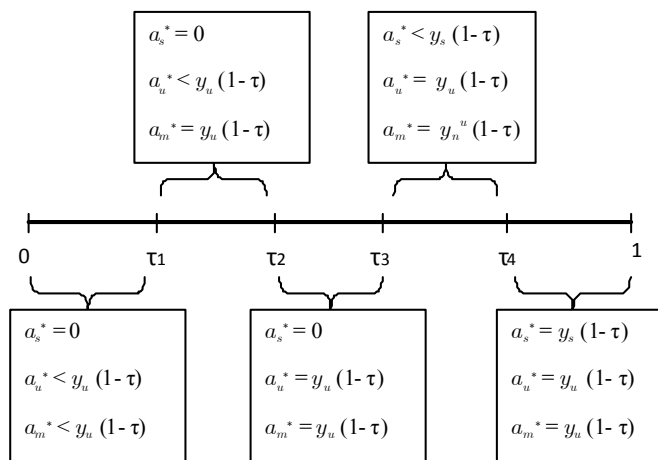
Figure 1. Individuals' Expenditures in Conflict.

Notice that when the tax rate τ is not too high, that is $\tau \in [0, \tau_3]$, skilled natives free-ride on the conflict effort made by the unskilled ones. Actually, for very low levels of the tax rate, i.e. $\tau \leq \tau_1$, the expenditure of an unskilled native is equal to the expenditure of an immigrant weighted by the ratio of immigrant to native population, i.e. $a_u^* = \frac{m}{n} a_m^*$. For larger tax rates, i.e. $\tau \in [\tau_3, 1]$, skilled natives expend positives amount of resources in conflict. At $\tau = \tau_4$, the size of the public budget is so big that all groups expend their whole after tax income in the confrontation.

At this point it is relevant to study the effect of the tax rate on the new shares of the tax revenues that will emerge from conflict. This will prove helpful when analyzing the incentives of immigrants to start a confrontation.

Lemma 1 *Immigrants' equilibrium share of the public funds after conflict p_m^* is increasing in the size of the migrant group m and decreasing in the tax rate τ.*

Size gives an advantage to groups in conflict. As the stock of immigrants increases, they are able to capture a larger share of the public funds. The only exception occurs for very low levels of the tax rate. There the equilibrium total expenditures of natives relative to immigrants is simply the proportion of unskilled natives in the native population i.e. $\frac{n_u}{n}$. This is because of the free riding that takes place within the native coalition. This free-riding exacerbates as the skilled group increases in size.

On the other hand, the share of public funds that immigrants receive from conflict is weakly decreasing in the tax rate. The reason is that increases in the tax rate fuel natives' effort in conflict. And given that natives' capacity in conflict is larger -both because their bigger size and bigger income-, immigrants prospects from conflict worsen as τ increases.

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The reason why the share p_m^* is not strictly increasing in τ is because it remains constant across some regions in the space of tax rates. For instance, for very high tax rates, i.e. $\tau \geq \tau_4$, all groups are spending their after tax income in the contest, and the immigrants' share of the public funds after conflict is just equal to their income share, $\frac{my_u}{Y}$.[10]

4　When Does Conflict Start?

Immigrants will initiate conflict if they can obtain a larger payoff from it than by accepting the policies implemented by the government. We have seen in the previous section that individuals' expenditures on conflict depend on the level of the tax rate. Hence, individuals' payoffs will also change as τ varies. We thus need to discuss all the possible scenarios characterized in Proposition 1.

Let us start by defining the minimum share of the public funds that will stop immigrants from initiating conflict. That is, a α such that

$$V_m(\tau) \leq U_m(\tau, \alpha) \Leftrightarrow (1-\tau)y_u + p_m^* \frac{\tau Y}{m} - a_m^* \leq (1-\tau)y_u + \alpha \frac{\tau Y}{m},$$

$$\alpha \geq \underline{\alpha}(\tau) \equiv p_m^* - \frac{ma_m^*}{\tau Y}. \tag{5}$$

The share of public funds that appeases immigrants does not need to be as big as the share they would obtain by resorting to conflict. This is because conflict expenditures are wasteful. Then the government is always able to implement a policy that avoids conflict between natives and immigrants.

It is important to understand the effect of the tax rate on this threshold $\underline{\alpha}(\tau)$. Given (5), the general expression for the derivative of the minimum share with respect to τ is

$$\begin{aligned}
\frac{\partial \underline{\alpha}(\tau)}{\partial \tau} &= \frac{\partial p_m^*}{\partial \tau} + \frac{ma_m^*}{Y\tau^2}\left(1 - \frac{\partial a_m^*}{\partial \tau}\frac{\tau}{a_m^*}\right) \\
&= \frac{\partial p_m^*}{\partial \tau} + \frac{ma_m^*}{Y\tau^2}(1 + \varepsilon_a(\tau)).
\end{aligned}$$

The sign of this derivative depends critically on the immigrants' tax-rate elasticity of effort supply, $\varepsilon_a(\tau)$. It is straightforward to show (see the Appendix) that for very low levels of the tax rate, i.e. $\tau \leq \tau_1$, the equilibrium effort spent by immigrants is increasing in τ. But once they have hit their budget constraint, the sign of the derivative becomes negative. In addition, recall from Lemma 1 that the equilibrium share of public funds p_m^* is weakly decreasing in the tax rate. All these effects create a complex behavior of $\underline{\alpha}(\tau)$ with respect to the tax rate. The following Lemma characterizes it.

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[10]The other regions are $\tau \leq \tau_1$, where p_m^* only depends on n_u and n_s, and $\tau \in [\tau_2, \tau_3]$, where unskilled natives and immigrants are spending their whole after-tax income.

Lemma 2 *The minimum immigrants' share of the public funds compatible with peace $\underline{\alpha}(\tau)$ attains two minima at τ_2 and τ_4.*

Recall that when $\tau \leq \tau_1$, the share of public funds immigrants receive after conflict p_m^* is constant in τ. It only depends on the relative sizes of the unskilled and skilled natives' groups. On the other hand, immigrants' conflict effort is increasing in τ in this region. Hence, the minimum share compatible with peace $\underline{\alpha}(\tau)$ increases with τ over this interval.

For higher tax rates, immigrants hit their budget constraint and the minimum share of the public funds compatible with peace becomes simply

$$\underline{\alpha}(\tau) = p_m^* - \frac{(1-\tau)y_u m}{\tau Y}. \tag{6}$$

Note that the negative term in the RHS is just the ratio between the immigrants' total expenditures in conflict and the size of the public budget. As τ increases, this ratio decreases and conflict becomes relatively more attractive. That is because although the tax rate increases public funds under both peace and conflict, it reduces private consumption in the peaceful scenario. We call this effect the *tax base effect*. On the other hand, recall that immigrants' share after conflict is weakly decreasing in τ because it fuels natives' expenditures. We call this the *conflict effect*. The final effect of τ on $\underline{\alpha}(\tau)$ depends on the relative strengths of these two opposing forces.

When unskilled workers have not hit yet their budget constraint, i.e. $\tau \in [\tau_1, \tau_2]$, the *conflict effect* dominates and $\underline{\alpha}(\tau)$ is decreasing in τ. When unskilled natives are spending their entire after tax income in conflict, i.e. $\tau \in [\tau_2, \tau_3]$, the share p_m^* is again constant in τ and the *tax base effect* dominates, that is, $\underline{\alpha}(\tau)$ is increasing in τ. That makes $\underline{\alpha}(\tau)$ attain a local minimum at τ_2. The opposite happens when skilled natives enter conflict. In this case, higher tax rates induces natives to exert additional effort in the conflict against immigrants and the *conflict effect* dominates again (and $\underline{\alpha}(\tau)$ decreases with τ). Finally, when all groups are expending their after tax income in conflict, i.e. $\tau \geq \tau_4$, the *tax base effect* dominates again for the same reasons as when $\tau \in [\tau_2, \tau_3]$, and $\underline{\alpha}(\tau)$ increases with τ. That makes $\underline{\alpha}(\tau)$ attain another local minimum at τ_4.

5 The policy outcome

5.1 The equilibrium level of redistribution

The government selects the pair of policies $\{\tau, \alpha\}$ preferred by majority voting. Recall that we assume that only natives have the right to vote and that unskilled natives are the majority. Therefore, it is enough to characterize their preferences over policies $\{\tau, \alpha\}$ to obtain the equilibrium policy outcome.

We first check whether natives prefer conflict to a situation in which immigrants are given the minimum share that prevents them from resorting to conflict. This might be the case if appeasing immigrants is too costly. However, the following lemma shows that this is never the case.

Lemma 3 *For any tax rate, unskilled workers maximize their utility under peace.*

The logic of this result is natural. Conflict creates a waste of resources. This implies that for any level of the tax rate, there always exists a non-empty range of immigrants' shares of the tax revenue compatible with peace, i.e. $\alpha \geq \underline{\alpha}(\tau)$. Then natives' optimal level of α is equal to the minimum level that guarantees peace, that is $\alpha = \underline{\alpha}(\tau)$.

This Lemma implies that conflict does not actually take place in equilibrium. However, the possibility of confrontation is enough to shape policy outcomes. Formally, the tax rate chosen by unskilled natives is the one that maximizes their payoff in case of peace. It is characterized by the following problem:

$$\underset{\tau}{Max} \quad (1-\tau)y_u + (1-\alpha)\frac{\tau Y}{n}$$
$$\text{s.t. } \alpha = \underline{\alpha}(\tau).$$

As we saw above, the minimum share $\underline{\alpha}(\tau)$ changes with τ in a complex way and this makes the preferences of the unskilled natives over the income tax τ to be non-trivial. The first order condition of this maximization problem is

$$y_u m + n_s(y_s - y_u) - \underline{\alpha}(\tau)(1 + \varepsilon_\alpha(\tau))Y = 0, \qquad (7)$$

where $\varepsilon_\alpha(\tau)$ is the tax-rate elasticity of the share $\underline{\alpha}(\tau)$.

Solutions to this problem will depend critically on the skill premium and the size of the immigrant group. This is because they determine the unskilled natives' demand for redistribution. The following Proposition shows that the set of potential optimal tax rates for unskilled natives, and thus of potential policy outcomes, reduces to just two.

Proposition 2 *There exist two possible policy outcomes, $\{\tau_4, \underline{\alpha}(\tau_4)\}$ and $\{1, \underline{\alpha}(1)\}$, where*

$$\tau_4 \equiv \frac{n}{n + n_s \frac{m}{m + n_u + n_s \frac{y_s}{y_u}}}.$$

Moreover, $\{\tau_4, \underline{\alpha}(\tau_4)\}$ is the policy outcome if and only if

$$m > m^* = n_s(\frac{y_s}{y_u} - 1). \qquad (8)$$

The optimal tax rate for unskilled workers naturally depends on the threat of conflict. On the one hand, when the threat of conflict by immigrants is low, as in the extreme case of $m = 0$, total redistribution, i.e. $\tau = 1$, is the optimal policy for unskilled workers. We know from Lemma 2 that the minimum immigrants' share of tax revenue compatible with peace attains minima at tax rates τ_2 and τ_4. This makes these tax rates very attractive to unskilled natives. However, Proposition 2 proves that τ_4 is always preferred to τ_2 by unskilled workers.

Condition (8) shows that the number of migrants and the skill premium determine which tax rate is finally chosen. Next we perform comparative statics on these parameters in order to generate additional predictions.

5.2 Comparative statics

5.2.1 Stock of immigrants: We have seen that the threat of conflict is positively correlated with the size of the immigrant population. Therefore, it can be expected that in countries with a large migrant population, lower levels of redistribution should be observed as compared to countries with a smaller migrant population. The following Proposition demonstrates this.

Proposition 3 *The equilibrium tax rate τ^* is decreasing in the number of immigrants m, whereas the equilibrium share α is strictly increasing in m^*.*

The intuition for this result is easy to grasp: As the number of immigrants increases, they become more effective in conflict (the conflict effect). The share of the public funds they can capture becomes bigger, that is, α increases. The majority of the native population finds redistribution less attractive because maintaining peace becomes now too costly. That pushes the equilibrium tax rate τ down.

It remains an open question how an increase in the stock of migrants affect the welfare of natives and immigrants. For natives, an increase in number of immigrants increases the tax base but at the same time it makes the immigrant group more effective in confrontation. For immigrants, the conflict effect is positive but the per capita value of transfers decreases as they become more numerous. The following Proposition characterizes the final effect of an increase in m on the welfare of each group.

Proposition 4 *The equilibrium payoff is increasing in m for both types of natives, and it is decreasing in m for immigrants.*

This result is partially driven by the relationship between the equilibrium tax rate τ and the stock of migrants m described in Proposition 2. Unskilled natives benefit from a bigger migrant population because the tax base effect dominates over the conflict effect and despite vertical redistribution lowers. On the other hand, skilled natives benefit even more because

they benefit from the reduction in the tax rate that an increase in the stock of migrants brings. Finally, immigrants are harmed by the decrease in the tax rate and by their bigger numbers. This leaves them worse off despite the conflict effect works in their favour.

5.2.2 Skill premium: Let us now see how the equilibrium level of redistribution changes as the skill premium $\frac{y_s}{y_u}$ varies.

Expression (8) shows that the threshold number of immigrants needed for the shift in tax rates to take place increases with the skill premium. This suggests that increases in income inequality should temper the negative effect of migration on the levels of redistribution. Still, we need to check how τ_4 changes with $\frac{y_s}{y_u}$: Redistribution should *ceteris paribus* become more attractive for unskilled natives as the skill premium increases. The following Proposition confirms this intuition.

Proposition 5 *The equilibrium level of the tax rate τ is weakly increasing with respect to the skill premium $\frac{y_s}{y_u}$, whereas the equilibrium share α is strictly decreasing in $\frac{y_s}{y_u}$.*

The force driving this result is the following. An increase in the skill premium increases the capacity of natives in conflict relative to immigrants' and the threat of conflict becomes less intense, that is, the share of public funds they can obtain through conflict decreases with $\frac{y_s}{y_u}$. Natives find less costly to avoid conflict and this in turn increases the demand for redistribution. As a result, the equilibrium tax rate τ is higher for any level of the stock of migrants m. At the same time, this extra relative strength of natives in case of conflict reduces α. In more unequal societies then, horizontal redistirbution, measured as the share of public funds allocated to immigrants, is lower.

5.2.3 More migrants than skilled natives. One assumption in the analysis above was that the stock of immigrants was not bigger than the size of the group of skilled natives. When immigrants are no longer the minority group, i.e. $m > n_s$, then it can be the case that an even lower level of redistribution may be the equilibrium outcome. In addition to $\tau = 1$ and τ_4, the tax rate τ_2 can also be the policy outcome. It is not possible to characterize analytically the region of the parameter space in which this is the case. The figure below illustrates this with a numerical example.
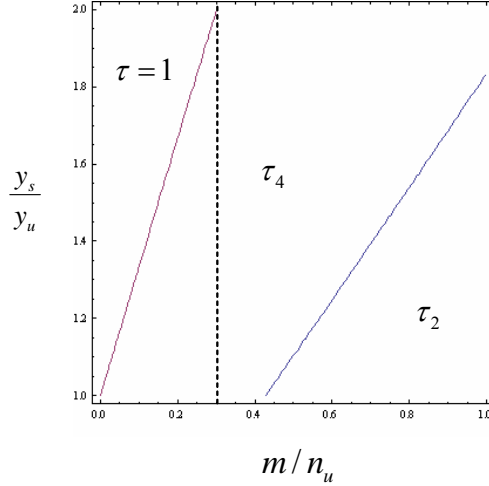
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Figure 2. Equilibrium levels of redistribution when $\frac{n_s}{n_u} = 0.3$.

Numerical analysis suggests that this third tax rate is more likely to emerge as the stock of immigrants becomes bigger and as the skill premium $\frac{y_s}{y_u}$ becomes smaller. This two forces go in the same direction: the threat of immigrants become more intense and inequality decreases, thus reducing the demand for redistribution.

6   Concluding Remarks

In this paper we have presented a model that relates the latent conflict between natives and immigrants to the level of redistribution observed in democracies. Whereas taxation can resolve the vertical conflict of interests between the poor and the rich, confrontation takes place when migrants are discontent with the share of public expenditures they receive. We believe that this latent conflict is at the root of the examples of immigrant unrest experienced in Europe and the US in the last few years.

Our main results concern how the threat of such a conflict between immigrants and natives shapes income redistribution. First, the possibility of conflict grants immigrants a positive share of public expenditures. Natives prefer to give away the minimum share of public funds that is compatible with peace rather than precipitate a costly conflict by neglecting immigrants. This is consistent with the observation that host countries devote public expenditures to cover immigrants needs even though immigrants do not have the right to vote. An alternative explanation for this observation might be that citizens of the host country genuinely care about the welfare of the migrant population. Here, we obtain positive public spending on immigrants even when natives hold purely egoistic preferences.

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We then study how the level of income redistribution changes with increases in the stock of immigrants. More migrants increase the demand for vertical redistribution because more resources enter the system. But at the same time the immigrants group becomes more effective in case of conflict and that rises the minimum share of public expenditures compatible with peace. This in turn reduces the demand for income redistribution. When the stock of immigrants is sufficiently large, the latter effect dominates and the majority of natives prefer lower levels of redistribution. This result is very much in line with a large amount of empirical evidence on the relation between public spending and immigration.

We also show that this negative effect of immigration on redistribution is softened by the degree of income inequality because as the income gap increases, unskilled natives prefer higher levels of taxation. But at the same time, more inequality makes natives become relatively stronger in conflict and that reduces horizontal redistribution. This suggests that more unequal countries should exclude immigrant more from public services. Finally, we show that despite the possibility of conflict, natives both skilled and unskilled are better off with larger migrant populations. For skilled natives this increase in welfare is even stronger due to the lower levels of vertical income redistribution. This is consistent with the evidence showing that attitudes towards immigration are more positive among the more educated.

Admittedly our model is very stripped down. This is because we want to identify a particular mechanism that relates immigration with policy outcomes. Here, we do not consider for instance the possible effect of immigrants in natives' labour income. Some empirical evidence shows that immigration affects wages by rising the skill premium (Borjas, 2003). That in turn can also explain why attitudes towards immigration are more positive among the skilled. It is possible to extend to our model to include this effect. If an increase in the stock of immigrants also affects the skill premium in a positive way, our results suggest that the negative effect of immigration on income redistribution should soften.

Finally, another caveat of our model is that it is static. It does not take in to account the effects of future possible enfranchisement of immigrants. In a recent paper, Ortega (2009) compares pure temporary migration (with no access to the right to vote) and permanent migration (with access to the right to vote) in a dynamic model where both income redistribution and the number of immigrants are chosen by majority vote. He finds that, in the long run, income redistribution is only supported under permanent migration. Introducing the effect of potential conflict in this setting could be an interesting line of future research. More generally, we plan to tackle the study of the enfranchisement of immigrants in our future research.

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A   Appendix

Proof of Proposition1.   From (3) and given that $n_u > n_s$ we can see that if the FOC for the unskilled natives holds, then the skilled workers want to exert zero conflict effort. If on the other hand, the FOC for skilled natives holds then unskilled ones want to spend their entire after tax income in conflict. Let us consider the former case. If $a_s = 0$ then from (3) and (4) we have that

$$\frac{a_u}{a_m} = \frac{m}{n},$$

and by substituting in any of the two previous FOCs we obtain

$$a_m^* = \frac{n_u}{(n + n_u)^2} \frac{n}{m} \tau Y, \tag{9}$$

$$a_u^* = \frac{n_u}{(n + n_u)^2} \tau Y.$$

From here we see that immigrants spend more in conflict than unskilled natives. Moreover, expenditures increase as the tax rate τ increases. That is because in this case taxes enlarge the prize groups are fighting for. When

$$\tau > \frac{m y_m (n + n_u)^2}{n_u n Y + m y_m (n + n_u)^2} \equiv \tau_1$$

immigrants hit their budget constraint and $a_m^* = (1 - \tau) y_u$. In this case, unskilled workers will spend

$$a_u^* = \frac{1}{n_u} \left(\sqrt{m(1-\tau) y_u n_u \frac{\tau Y}{n}} - m(1-\tau) y_u \right), \tag{10}$$

that is positive when $\tau > \tau_1$. Again, it may be the case that this level of expenditure exceeds the after tax income of the individual. That happens if and only if

$$\tau > \frac{n y_m (m + n_u)^2}{n_u m Y + n y_m (m + n_u)^2} \equiv \tau_2.$$

Tedious but straightforward calculus shows that $\tau_2 > \tau_1$.

Once immigrants and unskilled natives are hitting their budget constraints, skilled natives may or may not spend a positive amount of conflict effort. That will be determined by the solution to their FOC, that is

$$a_s^* = \frac{\sqrt{(1-\tau) y_u}}{n_s} \left(\sqrt{\frac{n_s m \tau Y}{n}} - (n_u + m) \sqrt{(1-\tau) y_u} \right). \tag{11}$$

Skilled natives will exert positive conflict effort only if this solution is positive, which holds true if and only if

$$\tau > \frac{n(n_u + m)^2 y_u}{n_s m Y + n(n_u + m)^2 y_u} \equiv \tau_3,$$

that is clearly greater than τ_2.

The last case that remains to be checked occurs when the solution to (11) hits the budget constraint of the skilled native. That is the case when

$$\tau > \frac{nY}{nY + mn^s y_u} \equiv \tau_4,$$

which is greater than τ_3. Above that tax rate, all agents in the economy will use their entire after tax income in conflict in case it erupts. ∎

Proof of Lemma 1. When $\tau < \tau_1$, the winning probability of immigrants is simply

$$p_{m1} = \frac{n}{n + n_u},$$

that is independent from τ. When $\tau \in (\tau_1, \tau_2)$, immigrants hit their budget constraint. In that case, their probability of victory is:

$$p_{m2} = \sqrt{\frac{nm(1 - \tau)y_u}{n_u \tau Y}},$$

that is decreasing in τ and increasing in m. For intermediate levels of the tax rate, both the unskilled natives and immigrants expend the whole after tax income but skilled natives still do not participate. In that case, immigrants' probability of victory is just:

$$p_{m3} = \frac{m}{n_u + m}.$$

When $\tau \in (\tau_3, \tau_4)$, skilled natives participate in conflict and spend part after-tax income. Immigrants winning probability in the former case is

$$p_{m4} = \sqrt{\frac{nm(1 - \tau)y_u}{n_s \tau Y}}.$$

Finally, for very high levels of τ, all groups spend their entire after tax income in conflict and the winning probability of immigrants becomes equal to their income share, that is,

$$p_{m5} = \frac{m y_m}{Y}.$$

∎

Proof of Lemma 2. Let us start with the case of very low taxes. Here skilled natives do not exert any effort and the equilibrium expenditures of unskilled natives and immigrants do not exceed their after tax income. Immigrants start conflict if and only if:

$$(1 - \tau)y_u + \left(\frac{n}{n + n_u}\right)^2 \frac{\tau Y}{m} > (1 - \tau)y_u + \alpha \frac{\tau Y}{m}.$$

Simplifying this, we rewrite the previous expression as:

$$\alpha < \underline{\alpha}_1 \equiv (p_{m1})^2 = \left(\frac{n}{n+n_u}\right)^2,$$

that does not depend on τ. When $\tau \in (\tau_1, \tau_2)$, immigrants will engage in confrontation if:

$$p_{m2}\frac{\tau Y}{m} > (1-\tau)y_u + \alpha\frac{\tau Y}{m}.$$

Simplifying this, we rewrite the previous expression as:

$$\alpha < \underline{\alpha}_2 \equiv p_{m2}(1 - p_{m2}\frac{n_u}{n}).$$

$$\frac{\partial\underline{\alpha}_2}{\partial\tau} = \frac{\partial p_{m2}}{\partial\tau}(1 - 2p_{m2}\frac{n_u}{n}).$$

Given that $\frac{\partial p_{m2}}{\partial\tau}$ is always negative, the sign of the derivative is determined by the sign of the second term. This term is increasing in τ and it is positive evaluated at $\tau = \tau_1$, because at this point $p_{m2} = p_{m1} = \frac{n}{n+n_u}$. Hence, $\underline{\alpha}_2$ strictly decreases with τ in the interval $[\tau_1, \tau_2]$.

In the region $[\tau_1, \tau_2]$, immigrants will engage in confrontation if:

$$\frac{\tau Y}{n_u + m} > (1-\tau)y_u + \alpha\frac{\tau Y}{m}.$$

Simplifying this, we rewrite the previous expression as:

$$\alpha < \underline{\alpha}_3 \equiv p_{m3}(1 - \frac{1-\tau}{\tau}\frac{(n_u+m)y_u}{Y}).$$

Given that p_{m3} is constant in τ, it is straightforward to see that $\underline{\alpha}_3$ is increasing. Hence, $\underline{\alpha}(\tau)$ attains a local minimum at τ_2.

The next case correspond to the scenario in which both unskilled natives and immigrants exhaust their income and skilled natives spend part of theirs. There, immigrants start conflict if:

$$\alpha < \underline{\alpha}_4 \equiv p_{m4}(1 - p_{m4}\frac{n_s}{n}).$$

$$\frac{\partial\underline{\alpha}_4}{\partial\tau} = \frac{\partial p_{m4}}{\partial\tau}(1 - 2p_{m4}\frac{n_s}{n}).$$

Given that $\frac{\partial p_{m4}}{\partial\tau}$ is always negative, the sign of this derivative is determined by the sign of the second term. This term is increasing in τ and it is positive evaluated at $\tau = \tau_3$. Hence, it remains positive in this region and we can conclude that $\underline{\alpha}_4$ is decreasing in τ. This also implies that $\underline{\alpha}(\tau_3)$ is a local maximum.

The last case occurs when $\tau > \tau_4$. In that region, the minimum share that must be allocated to immigrants is

$$\alpha < \underline{\alpha}_5 \equiv p_{m5} \frac{2\tau - 1}{\tau},$$

that is increasing in τ. Hence, $\underline{\alpha}(\tau)$ attains another local minimum at τ_4. ∎

Proof of Lemma 3. The utility level for unskilled workers in case of peace is higher than under conflict if and only if for any τ:

$$(1 - \tau)y_u + (1 - \underline{\alpha}(\tau))\frac{\tau Y}{n} > (1 - \tau)y_u + (1 - p_m)\frac{\tau Y}{n} - a_u \Leftrightarrow$$

$$a_u > (\underline{\alpha}(\tau) - p_m)\frac{\tau Y}{n}.$$

Notice that by definition of $\underline{\alpha}(\tau)$ (see 5) we have that $\underline{\alpha}(\tau) < p_m$ for any $a_m > 0$. Since $a_m \geq a_u$ then the inequality above is satisfied for any τ. ∎

Proof of Proposition 2. The general expression for the derivative of the objective function is

$$\frac{\partial u_n^u(\alpha, \tau)}{\partial \tau} = y_u m + n_s(y_s - y_u) - \underline{\alpha}(\tau)(1 + \varepsilon_\alpha(\tau))Y.$$

In the region where $\tau < \tau_1$, the derivative of this function with respect to the tax rate is

$$\frac{\partial u_n^u(\underline{\alpha}_1, \tau)}{\partial \tau} = -y_u + n_u \frac{2n + n_u}{(n + n_u)^2}\frac{Y}{n},$$

which is either positive or negative. This implies that maxima in this region can be attained either at $\tau = 0$ or τ_1.

When $\tau \in [\tau_1, \tau_2]$, the derivative of the payoff with respect to τ is more involved:

$$\frac{\partial u_n^u(\underline{\alpha}_2, \tau)}{\partial \tau} = -y_u \frac{m + n}{n} + \frac{Y}{n} - \frac{1 - 2\tau}{2\sqrt{(1 - \tau)\tau}}\sqrt{\frac{my^u Y}{n_u n}},$$

which is itself increasing in τ. Let us evaluate this derivative at the extremes of the interval:

$$\frac{\partial u_n^u(\underline{\alpha}_2, \tau)}{\partial \tau}\bigg|_{\tau=\tau_1} = y_s \frac{n_s}{n_s + n_u}(\frac{n_s + 3n^u}{2(n_s + 2n^u)})$$

$$+ \frac{y_u}{n_s + n_u}(\frac{(n_s + 3n^u)(m + n_u)}{2(n_s + 2n^u)} + \frac{m(n_s + 2n^u)}{2n^u} - (m + n_s + n_u)),$$

which is positive if and only if

$$\frac{y_s}{y_u} > \frac{2(n_s + 2n^u)(m + n_u + n_s)}{n_s(n_s + 3n^u)} - \frac{m + n_u}{n_s} - \frac{m(n_s + 2n^u)^2}{n_s n_u(n_s + 3n^u)}.$$

On the other hand, the derivative evaluated at $\tau = \tau_2$ is

$$\left.\frac{\partial u_n^u(\underline{\alpha}_1, \tau)}{\partial \tau}\right|_{\tau=\tau_2} = \frac{y_u}{n_u + n_s}\frac{n_s m + n_u(n_u - n_s)}{2n^u} + \frac{n_s}{n_u + n_s}\frac{m + 2n^u}{2(m + n_u)}y_s > 0.$$

This means that depending on the value of the skill premium, the payoff for unskilled natives will either attain a minimum or will be increasing in this region. The local maximum will be located then in one of the two extremes, i.e. τ_1 or τ_2.

Let us show now that τ_1 is dominated by τ_2 for any $m < n$. The payoff function evaluated at τ_1 is

$$u_n^u(\underline{\alpha}(\tau_1), \tau_1) = (1 - \tau_1)y_u + n_u\frac{2n + n_u}{(n + n_u)^2}\frac{\tau_1 Y}{n}$$

$$= y_u\frac{n_u}{n_u + m\frac{(2n^u + n_s)^2}{(n_u + n_s)}\frac{y_u}{Y}}(1 + \frac{m}{n_u + n_s}\frac{n_u}{n_u + n_s} + \frac{2m}{n_u + n_s}),$$

whereas on the other hand, the payoff when $\tau = \tau_2$ boils down to

$$u_n^u(\underline{\alpha}(\tau_1), \tau_1) = y_u(\frac{n_u}{n_u + (n_u + n_s)\frac{(m+n_u)^2}{m}\frac{y_u}{Y}})(1 + \frac{m}{n_u + n_s} + \frac{m + n_u}{m}),$$

so proving the lemma amounts to prove that

$$\frac{\frac{n_u}{n_u + m\frac{(2n^u + n_s)^2}{(n_u + n_s)}\frac{y_u}{Y}}}{\frac{n_u}{n_u + (n_u + n_s)\frac{(m+n_u)^2}{m}\frac{y_u}{Y}}} \leq \frac{1 + \frac{m}{n_u + n_s} + \frac{m + n_u}{m}}{1 + \frac{m}{n_u + n_s}\frac{n_u}{n_u + n_s} + \frac{2m}{n_u + n_s}} \Leftrightarrow$$

$$\frac{n_u m(n + m) + n(m + n_u)^2}{nn^u(m + n) + m(n + n_u)^2} \leq \frac{nm + m^2 + n(m + n_u)}{n^2 + n_u m + 2mn} \Leftrightarrow$$

$$-m^2(n + m)(n + n_u) + n(m + n_u)[(n + 2m)(m + n_u) - (n + m)n_u]$$
$$+ m(m + n_u)[n_u(m + n_u) - (n + n_u)^2] < 0 \Leftrightarrow$$

$$m[(n_u - n)(n_u + n) - n(m + n_u)] + n(2m - n_u)(m + n_u) < 0 \Leftrightarrow$$

$$-(n - m)[(n_u)^2 + mn] < 0.$$

In the third region, i.e. $\tau \in [\tau_2, \tau_3]$, the derivative of the payoff function is given by

$$\frac{\partial u_n^u(\underline{\alpha}_3, \tau)}{\partial \tau} = -y_u\frac{m + n}{n} + \frac{Y}{n}\frac{n_u}{n_u + m}.$$

The sign is either positive or negative so the maxima can be again located only at the extremes of the region.

In the fourth case the derivative of the payoff with respect to τ is almost identical to the one for the second region:

$$\frac{\partial u_n^u(\underline{\alpha}_4, \tau)}{\partial \tau} = -y_u\frac{m + n}{n} + \frac{Y}{n} - \frac{1 - 2\tau}{2\sqrt{(1 - \tau)\tau}}\sqrt{\frac{my^u Y}{n_s n}},$$

that is again increasing in τ. The analysis is now less intricate because

$$\left.\frac{\partial u_n^u(\underline{\alpha}_4, \tau)}{\partial \tau}\right|_{\tau=\tau_3} = y_u \frac{n_u(n_u + m) + n_s(n_u - 2n^s)}{n_s} + n_s \frac{2n^u + m}{n_u + m} y_s > 0,$$

which means that the derivative is positive in the whole interval $[\tau_3, \tau_4]$ and the payoff attains a maximum at $\tau = \tau_4$. Note that discards τ_3 as a candidate for global maximum.

The last case that needs to be considered occurs at $\tau > \tau_4$, where the derivative of the unskilled natives' payoff is:

$$\frac{\partial u_n^u(\underline{\alpha}_5, \tau)}{\partial \tau} = -y_u \frac{m + n_s}{n_s + n_u} + y_s \frac{n_s}{n_s + n_u} > 0 \Leftrightarrow$$

$$\frac{y_s}{y_u} > \frac{m + n_s}{n_s}.$$

This implies that $\tau = 1$ is preferred to τ_4 if and only if

$$m < \frac{n_s(y_s - y_u)}{y_u}.$$

Observe also that

$$u_n^u(\underline{\alpha}_1, 0) = y_u < \frac{n_u}{n} y_u + \frac{n_s}{n} y_s = u_n^u(\underline{\alpha}_5, 1),$$

which implies that $\tau = 0$ cannot be a global maximum.

Finally, let us prove that for any combination of skilled premium and a native and immigrant populations, τ_4 is always preferred to τ_2 by unskilled workers. The utility levels when taxes are τ_2 and τ_4 are correspondingly:

$$u_n^u(\underline{\alpha}_2, \tau_2) = \frac{[(n_u + n_s)(2m + n_u) + m^2] y_u n_u((n_u + m) y_u + n_s y_s)}{(n_u + n_s)(n_u m((n_u + m) y_u + n_s y_s) + (n_u + n_s) y_u(m + n_u)^2)}$$

$$u_n^u(\underline{\alpha}_4, \tau_4) = \frac{((n_u + m) y_u + n_s y_s)(n_u + n_s)[n_u y_u + n_s y_s] + mn(y_u)^2[m + n_u + n_s]}{(n_u + n_s)[(n_u + n_s)((n_u + m) y_u + n_s y_s) + mn^s y_u]}.$$

For the sake of simplicity we can normalize $n_u = 1$ and $y_u = 1$ such that n_s, m and y_s become the proportion of skilled to unskilled population, the proportion of immigrants to unskilled workers, and the skill premium, respectively. Therefore $n_s \in (0, 1)$, $m \in (0, 1)$ and $y_s > 1$. We obtain that $u_n^u(\underline{\alpha}_4, \tau_4) > u_n^u(\underline{\alpha}_4, \tau_4)$ if and only if:

$$(1+m)^2(m+n_s)(n_s-1) + (1+m)(2+(m-2)n_s)n_s y_s + (3+m(3+n_s))(n_s y_s)^2 + (n_s y_s)^3 > 0.$$

Notice that the function above is increasing in y_s. Then if the above inequality is satisfied for any $n_s \in (0, 1)$, $m \in (0, 1)$ and $y_s > 1$ it is also satisfied for any $n_s \in (0, 1)$, $m \in (0, 1)$ and $y_s = 1$. Then, $u_n^u(\underline{\alpha}_4, \tau_4) > u_n^u(\underline{\alpha}_4, \tau_4)$ if:

$$(1 + m + n_s)^2(m(n_s - 1) + n_s) > 0 \Leftrightarrow$$

$$(m(n_s - 1) + n_s) > 0.$$

But the inequality above is always satisfied since $n_s > m$ and $n_s \in (0,1)$, $m \in (0,1)$. Therefore, for any combination of skilled premium and a native and immigrant populations, τ_4 is always preferred to τ_2 by unskilled workers.

Therefore there are only two possible optimal taxes for unskilled workers, τ_4 and $\tau = 1$, and τ_4 is the global maximum if and only if :

$$m > \frac{n_s(y_s - y_u)}{y_u}.$$

∎

Proof of Proposition 3. First, let us prove that for every level of the skill premium and composition of native population there exists a critical number of migrants $m^* < n$ such that for $m \geq m^*$ such that τ_4 is preferred to $\tau = 1$ by unskilled workers. Notice that if $\frac{y_s}{y_u} \leq R(m) \equiv \frac{m}{n_s} + 1$ then τ_4 is preferred to $\tau = 1$ by. Since $R(m)$ is increasing in m this function attains a minimum at $m = 0$ such that $R(0) = 1$. Then for any $m > 0$ there exist a skilled premium and a native population such that the total redistribution is not the optimal policy.

Second, in order to prove that the optimal tax for unskilled workers is weakly decreasing in m, we have to prove that τ_4 is weakly decreasing in m. But this is true since:

$$\frac{\partial \tau_4}{\partial m} = \frac{-n y^u n_s (n_s y_s + n_u y_u)}{(nY + m n^s y_u)^2} < 0.$$

Let us also check how the minimum shares $\underline{\alpha}(\tau_4)$ and $\underline{\alpha}(1)$ change with the stock of migrants:

$$\frac{\partial \underline{\alpha}(1)}{\partial m} = \frac{n_u + n_s y_s}{(m + n_u + n_s y_s)^2} > 0$$

$$\frac{\partial \underline{\alpha}(\tau_4)}{\partial m} = \frac{\partial p_{m4}}{\partial m}(1 - 2 p_{m4} \frac{n_s}{n}) > 0,$$

where the last inequality holds from the facts that $\frac{\partial p_{m4}}{\partial m} > 0$ and that $p_{m4} < \frac{1}{2}$. Hence, the level of horizontal redistribution increases with the stock of migrants. ∎

Proof of Proposition 4. For the sake of simplicity we can normalize $n_u = 1$ and $y_u = 1$ such that n_s, m and y_s become the proportion of skilled to unskilled population, the proportion of immigrants to unskilled workers, and the skill premium, respectively. Therefore $n_s \in (0,1)$, $m \in (0,1)$ and $y_s > 1$.

Let us first check weather unskilled natives are better off under an increase in m. Notice that when $\tau = 1$ is the optimal tax rate for unskilled

workers their payoff is constant in m. However, it is not the case when τ_4 is the optimal tax rate for unskilled natives.

$$\frac{\partial U_u(\tau_4, \alpha_4)}{\partial m} = \frac{m^2(1 + 2n_s) + (1 + n_s)(1 + n_s y_s)(2m - n_s(y_s - 1))}{(1 + n_s)\left(1 + m + n_s + 2mn_s + n_s(1 + n_s)y_s\right)^2} > 0,$$

since $m > m^* = n_s(y_s - 1) > 0$.

Second, for the case of the skilled natives, it easy to see that when $\tau = 1$ is implemented their payoff is also constant in m. In additions given that:

$$U_s(\tau_4, \alpha_4) = U_u(\tau_4, \alpha_4) + (1 - \tau_4)(y_s - 1).$$

Therefore $\frac{\partial U_s(\tau_4, \alpha_4)}{\partial m} > \frac{\partial U_u(\tau_4, \alpha_4)}{\partial m} > 0$ because τ_4 is decreasing in m.

Finally for immigrants it is also easy to see that when $\tau = 1$ is implemented their utility is also constant in m. When when τ_4 is implemented the payoff for immigrants is just

$$U_m(\tau_4, \alpha_4) = \frac{(1 + n_s)}{(1 + n_s) + \frac{mn_s}{(1+m)+n_s y_s}}.$$

It straightforward to see that the denominator is increasing in m and then $\frac{\partial U_u(\tau_4, \alpha_4)}{\partial m} < 0$. ■

Proof of Proposition 5. We have to prove that τ_4 is increasing in $\frac{y_s}{y_u}$. For the sake of simplicity we can normalize $n_u = 1$ and $y_u = 1$ such that n_s, m and y_s become the proportion of skilled to unskilled population, the proportion of immigrants to unskilled workers, and the skill premium, respectively. Then we have that:

$$\begin{aligned}
\frac{\partial \tau_4}{\partial y_s} &= \frac{n_s(n_s + 1)[(n_s + 1)(1 + m + n_s y_s) + mn^s] - n_s(n_s + 1)[(n_s + 1)(1 + m + n_s y_s)]}{[(n_s + 1)(1 + m + n_s y_s)]^2} = \\
&= \frac{m(n_s)^2(n_s + 1)}{[(n_s + 1)(1 + m + n_s y_s)]^2} > 0.
\end{aligned}$$

Let us also check how the minimum shares $\underline{\alpha}(\tau_4)$ and $\underline{\alpha}(1)$ change with the skill premium:

$$\begin{aligned}
\frac{\partial \underline{\alpha}(1)}{\partial y_s} &= -\frac{n_s}{(m + n_u + n_s y_s)^2} < 0 \\
\frac{\partial \underline{\alpha}(\tau_4)}{\partial y_s} &= \frac{\partial p_{m4}}{\partial y_s}\left(1 - 2p_{m4}\frac{n_s}{n}\right) < 0,
\end{aligned}$$

where the last inequality holds from the fact that $\frac{\partial p_{m4}}{\partial y_s} < 0$ and that $p_{m4} < \frac{1}{2}$. Hence, the level of horizontal redistribution decreases with the skill premium. ■