Immigration Control and the Welfare State

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ABSTRACT. We examine immigration policy and its redistributive effects using a model of a rich country which must spend on border control in order to regulate immigration from a poor country. There are owners and workers in the rich country, and a public sector which makes redistributive transfers from owners to workers. We first consider the case where illegal immigrants have access to the public sector, a situation currently observed in many countries. We show that as border control becomes more expensive inequality in the rich country increases, redistributive transfers may increase or decrease, some immigration is permitted and foreign aid may be used by the rich country in order to reduce the migration pressure along its border with the poor country. Because of nonconvexities, we also show that a small decrease in the aversion to inequality or a small increase in the poor country's population can lead to the collapse of the redistributive public sector. We then consider excluding illegal immigrants from the public sector (e.g. California Proposition 187). We find that the possibility of collapse vanishes and that the rich country takes the toughest official stance on immigration but does not enforce it with border controls.

1. BACKGROUND

Two important prerequisites for large-scale international migration in recent history have been the transition from an agrarian to an industrial economy in the sending country and the fast population growth it entails. These, for example, were true for the main sources of migration to the US: Europe in the nineteenth and early twentieth centuries, developing countries in Latin America and Asia after the second world war.[1] It is also true that in every case migration has been directed toward better quality of

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[1] According to Kennedy [13, 1996] European population more than doubled during the industrial revolution in the nineteenth century, from two hundred million to four hundred million even after seventy million had left Europe altogether. Since the second world war the Mexican population, by far the largest source of emigration to the US, has more than tripled.

opportunity—both economic and political.[2] Largely unrestricted immigration to the US during the quarter century before the first world war brought about seventeen million mostly European immigrants in the country. Binding immigration quota in the 1930s reduced the flow dramatically, but large–scale immigration resumed after the Immigration and Nationality Act of 1965 to bring more than twenty million people mostly from Latin America and Asia (Kennedy [13, 1996]).[3] After the second world war, and excluding the mass ethnic resettlements forced between 1945 and 1950 by the Yalta and Potsdam agreements, some fourteen million people came to the EU countries from Eastern Europe alone (Fassmann and Münz [9, 1994]).[4] Immigration rates to the EU have grown rapidly in the recent past.[5]

Even though the fundamental determinants of emigration volume and direction have changed little during the century, the impact of immigration on the receiving rich countries to–day is considerably different than that experienced by the US prior to the first world war. During that early period the US economy was uncongested and the fiscal impact of immigration was small because the public sector itself was small, public welfare programmes were even smaller and immigrants were mostly young because of provisions that precluded those likely to become social dependents. By contrast, the rich economies now appear to be congested and the fiscal impact of immigration can be significant because public sectors have grown considerably, much of this growth can be attributed to the expansion of public welfare programmes that did not exist a century ago, and immigrants are older on average because of many dependents admitted under current immigration laws.[6] There is no agreement in

[2]During the past century European immigrants to the US were not only attracted by the prospect of a better economic future, but also by the promise of civil rights and equality before the law. This was especially true for people from Central and Eastern Europe where feudal systems persisted at the time. The difference in political systems as a cause of emigration to the US is still strong to–day, but the economic pull seems even stronger. For example Mexico has in relation to the US the largest real income difference between any two contiguous countries in the world to–day (Kennedy [13, 1996]).

[3]In the first decade of this century 8.8 million immigrants were admitted, which corresponds to 10.5 individuals per 100 US population (Greenwood [11, 1994]). In the 1930s only half a million immigrants entered (0.4 per 100). In the 1980s the numbers had increased to 7.3 million (3.1 per 100).

[4]In regard to economic causes of migration from Eastern Europe to the EU, the real income difference between those two regions may now be tenfold (Wellisch and Wildasin [19, 1996]). In regard to emigration induced by political factors, the number of those who found asylum in the EU went from 190,000 in 1987 to 700,000 in 1992 (Freeman [10, 1992]).

[5]Although recently increasing rates of immigration in the EU countries can be attributed to the collapse of communism in Eastern Europe, a further immigration potential of five to twenty-five million eastern Europeans over the next decade has been proposed by different sources (Fassmann and Münz [9, 1994]). These calculations must be augmented to take into account the other main sourses of EU immigration, esp. North Africa, the Near East and the Far East.

[6]Whereas in the time of Henry George government expenditure levels were less than ten percent

the literature about whether immigrants to–day impose a fiscal benefit or a fiscal burden (Borjas [3, 1996]). It is true however that the rates of welfare recipiency for immigrants are high in general (ibid [3, 1996]) and that the cost of public–sector programmes has grown rapidly with an ever increasing population to the extent that many now fear a collapse of the welfare state as we came to know it. These, put against the background of a congested economy, may account for a widely held belief that immigrants now impose a social cost on the rich countries. Negative public perceptions about immigration are further reinforced by two additional facts. Firstly, illegal immigration has become a significant part of total immigration.[7] Secondly, the ethnic composition of immigrants has changed to create visible minority groups with strong cultural cohesiveness in the receiving countries. If current trends continue such minorities could acquire economic and political strength sufficient to implement deep changes in the overall ways the historical mainstream of a country organises and conducts its affairs.[8]

These strong tendencies are bound to continue. Due to political problems and population growth in less developed countries, to severe international economic dis-

of national income, expenditure levels in the EU countries and the US now range from one–third to one–half of national income (Wellisch and Wildasin [19, 1996]). The aging of the immigrant population in the US is a direct consequence of the 1965 family–reunification provisions under which over eighty percent of immigrants entered the country in 1993 not as workers but as dependents of resident aliens. "The percentage of immigrants over sixty–five exceeds the percentage of natives in that income group, and immigrants over sixty–five are two and a half times as likely as natives to be dependent on Supplemental Security Income, the principal federal program making cash payments to the indigent elderly." (Kennedy [13, 1996].) Among EU countries, encouragement of family immigration was instituted in France during the 1980s.

[7]The estimated monthly peak over a calendar year of illegal crossings and crossing attempts from Mexico to the US rose from 200,000 in 1977 to almost 350,000 in 1986 (Espenshade [7, 1995]), when the total number of illegal immigrants was estimated to between three and five million. About 300,000 of those who entered the country during the 1990s stayed permanently (Borjas [3, 1996]). Analogous figures for the EU countries are difficult to find but all sources agree that illegal immigration is substantial because of easily crossed borders in a region where effective policy co–ordination among member states is difficult to achieve (Wellisch and Wildasin [19, 1996], Freeman [10, 1992]).

[8]Between 1955 and 1985 guest workers and colonial immigrants in the EU countries grew faster and returned less frequently than expected, to create large social costs esp. in Germany, England and France (Lemay [14, 1989]). Three quarters of all foreign workers in Germany come from outside the EU, mainly from Turkey and the former Yugoslavia, while the corresponding half of all foreign workers in France come primarily from North Africa (Zimmerman [21, 1995]). But the most striking case is presented by the Hispanic immigration in the US. Although European immigrants dominated until the 1950s, only about ten percent of those admitted in the 1980s were Europeans. It is now estimated that non–Hispanic whites may constitute a minority in the US soon after 2050 (Borjas [3]). Hispanics, mainly Mexicans, represent twenty–eight percent of the population in Texas and thirty–one percent of the population in California. No other immigrant group had the size, concentration and easy access to its original culture than the Mexican immigrants in the southwestern US to–day (Kennedy [13, 1996]).

parities, to better information in poor countries about the degree of those disparities and to reduced migration costs, the external migration pressure on the borders of the rich countries is expected to increase. As a response, many significant events and policy changes have taken place in the Western countries during the recent past. "Western Europe has reacted to the new wave of immigration [after the collapse of communism in Eastern Europe] with a mixture of fear, rejection and massive administrative measures, including the deployment of specialized police and military along the borders, at ports and airports."[9] Measures against illegal immigration have also increased in the US after the 1986 Immigration Reform and Control Act which provided for sanctions against employers hiring illegals, conditional amnesty for those already living in the US, and stronger direct enforcement along the southern border.[10] Perhaps the most controversial type of legislation along these lines is California Proposition 187 which aims to discourage illegal entry and to encourage the return of illegal residents by denying them explicitly the use of redistributive public services such as public health and education.[11] Other significant events, such as work to improve conditions in Haiti or supporting the peso currency, represent US policies aimed to curb illegal immigration through international transfers that improve conditions at the origin—rather than through wall-building at destination.[12] Turning to legal immigration issues, it appears that the restrictionist side is gaining momentum both in the US (where it came close to shutting down the border in the 1930s) and in other developed countries.[13] This movement has been represented even in countries

[9](Fassman and Münz [9, 1994, p. 534].) The concept of a 'Fortress Europe' immigration policy, meant to tighten external EU border controls and facilitate internal movement, was expressed in the 1985 and 1990 Schengen Accords (Zimmermann [21, 1995]). Beyond these collective agreements, EU countries acting independently have instituted stricter national border controls to prevent illegal immigration.

[10]Under IRCA over two million illegal aliens have been legalised. At the same time, enforcement along the southern border includes walls build in the vicinity of major American cities. (Extending them along the entire border has been proposed by Pat Buchanan during the last Republican presidential nomination campain.) IRCA reduced illegal immigration from an estimated 115,000 per year before to 61,000 per year after the policy was applied (Jones [12, 1995]). More recent evidence however indicates that this remarkable drop was temporary (Freeman [10, 1992], Espenshade [7, 1995]).

[11]This proposition is currently before the courts. A similar one by Texas was struck down. Both are against current federal laws under which illegal immigrants are allowed access to important public services such as health and education. This may imply massive loss of federal funding (about fifteen billion annually at stake in California) where state and federal requirements are in conflict (Martin [16, 1994]).

[12]The transfers made to Mexico during the peso crisis were explicitly rationalised by federal officials as reducing and preventing migration pressure on the US–Mexican border.

[13]Australia, for example, has reduced its annual immigration quota from 140,000 in 1989 to 80,000 in 1992 (Freeman [10, 1992]). Considerable tightening of admission standards for political refugees now applies to all receiving countries.

with traditionally liberal attitudes to immigration. For example, both the Reform Party in Canada and the National Front in France include more restrictive immigration policies as an important plank in their political platform.[14] Opposite trends are also underway. Canada and Japan are committed to accepting larger numbers of immigrants, the latter because of a growing demand for unskilled labour. The 1990 IRCA revisions have increased the volume of legal immigration in the US (Freeman [10, 1992]). Finally, the NAFTA agreements encourage immigration in the short–run but are expected to slow down flows in the long–run by reducing wage differentials among the countries involved—notably Mexico and the US. In this respect NAFTA can be interpreted as an international migration policy (Freeman [10, 1992]).

2. OVERVIEW

Our aim is to assess the various policies described in the last paragraph of the previous section within a unified modelling context. We are particularly interested in the consequences of legal and illegal migration on the rise and the potential collapse of the modern welfare state.

The premise of our paper is that the world of the 1990s is congested in the sense that rich countries view their national interest as being served by restricting the economic immigration of unskilled labour. The predominant instrument of immigration control is an enforced quota system, whereby countries place an upper limit on the number of legal immigrants they will accept in each of the following categories: economic migrants, political refugees and family reunification.[15] Once accepted an immigrant gains free access to labour markets and public services. In this paper we work with a quota system and focus on economic migrants.

Why is it that rich countries raise barriers against immigration? Our background discussion suggests several arguments, including some with racist or nationalistic undertones. But there are also arguments grounded in economics. First, the immigration of unskilled labour may directly hurt indigenous unskilled workers who compete with the immigrants. Second, rich countries have large and sophisticated public sectors providing public services such as policing, health and education which involves a significant redistributive element. Since immigrants use public services they increase the cost of redistribution by congesting them. Following these ideas we introduce congestion through a redistributive public sector.

In section three we describe a simple model of two countries (one rich and one poor), one good and two factors. There are two types of agents in the rich country,

[14] A sinister expression of negative feelings toward legal alien residents is the endemic underground violence against guest workers, especially Turks, as well as against Eastern European and Asian immigrants in Germany.

[15] For alternative entrance price policies see Chiswick [4, 1982], Simon [18, 1989] and Becker [1, 1990]. For entrance prices and exit subsidies see Myers and Papageorgiou [17, 1996].

workers and owners of the fixed factor. Owners in the rich country can be thought of as skilled workers, capitalists or landowners. The poor country is inhabited by workers alone. In section four we overlay a redistributive public sector on the model of the rich country. We assume that owners are relatively rich and workers relatively poor, and that the outcome of the political process in the rich country is characterised by an aversion to inequality. This implies redistributive transfers from owners to workers through the public sector. In order to specify redistributive public services we must face the issue of what an illegal immigrant receives in the rich country. We consider two alternatives, one in which illegal immigrants receive public benefits (the current situation in the US) and the other in which they are excluded from the public sector (California Proposition 187). In the first case illegal immigrants receive both the rich country's wage and the net fiscal package (public services minus taxes) while, in the second, they receive only the rich country's wage. The net fiscal package illegals receive varies from country to country and is in any case difficult to determine because of the illegal nature of immigration. In the US, for example, an illegal immigrant may pay some taxes such as sales and payroll taxes but may avoid others such as income taxes. On the benefit side illegal immigrants may receive some public benefits through access to public health and public education but they are not eligible for others such as unemployment assistance. It is reasonable to assume that they receive less public benefits and pay less tax than a legal immigrant or an indigenous worker. We abstract from this potential complexity and assume that when illegal immigrants receive public benefits their *net* fiscal package is the same as that received by a legal immigrant or indigenous worker.

Before proceeding to study immigration and immigration control, we provide the reader with a primer to our results by describing the extreme case in which migration between the two countries is impossible. This is done in section five. In the following section we introduce border control. We assume that the government of the rich country enforces quota by facing potential illegal immigrants with migration cost (e.g. wall–building) sufficient to ensure that it is not in their interest to cross the border. The migration cost could be thought of as the payment to a smuggler which would ensure a successful illegal border crossing. The total cost of enforcement is proportional to the product of two variables: the number of potential illegal immigrants and the income difference workers receive in the two countries.[16]

[16]There is a large and varied literature on international migration and immigration policy (see Myers and Papageorgiou [17, 1996] for some references), including some which examines immigration and redistribution. However only a very small part of that literature provides a theoretical analysis of illegal immigration and costly border control. (Models with legal immigration under costless border control and a redistributive public sector include Chiswick [4, 1982], Wildasin [20, 1994] and Wellisch and Wildasin [19, 1996]. Also see Chiswick [5, 1988] for a very interesting discussion of issues associated with illegal immigration.) The seminal paper in that category is Ethier [8, 1986] which

In section seven we discuss fundamentals in the case where illegal immigrants receive the same net fiscal package as indigenous residents and legal immigrants. Sections eight and nine describe the baseline case of costless immigration quota enforcement, while costly enforcement is presented in sections ten through thirteen.

Under costless enforcement immigration is detrimental to the indigenous residents of the rich country because immigrants receive the redistributive public services. Faced with congestion, the rich country chooses a zero immigration quota and there is no migration in equilibrium. For costly enforcement, we are particularly interested in how increasing border control cost affects the level of immigration, the amount of redistributive public services and inequality. We find that as long as the cost is sufficiently small a prohibitive quota is still enforced. Within this cost range, as cost increases, inequality between owners and workers in the rich country increases while redistributive transfers decrease. The logic is that redistribution causes pressure on the border, and as border control becomes more costly the rich country economises by doing less redistribution. Still higher cost forces the rich country to allow some immigration in order to reduce expenditure on border control. The amount of immigration and inequality increases in the border control cost, but now public service provision may also increase. The reason is that there are two ways to economise on border control as it becomes more expensive—decreasing the redistributive transfer or allowing entry. The latter has the secondary effect of decreasing the wage and increasing the rent. When this secondary effect dominates the equilibrium transfer becomes larger to compensate the workers. Once border control becomes very expensive we show that the rich country allows in the efficient number of immigrants, redistributes if desired, and removes a further incentive to migrate by making a direct international transfer to equalise the well–being of workers on both sides of the border.[17] The system in effect comes to resemble an informal federation with a common labour market (i.e. no border controls) and a common redistributive public sector supported by interregional transfers.

One significant implication of our model is that the consumption possibility set of the rich country is not convex. Thus the results described in the previous paragraph are based on the assumption that the aversion to inequality is sufficient to ensure a unique equilibrium allocation and smooth transitions. When these conditions do not hold we show in sections nine and thirteen how marginal decreases in the aversion

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was extended by Djajic [6, 1987] and Bond and Chen [2, 1987]. Ethier involves a rather sophisticated model of enforcement controls, both internal and external, but does not consider redistribution.

[17] As an extreme example of how this can be possible consider the case of a single potential migrant. Would it be less expensive for the rich country to prevent illegal immigration by building a wall, or by bringing the foreign worker up to the rich country's standard using a direct international transfer? At the risk of over–interpreting our simple model this result is consistent with the U.S. transfers to Mexico during the peso crisis.

to inequality or marginal increases in the border control cost (for example, a small increase in the population of the poor country) can cause the collapse of the welfare system in the rich country. Collapse leads to the most preferred allocation for owners.

In section fourteen we analyse the policy of excluding illegal immigrants from access to redistributive public services. In this case the rich country prefers an illegal over a legal immigrant as both types are equally productive and illegal immigrants do not share the use of public services. Illegal immigrants are in fact beneficial to the indigenous residents of the rich country while legal immigrants are not. The simple and stark results here are induced precisely because of these observations. We find that, independently of border control cost, the rich country imposes a zero quota for legal immigration and spends nothing on enforcing it thereby allowing free entry to illegal immigrants. By adopting this strategy the rich country circumvents the restrictions inherent in a quota system which do not allow discriminatory fiscal treatment of *legal* immigrants.[18]

Finally in section fifteen we attempt a broad reconstruction of American immigration and welfare policy within the unified context of our model.

3. Underlying Models

Two countries form a closed system, where country one is rich and country two poor. An homogeneous population of workers of total fixed size $\bar{L}$ is partitioned between the two countries. Workers are potentially mobile, and they choose to live and work in the country which gives them the highest level of utility. The initial population of workers in a country is denoted L_j^o for $j = 1, 2$.[19] The rich country has also an immobile population of owners denoted $\bar{T}$, each owning one unit of a productive fixed resource which could be thought of as skilled labour (Ethier [8, 1986]), capital (Bond and Chen [2, 1987]) or land. For simplicity we shall assume that there is no fixed resource in the poor country.

Labour and the resource available in the rich country are combined by competitive firms to produce the consumption good under a linear, homogeneous and concave technology $X_1\left[L_1, \bar{T}\right]$. In consequence labour and resource are paid their marginal product denoted w_1 and r respectively while firms earn zero profits:

$$X_1\left[L_1, \bar{T}\right] = L_1 w_1 + \bar{T} r. \tag{1}$$

In the poor country labour alone produces the good under a linear technology and is paid its marginal product by competitive firms, so

[18] Although highly stylised, this model has qualitative empirical content. For if an exclusion policy is implemented the model predicts tighter quota on legal economic immigration combined with a *decrease* on border control expenditure to enforce the quota.

[19] Throughout a superscript 'o' denotes variables at the initial state of the system.

$$X_2 = L_2\bar{w}_2 \tag{2}$$

where $\bar{w}_2$ is the constant marginal product of labour. We assume $w_1^o > \bar{w}_2$, which will ensure that the migration pressure is on the rich country's border at the initial population partition. We also assume $r^o > w_1^o$. This, in conjunction with $w_1' \equiv \partial w_1/\partial L_1 < 0$ and $\partial r/\partial L_1 > 0$ which hold by our assumptions on technology, implies that the owners represent the highest income group in the system for $L_1 \geq L_1^o$. Finally the efficient partition of workers, where the marginal products of labour are equalised, is denoted L_1^*. We assume that $L_1^* < \bar{L}$.

Under a quota system of immigration control legal immigrants become citizens of the admitting country. Citizens are allowed direct access to labour markets, public health and education services as well as indirect access to such things as publicly subsidised transportation, policing, parks, libraries, national security, etc. To keep our analysis simple we assume that the utility derived from all these diverse goods is summarized in terms of consumption, and that a citizen's interaction with the public sector is summarised through a net transfer between individuals and the public sector. We write the income or consumption of an owner as

$$x^t = r - \tau \tag{3}$$

where τ is a tax on owners. The income or consumption of an indigenous worker and a legal immigrant is given by

$$x_1^l = w_1 + \sigma \tag{4}$$

where σ is a redistributive public transfer.

The income of illegal immigrants depends on whether or not they receive the public transfer. If they do, their income is x_1^l but their consumption is expressed as

$$x_1^i = w_1 + \sigma - m \tag{5}$$

where m denotes the migration cost associated with gaining illegal entry. By contrast, if illegal immigrants do not receive the public transfer, their consumption reduces to

$$x_1^i = w_1 - m. \tag{6}$$

The government of country one chooses the redistributive policies, a quota for legal migrants and undertakes quota enforcement expenditures. We shall consider two types of expenditure, namely, border control (e.g. wall building) at cost E and direct international transfers to the poor country (which reduce the migration pressure along the border) at cost S. The government's budget constraint also depends on whether or not illegal immigrants receive the public transfer. If they do, it is expressed as

$$\bar{T}\tau - L_1\sigma - E - S = 0. \tag{7}$$

By contrast, if they do not receive the public transfer, the government's budget constraint becomes

$$\bar{T}\tau - L_1^\circ\sigma - E - S = 0. \tag{8}$$

Country two has no fixed factor available to generate redistributive transfers, but if the government of country two receives an international transfer it maximises the well–being of its homogeneous population and balances its budget by distributing it equally among the residents. Thus the income of a worker in the poor country is

$$x_2^l = \bar{w}_2 + \frac{S}{L_2} \tag{9}$$

where $S \geq 0$.

4. REDISTRIBUTIVE OBJECTIVES

In generating government objectives for the rich country which are useful for an analysis of redistributive policy we assume that the government of the rich country (1) cares only about the well–being of its indigenous residents, (2) cares equally about an individual irrespective of type and (3) is averse to inequality. One alternative to the first assumption could be that the government cares about all individuals irrespective of nationality, which is ethical but not consistent with observation. Another alternative is to assume that the government cares about all residents irrespective of origin or legal status. When illegal immigrants receive the public transfer this objective seems plausible and one which may be worth exploring in the future.[20] The second assumption is related to the axiom of anonymity in social choice theory and will yield public indifference curves which are simple in that they are symmetric around the equal–consumption line. A more descriptively accurate alternative would be to assign different weights for individuals of different types to reflect differences in political power.[21] Finally, we chose the third assumption because of our interest in redistributive policy.

[20] Under this alternative the objective function could be combined with feasibility to determine immigration policy. Such policy, if it involved migration, would change the weights in the objective function (see (10)): the structure of the objective function itself becomes endogenous to policy choices (see Mansoorian and Myers [15, 1997]). Here we ruled out this alternative for tractability.

[21] We believe that modelling this more complicated alternative would not change the qualitative nature of our conclusions.

Given these assumptions, the rich country's government aims to maximise

$$W_1 = \begin{cases} L_1^\circ \dfrac{(x_1^l)^{1-\alpha}}{1-\alpha} + \bar{T}\dfrac{(x^t)^{1-\alpha}}{1-\alpha} & \text{when } \alpha \neq 1 \\ L_1^\circ \ln(x_1^l) + \bar{T}\ln(x^t) & \text{when } \alpha = 1 \end{cases} \tag{10}$$

where $\alpha \geq 0$ measures the degree of aversion to inequality in the social preferences. Given our assumptions, when $\alpha \to 0$ public preferences in the rich country approach the utilitarian principle of Bentham, and when $\alpha \to \infty$ they approach the maximin principle of Rawls. Under these circumstances the marginal rate of social substitution is

$$\frac{dx^t}{dx_1^l} = -\frac{L_1^\circ}{\bar{T}}\left(\frac{x^t}{x_1^l}\right)^\alpha. \tag{11}$$

Notice that our third assumption implies $\alpha > 0$.

5. AN ISOLATED RICH COUNTRY

Before proceeding to study immigration control it is useful to fix ideas by considering the extreme case where migration between the two countries is impossible. In that case illegal immigration becomes irrelevant and the rich country does not have to spend anything on migration control ($E = S = 0$), so that its government's budget constraint is simply $\bar{T}\tau - L_1\sigma = 0$ by (7). Using (1), (3) and (4) at $L_1 = L_1^\circ$ national feasibility is given by

$$X_1^\circ = \bar{T}x^t + L_1^\circ x_1^l. \tag{12}$$

The graph of (12), which represents the consumption possibility frontier for the rich country (henceforth CPF), is given by line AB in figure 1 for $L_1^\circ = \bar{T}$. Also shown in that figure are the welfare–maximising public indifference curve for the rich country (henceforth PIC) given by curve CD, and the initial consumption at F with $r^\circ > w_1^\circ > \bar{w}_2$ as already assumed. The CPF in that figure has a slope equal to

$$\frac{dx^t}{dx_1^l} = -\frac{L_1^\circ}{\bar{T}} \tag{13}$$

and there is a tangency at $x^t = x_1^l$ for all α by (11). Thus for any positive degree of aversion to inequality the unique welfare maximum is at E where owners and workers have the same consumption. The redistribution from F to E occurs because there is a complete set of lump–sum taxes, because workers and owners are equally proficient at turning consumption into utility and because the government cares equally about different types and is averse to inequality. All four factors are necessary for deriving this simple outcome upon which we base our comparisons below.

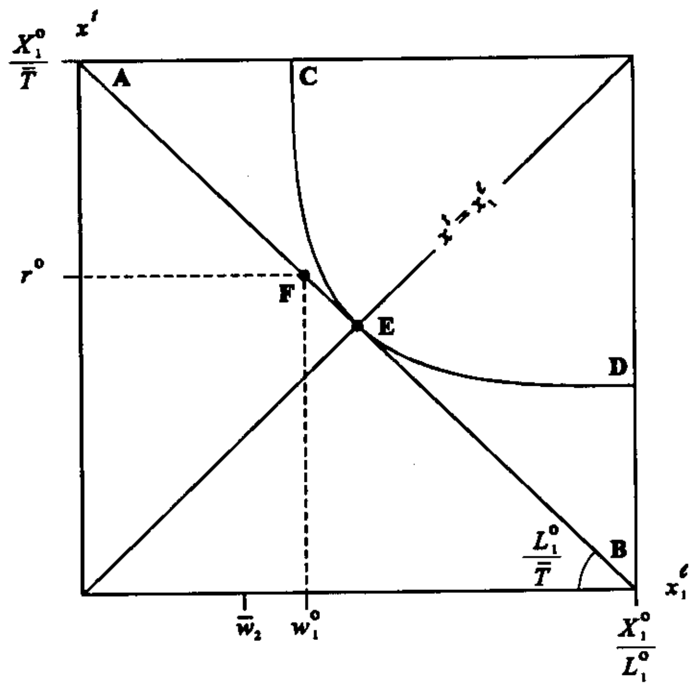

Figure 1: Optimal Consumption in an Isolated Rich Country.

6. Border Control Cost

The rich country prevents illegal immigration by facing potential migrants with immigration cost. Since illegal immigration will proceed for as long as $x_1^i > x_2^l$, the minimum cost per migrant that must be produced so that it is not in his or her interest to migrate depends once again on whether or not illegal immigrants receive the public transfer. If they do, using (4) and (33), we find that the minimum cost sufficient to prevent an illegal immigrant from entering the rich country is

$$m = x_1^l - x_2^l. \tag{14}$$

If, on the other hand, illegal immigrants do not receive the public transfer then that minimum cost becomes

$$m = w_1 - x_2^l \tag{15}$$

by (34).

For simplicity we assume that the border control expenditure E is proportional to the total immigration costs produced, that is, $E = CmL_2$ where $C \geq 0$. Therefore when illegal immigrants receive the public transfer the border control expenditure is expressed as

$$E = C\left(x_1^l - x_2^l\right) L_2 \tag{16}$$

and when they do not it reduces to

$$E = C\left(w_1 - x_2^l\right) L_2. \tag{17}$$

Although this cost structure is a 'black box', it has some sensible features. The border control cost increases with the income difference which provides the migrant with energy to climb a wall. If there is no income difference, or no potential illegal immigrants, the cost is zero. Finally, for $C = 0$ we can study the baseline case of costless enforcement.

7. EQUILIBRIUM POLICIES WHEN ILLEGALS RECEIVE THE PUBLIC TRANSFER

The government of the poor country is passive. Its only activity is to hand out any transfer it receives from the rich country so as to maximise the utility of its population while keeping a balanced budget. Thus our main object of study is the rich country. We are interested in characterising how costly border control affects equilibrium policies in regard to levels of immigration, the type of immigration control used, the levels of redistribution undertaken and the resultant inequality. We assume that these are determined in the context of two stages. At the first stage governments choose their policies. At the second stage, taking those policies and the location of other workers as given, workers migrate to maximise utility. We further assume that governments know perfectly well the consequences of their first–stage choices on second–stage migration.

We now begin the analysis of the system when illegal immigrants receive the public transfer. In that case the rich country is indifferent between legal or illegal immigrants as both are equally productive, both receive the same payment x_1^l, and the border control expenditure for a given level of immigration $(L_2^o - L_2)$ is the same whether or not that immigration is legal (see (16)). Migrants on the other hand prefer legal entry to avoid the migration cost associated with illegal entry. Given these preferences we assume that if migration is allowed it is legal migration, so choosing $L_1 > L_1^o$ is choosing to allow legal entry for some immigrants with further entry prohibited by the necessary immigration control expenditure. This assumption implies some measure of good will toward immigrants on the part of the rich country.

8. COSTLESS IMMIGRATION CONTROL

The first step in determining equilibrium behaviour for the rich country when illegal immigrants receive the public transfer is to specify feasible population partitions and consumption allocations given the policy instruments, i.e. to specify the CPF once the constraints associated with second–stage migration behaviour are imposed. We first examine the baseline case $C = 0$.

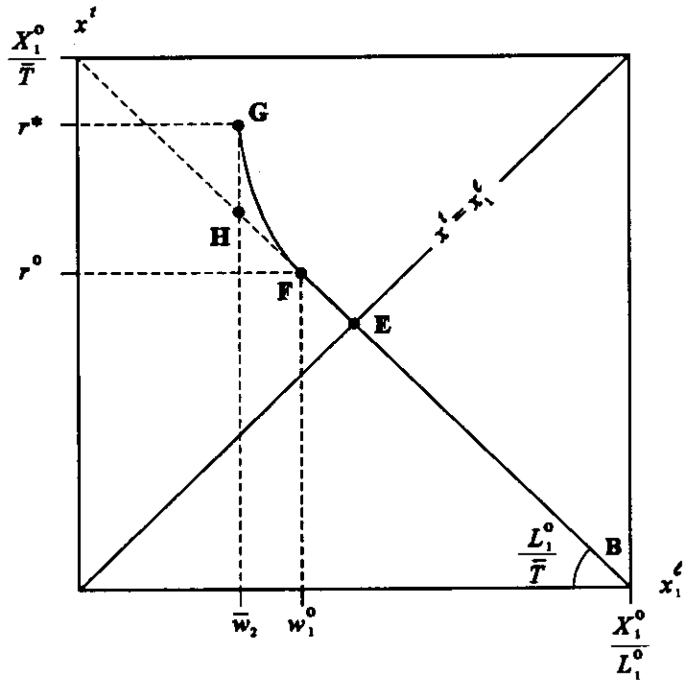

Figure 2: The CPF Under Costless Border Control.

The CPF for the rich country when $C = 0$ is given by GFB in figure 2.[22] To gain some intuition about this result, consider first the consumption possibilities with L_1^o. We know that when $C = 0$ no allocations on the CPF for the rich country would involve an international transfer because the costless border control provides a less expensive method of immigration control, i.e. $S = 0$. With the population partition at L_1^o the consumption possibilities are given by HB in figure 2. This differs from the case where migration is not feasible as in section four because, if the rich country attempted to support $x_1^l < \bar{w}_2$ with a sufficiently negative transfer σ, workers from the rich country would move to the poor country and consume $\bar{w}_2$ while the poor country would have no incentive to stop them even under costless border control since it is uncongested.

Consider now whether immigration can enlarge the rich country's consumption possibilities. Notice that the redistributive transfer is negative along HF, zero at F and positive along FB. Hence, as we move northwest from B to F, workers consume more than they produce and allowing immigration would lead to fewer resources for

[22]In the appendix we investigate the case $C > 0$ which, for $\lim C \to 0$, gives what we discuss here. An explicit proof of these results in the case $C = 0$ is available upon request.

the rich country's indigenous population. By contrast, as we move away from F along FH, the rich country would be making a transfer from workers to owners, and immigrants would consume less than what they produce. Thus, in maximising x^t for a given $x_1^l < w_1^\circ$, sufficient migrants are allowed entry so that the marginal benefit of an additional migrant w_1 is balanced by the corresponding marginal cost x_1^l which implies that, for allocations on the CPF with $x_1^l < w_1^\circ$, we have $w_1 = x_1^l$. Consequently $\sigma = 0$ and $x^t = r$. As lower x_1^l are to be supported, the marginal product of labour falls in the rich country, immigration brings L_1 closer to the efficient population partition and national product rises along FG, until the extreme allocation is reached at G where $x_1^l = w_1^* = \bar{w}_2$—hence $\sigma = 0$, $x^t = r^*$ and $L_1 = L_1^*$. Since the slope of GF is given by

$$\frac{dx^t}{dx_1^l} = -\frac{L_1}{\bar{T}} \tag{18}$$

for $L_1^\circ \leq L_1 \leq L_1^*$, it is steepest at $L_1 = L_1^*$ and has the slope of FB at $L_1 = L_1^\circ$ by (13). We conclude that the consumption possibility set is not convex.[23]

Allocations along FB are supported by a zero quota policy and the appropriate non–negative redistributive transfer. Allocations along FG are supported by a zero redistributive transfer and the appropriate quota level. At G quota do not bind because, there, we have $x_1^l = x_2^l$.

Although immigration in our model generates a larger total product and benefits both the immigrants and the owners, immigration without redistribution hurts the indigenous workers of the rich country who suffer a wage reduction. Since wages fall and rents increase in the rich country along FG in figure 2, immigration would increase the income inequality. The net loss suffered by indigenous workers from increased competition with the immigrants, together with the surplus created by a bigger economy, accrues to the owners in the rich country. These implications continue to be valid in the case of costly immigration control and they agree with the arguments of Borjas [3, 1996] concerning US immigration.

9. COLLAPSE OF THE WELFARE STATE

Figure 3 superimposes three welfare–maximising PICs on the CPF of figure 2. We begin with CD from figure 1, which is drawn under sufficient aversion to inequality to ensure that the optimal choice is once again at E where owners and workers of the rich country consume the same amount. Since immigration is detrimental to the rich country the equilibrium allocation is supported by applying a zero quota policy

[23] To the best of our knowledge this nonconvexity has gone unnoticed in the existing empirical and theoretical literature on immigration and immigration control policy. The nonconvexity arises because of the restriction that a government cannot tax–discriminate against someone on the basis of original residence. This is a defining characteristic of a quota system.

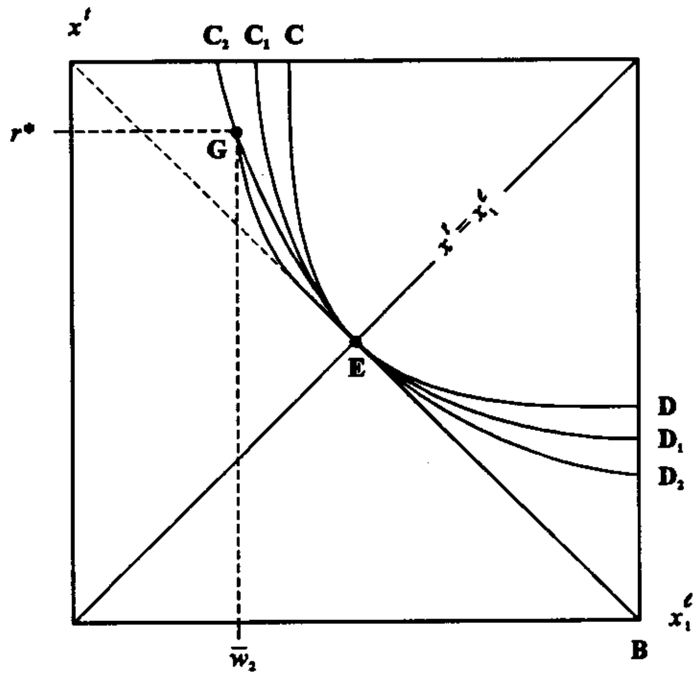

Figure 3: Optimal Consumption Under Costless Border Control.

in conjunction with the appropriate taxes and subsidies.[24] Now reduce the degree of aversion to inequality so that the PIC gradually flattens from CD through C_1D_1 to C_2D_2. Point E is the equilibrium allocation up to C_2D_2. But a further marginal reduction in the aversion to inequality causes a discontinuous transition to a new equilibrium at G, that is, a complete abandonment of border controls and the collapse of the welfare state. After this catastrophe the national product is maximised in the rich country, workers consume the same amount in both countries and redistribution is abandoned altogether to create the highest feasible level of income inequality between the two classes.

10. COSTLY IMMIGRATION CONTROL

In the appendix we prove that the consumption possibility frontier for the rich country with $0 < C < 1$ is given by curves such as GF_1B_1 in figure 4. Points G and H are carried over from figure 2. These are feasible points for all C because, there, the immigration control costs are zero irrespectively of C. Each variant of GF_1B_1 combines a clockwise rotation of GF through G and of HB through H in figure 2.

[24]These are given by $\tau = (r^o - w_1^o)/(1 + \bar{T}/L_1^o) > 0$ and $\sigma = (r^o - w_1^o)/(1 + L_1^o/\bar{T}) > 0$ which yield $x_1^t = x_1^l = X_1^o/(L_1^o + T_1)$.

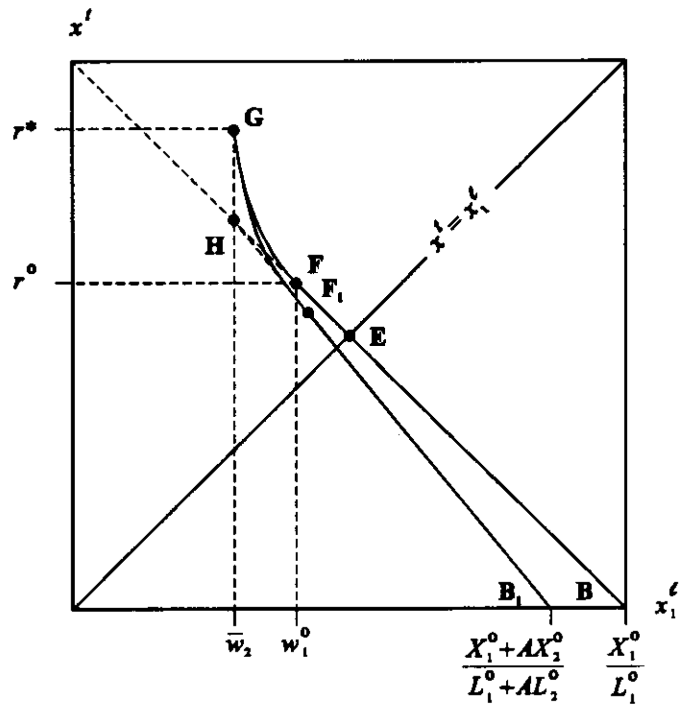

Figure 4: Effect of Border Control Cost on the CPF.

The intuition behind this result follows. Begin once again with the case where the population partition is fixed at L_1°. As long as $C < 1$ border control dominates international transfers as a method of immigration control, so $S = 0$. We can therefore write the government's budget constraint as $\bar{T}\tau - L_1^\circ\sigma - E = 0$ by (7) which, together with (3), (4) and (16) yields a national feasibility

$$X_1^\circ - C\left(x_1^l - \bar{w}_2\right) L_2^\circ = \bar{T}x^t + L_1^\circ x_1^l. \tag{19}$$

The graph of this equation is given by the line HB_1 with slope

$$\frac{dx^t}{dx_1^l} = -\frac{(L_1^\circ + CL_2^\circ)}{\bar{T}} \tag{20}$$

which is steeper than HB since redistributive transfers generate migration pressure on the border and more expensive border control makes that pressure more costly to control. The redistributive transfer σ is negative at H, it reaches zero where $x_1^l = w_1^\circ$ and then it becomes positive. Therefore, as in the costless control case, workers consume more than what they produce along $\mathrm{B}_1\mathrm{F}_1$. The logic as to when immigration expands

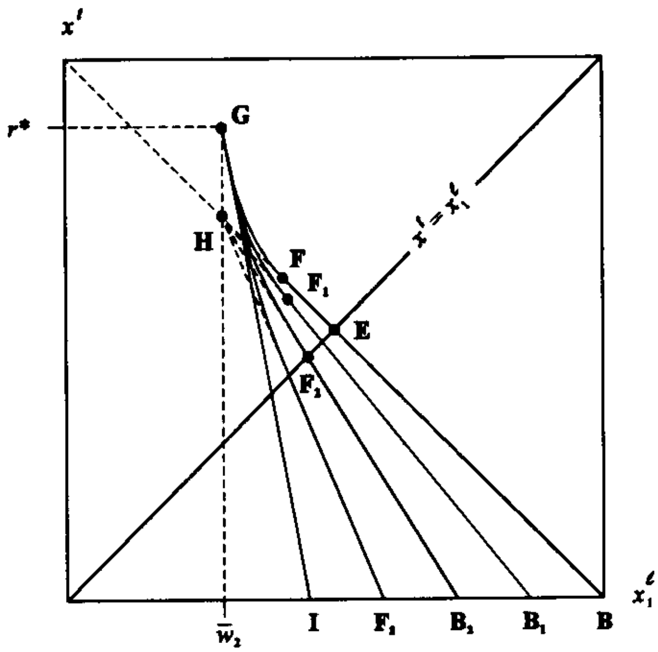

Figure 5: CPF Variants Under Costly Border Control.

the rich country's consumption possibilities remains as before—but with one addition. There is now a new benefit of allowing entry to an immigrant at a given x_1^l, namely, the associated reduction in border control costs $dE/dL_1 = E/L_2$. Thus along B_1F_1, and excluding F_1, the marginal costs of allowing entry dominate $\left(x_1^l > w_1 + E/L_2\right)$ but along GF_1, and including F_1 where $L_1 = L_1^\circ$, sufficient immigrants are allowed to equalise benefits and costs $\left(x_1^l - w_1 = E/L_2 = \sigma > 0\right)$. Under these circumstances, as we support lower x_1^l along F_1G, more immigrants are admitted raising the national product, σ falls and border control costs diminish until the extreme allocation is reached at G where $x_1^l = \bar{w}_2$ and, therefore, $E = \sigma = 0$, $x_1^l = w_1^* = \bar{w}_2$, $L_1 = L_1^*$ and $x^t = r^*$. In the appendix we show that the slope along GF_1 is given by

$$\frac{dx^t}{dx_1^l} = -\frac{(L_1 + CL_2)}{\bar{T}} \tag{21}$$

for $L_1^\circ \leq L_1 \leq L_1^*$, which is steepest at $L_1 = L_1^*$ for $C < 1$ and has the slope of the line F_1B_1 at $L_1 = L_1^\circ$ by (20).

Two of the CPF variants shown in figure 5 (GF_2B_2 and GF_3) differ by the position of the points F_i relative to the equal–consumption line. As C increases F_i moves downward, crosses the equal–consumption line and reaches the x–axis at F_3.[25] For still larger C which satisfy $C < 1$ the whole CPF is entirely given by a GF_i curve. As C approaches unity the curvature of GF_i diminishes until, at $C = 1$, the CPF becomes the straight line segment GI with slope

$$\frac{dx^t}{dx_1^l} = -\frac{\bar{L}}{\bar{T}} . \tag{22}$$

In the appendix we show that the CPF for $C > 1$ corresponds to the same line segment. Moreover, for $C > 1$, there is a policy switch from border control to international transfers because it becomes more expensive to keep illegal immigrants out by building a wall rather than to bring all the workers of the poor country up to the rich country's standard of living through a direct international transfer.[26] Under these circumstances the only objective of the rich country in regard to the population partition is to maximise the economy's output by allowing the efficient number of immigrants, $L_1 = L_1^*$, irrespectively of the chosen distribution between workers and owners. In the appendix we show that $S = L_2^*(x_1^l - \overline{w}_2)$. Thus at point G workers' wages are equalised so that $\sigma = S = 0$ but, as we move southeast from G, S and σ increase.

11. Maximising National Income

A rather common assumption in the trade literature about international migration is that governments aim to maximise national income. In our model this is captured by the extreme case of zero aversion to inequality, where PICs are linear with a slope of $-L_1^\circ/\bar{T}$. In this case G is the unique equilibrium allocation for any $C \geq 0$ due to the non–convexity. We know that point G is characterised by the efficient population partition, equal consumption $\bar{w}_2$ for all workers irrespectively of their residence, maximal inequality, and no immigration control expenditure. These implications are consistent with Ethier's [8, 1986] market–clearing model.

12. Equilibrium Inequality

Figure 6 compares an equilibrium allocation under costless border control with a corresponding allocation when $C > 0$. In this figure we avoid the possibility of corner

[25]Define $C_2 \equiv (r^\circ - w_1^\circ)/\left(\bar{L}(w_1^\circ - \bar{w}_2)/\bar{T} + (r^\circ - \bar{w}_2)\right)$ and $C_3 \equiv r^\circ/\left(\bar{L}(w_1^\circ - \bar{w}_2)/T_1 + r^\circ\right)$ and note that $0 < C_2 < C_3 < 1$. In the appendix we show that CPFs which are characterized by F_i above the equal–consumption line (e.g. GF_1B_1) correspond to $0 \leq C < C_2$. At $C = C_2$ the CPF is given by GF_2B_2 with point F_2 on the equal–consumption line, while at $C = C_3$ it is given by GF_3 with F_3 on the x–axis.

[26]To see that this is a theoretical possibility consider the case of a single potential immigrant ($L_2^\circ = 1$). Would it be cheaper to build a wall, or bring that potential migrant up to the rich country's standard? For some evidence that the same represents an empirical possibilitiy as well consider the American transfers made to Mexico during the recent peso crisis.

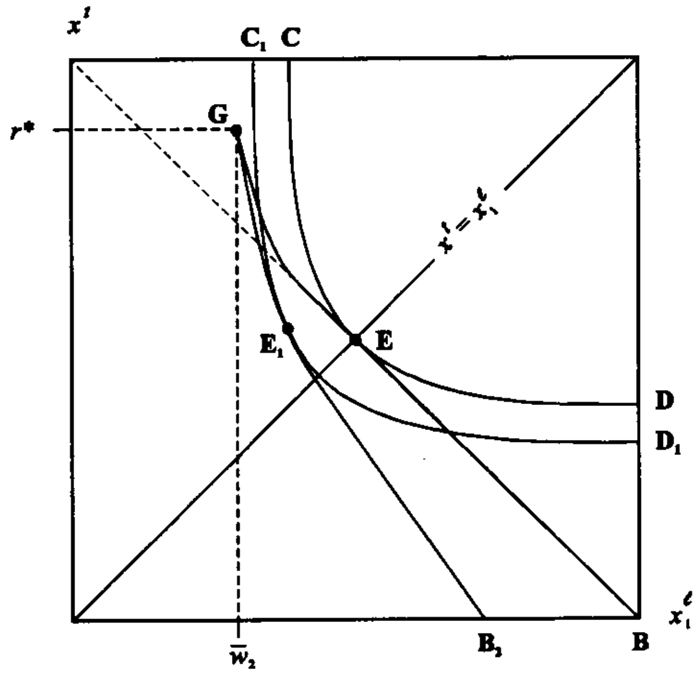

Figure 6: Border Control Cost Implies Equilibrium Inequality.

solutions by invoking a degree of aversion sufficient to ensure that both equilibria are unique and given by a simple tangency condition.[27] We observe immediately that border control expenditure forces inequality between the owners and the workers of the rich country as C increases from zero. Increasing cost implies larger inequality as the CPF rotates clockwise. The reason is that the price for a given amount of redistribution increases when border control becomes more expensive.

Let us now examine in more detail what can be said about the characteristics of equilibrium as C increases from zero. We begin with the case where C is sufficiently small so that the equilibrium allocation occurs on the straight–line segment of the CPF, for example, at or below F_1 in figure 5. Since $C > 0$ then $\sigma > 0$ and since $C < 1$ we know that border control is the only immigration control instrument used by the government of the rich country. We also know that prohibitive immigration quota are maintained throughout this range, so increasing border control costs do not lead

[27]Using (11) and (44) from the appendix, a sufficient condition is given by

$$\frac{d^2x^t}{d(x_1^l)^2} \underset{\text{PIC}}{=} \frac{\alpha L_1^o}{\overline{\overline{T}}x_1^l}\left(\frac{x^t}{x_1^l}\right)^{\alpha-1}\left(\frac{x^t}{x_1^l}-\frac{dx^t}{dx_1^l}\right) > -\frac{(1-C)^2}{w_1^l\overline{T}} \underset{\text{CPF}}{=} \frac{d^2x^t}{d(x_1^l)^2}$$

This is satisfied when the aversion to inequality is high enough.

to immigration. Using (11) and (20) we find that

$$\left.\frac{x^t}{x_1^l}\right|_{\text{equil}} = \left(\frac{L_1^\circ + CL_2^\circ}{L_1^\circ}\right)^{1/\alpha} \equiv \Delta^\circ \quad \text{for solutions on the straight–line segment of the CPF.} \tag{23}$$

From (23) we conclude that equilibrium inequality in the rich country increases in C for a finite aversion to inequality. Finally, as C increases, the level of redistributive public transfers must decrease. The reason is that wage and rental rates remain unchanged because there is no immigration, while an increasing amount of the owners' tax is used for border control. These and increased inequality account for the reduction in public transfers.[28] By contrast the well-being of workers in the poor country remains independent of C because there is neither emigration nor international transfers.

We next consider the case where the equilibrium allocation is found on the curved–line segment of the CPF, as would necessarily happen if F_i is found at or below the equal consumption line in figure 5 ($C \geq C_2$). Although it remains true that border control is the only immigration policy instrument applied by the government of the rich country and that $\sigma > 0$ for all points southeast of G, some of our previous results are significantly modified. From (11) and (21) we obtain

$$\left.\frac{x^t}{x_1^l}\right|_{\text{equil.}} = \left(\frac{L_1 + CL_2}{L_1^\circ}\right)^{1/\alpha} \equiv \Delta \quad \text{for solutions on the curved segment of the CPF} \tag{24}$$

where once again $\Delta > 1$ for a finite aversion to inequality. As already explained, we have $x_1^l - w_1 = \sigma = E/L_2$. Using this and (16) we find that $x_1^l - w_1 = C(x_1^l - \bar{w}_2)$. Therefore starting at an equilibrium such as E_1 in figure 7, if C increases and we hold x_1^l constant then w_1 must decrease or, equivalently, L_1 must increase. We conclude that L_1 at J is larger than at E_1. In the appendix (equation (41)) we show that L_1 increases as x_1^l decreases along a given CPF. Consequently both C and L_1 are larger at point K than at E_1, so that the slope of the CPF at K is steeper than the slope of the CPF at E_1 by (21) and $C < 1$. We also know by (11) that all PICs intersect any ray from the origin at points with the same slope. Thus the equilibrium must be found to the northwest of K at a point such as E_2. So increasing C in this range leads

[28] Using (3) and (4) in (23), then using (7) to eliminate τ and (16) to eliminate C we find that

$$\sigma = \frac{r^\circ - \Delta^\circ w_1^\circ - C(w_1^\circ - \bar{w}_2)L_2^\circ}{\Delta^\circ + (L_1^\circ + CL_2^\circ)/\bar{T}}$$

Since Δ° increases in C, σ decreases in C.

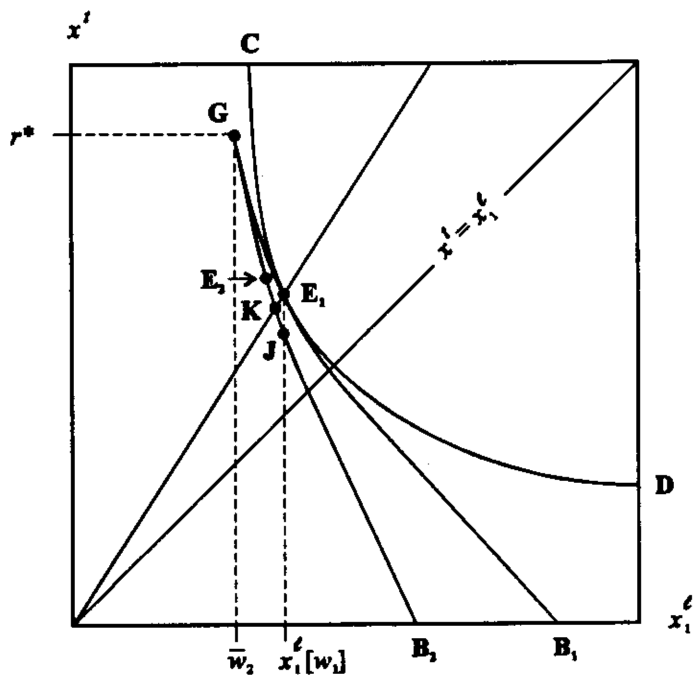

Figure 7: Increasing Border Control Cost Increases Optimal Inequality.

not only to greater inequality in the rich country but to an increase in immigration as well.

Although it seems reasonable to expect that increasing border control cost would cause declining redistributive transfers as before, we find it possible in the case where the equilibrium exists along the curved–line segment of the CPF that the opposite can also happen. To see this possibility use (3) and (4) in (24), then (7) to eliminate τ. Taking into account that $E = L_2\sigma$ we have

$$\sigma = \frac{r - \Delta w_1}{\Delta + \bar{L}/\bar{T}} > 0 \; . \tag{25}$$

Consider now the case of an infinite aversion to inequality where $\Delta = 1$. By the same arguments as above larger C implies larger L_1 at the intersections between a ray through the origin and corresponding CPFs. Since larger L_1 implies smaller w_1 and larger r we conclude using (25) that under infinite aversion to inequality both L_1 and σ increase with C. In order to gain some intuition notice that there are two ways of adjusting when border control becomes more expensive. One is to reduce σ, the other is to allow immigration. Immigration has the secondary effect of making the owners richer and the workers poorer, thereby increasing the income inequality.

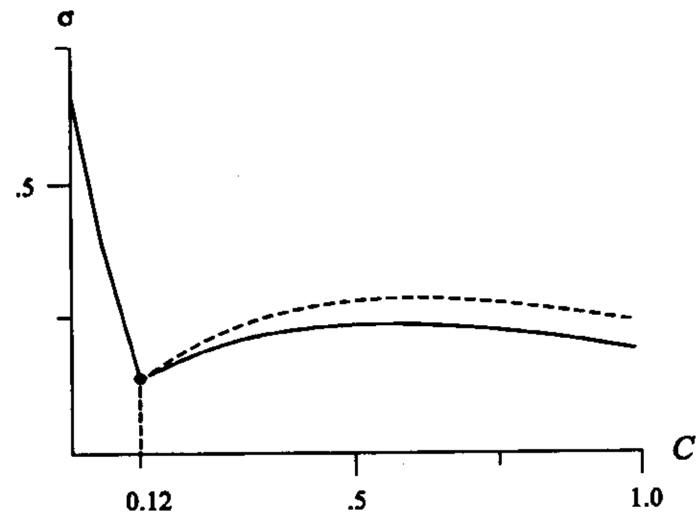

Figure 8: Numerical Example.

It is precisely this effect that allows for the increase in redistributive transfers as a reaction to increasing border control expense.

Figure 8 illustrates the relationship between the equilibrium public transfer and the border control expense using a numerical example which is based on a quadratic production technology and $\alpha = 1$. Equilibria on the straight–line segment of the CPF correspond to $0 < C \leq 0.12$, while those on the curved–line segment of the CPF correspond to $0.12 < C < 1$. The solid line represents σ for $0 < C < 1$. The size of the redistributive public sector measured by expenditure $L_1\sigma$ is given by the solid line for $0 < C \leq 0.12$ (the assumption is $L_1^o = 1$) and by the dashed line for $0.12 < C < 1$ (where $L_1 > 1$). The qualitative structure of this graph precisely matches our previous discussion. In the same example the total expenditure on immigration control E first increases from zero with C and then declines for $C > 0.55$.[29] At the same time, as C increases, x_1^l becomes smaller while x^t becomes larger for $0 < C < 1$. Therefore in this numerical example we find that the rich get richer even though increasing resources are used for border control, which implies not only that inequality does increase as expected from our theoretical analysis but also that both the increased cost and a higher standard of living for the owners is achieved at the expense of the workers.[30]

[29]That total cost eventually falls as border control becomes more expensive reflects a consumer buying less of something when its price increases. The total cost declines to zero at $C = 1$ if the corresponding welfare maximum is at point G in figure 7.

[30]The absolute increase in equilibrium x^t due to an increase in C, in this example, is not a general result. Consider the equilibrium with $\alpha \rightarrow \infty$; one simply moves down the equal–consumption line

We now turn to the consumption of original workers in the poor country for the case under consideration. In section six we have assumed that when illegals receive the public transfer there is only legal immigration because the rich country is indifferent and because the workers of the poor country prefer legal immigration. Under these circumstances the workers who are accepted as legal immigrants benefit by both an increase in wages and in public benefits, while those who remain in the poor country receive only $\bar{w}_2$ because there are no international transfers. However if the rich country allowed no legal immigrants but did not carry out the necessary border control expenditure to enforce the quota, thus attaining the desired L_1 through illegal immigration, then the well-being of all original residents of the poor country would once again be independent of C. On the one hand poor workers who stayed at home would continue to receive $\bar{w}_2$. On the other hand illegal immigrants would have to pay the migration cost which, using (14), would reduce their consumption to $\bar{w}_2$. By contrast nothing would change in the rich country. Invoking (16) we observe that border control expenditure would be the same as under legal immigration because in both cases the rich government's objective is to prevent the same number L_2 of poor workers from entering the rich country and because the difference in workers' consumption $x_1^l - \bar{w}_2$ is the same whether immigrants are legal or not.

Finally consider the case $C \geq 1$. Then, as explained in section nine, there is a policy switch from border control to international transfers and all allocations are on the line segment GI in figure 5. These are characterised by $L_1 = L_1^*$ (efficiency) and by $S = L_2^*(x_1^l - \overline{w}_2) = L_2^*\sigma$. Using (11) and (22) we conclude that the equilibrium allocation will be found at

$$\left.\frac{x^t}{x_1^l}\right|_{\text{equil}} = \left(\frac{\bar{L}}{L_1^\circ}\right)^{1/\alpha} \equiv \overline{\Delta} \quad \text{for} \quad C \geq 1. \tag{26}$$

Clearly both σ and S are increasing in the aversion to inequality. Moreover, for any given and finite aversion to inequality, equilibrium inequality in the rich country is larger under an international transfer regime than under a border control regime because $\overline{\Delta} > \Delta$ by (24) and (26). Also notice that the level of the public transfer can still increase as an increasing C causes a switch in immigration control regimes. For $C \geq 1$ we have

$$\sigma = \frac{r_1^* - \overline{\Delta} w_1^*}{\overline{\Delta} + \bar{L}/\bar{T}} \, . \tag{27}$$

If we invoke once again the case of an infinite aversion to inequality then σ from (27) is larger than σ from (25) because L_1^* in (27) is larger than L_1 in (25). Once again

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as C increases.

this happens because owners become richer and workers poorer in the rich country as immigration proceeds.

In summary, we have shown that as border control becomes more expensive inequality in the rich country increases, public transfers and the size of the redistributive public sector may increase or decrease, some immigration is permitted, and international transfers may be implemented to reduce the migration pressure.

13. COLLAPSE OF THE WELFARE STATE REVISITED

Our analysis in sections ten and twelve suggests that a lower degree of aversion to inequality is not the only reason for the collapse of the welfare state when border control is costly. Indeed the same can happen with sufficiently low but fixed aversion as the CPF in figure 5 rotates clockwise for some reason. Thus, using (20), we observe that a marginal increase in border control cost C or in the initial population of potential migrants L_2° may cause the collapse of the welfare state.[31]

14. EXCLUDING ILLEGALS FROM THE PUBLIC TRANSFER

When the rich country implements a policy to exclude illegal immigrants from the public transfer (34), (8) and (17) replace (33), (7) and (16) respectively.[32] The first point here is that the government of the rich country now prefers illegal immigration over legal as both types are equally productive while legal immigrants are more expensive. It follows that if immigration is allowed at all it will be illegal immigration, which implies that redistributive transfers in the rich country will be strictly limited to the indigenous population. This is a fundamental policy change which has deep consequences in terms of both efficiency and distribution because excluding illegal immigrants from the public transfer allows the rich country to free its domestic output–maximising objective from its redistributive objective. The instruments σ and τ are now a complete set of lump–sum taxes which allow the rich country to divide at will any given total product among its owners and indigenous workers.

Using (1) (3) and (4) on the government's budget constraint (8) yields the national feasibility constraint $X_1 - (L_1 - L_1^{\circ})w_1 - E - S = T_1 x^t + L_1^{\circ} x_1^l$. Since the output–maximising objective of the rich country's government has become independent of its redistributive objective, the rich country can maximise national income $X_1 - (L_1 - L_1^{\circ})w_1 - E - S$ directly with respect to immigration. Notice that, for $L_1 = L_1^{\circ}$, $X_1 - (L_1 - L_1^{\circ})w_1$ is constant in L_1 but supporting this partition requires immigration

[31] The effect of a poorer poor country (a decrease in $\overline{w}_2$) is not so clear because it involves conflicting effects in terms of collapse: on the one hand there is a parallel inward shift of the straight–line segment of the CPF, which works in favour of the collapse (see (20)); on the other, there is a leftward movement of point G which works against the collapse.

[32] This section will assume that a policy of exclusion is time–consistent in the sense that potential illegal immigrants believe that the rich country would deny their children access to public schools and hosptials.

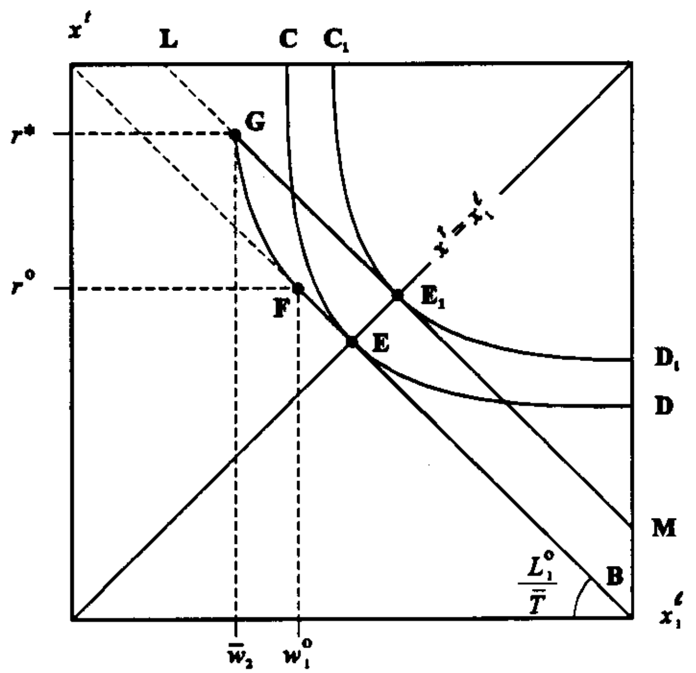

Figure 9: Inclusion and Exclusion Policies Compared.

control expenditures. In consequence entry is allowed by setting $E = S = 0$. For $L_1 > L_1^o$, $X_1 - (L_1 - L_1^o)w_1$ is increasing with L_1 until the efficient population partition $L_1 = L_1^*$ is achieved where wages are equalised and there is no pressure on the border. Therefore solving the problem in this case leads to the conclusion that $L_1 = L_1^*$, $w_1 = \bar{w}_2 = w^*$ and $S = E = 0$, so that the CPF is now determined by

$$X_1^* - (L_1^* - L_1^o)\bar{w}_2 = T_1 x^t + L_1^o x_1^l \tag{28}$$

which is independent of the border control cost.[33]

Figure 9 compares the main policy alternatives of including and excluding illegals from the public transfer under costless border control. When illegal immigrants are included the CPF is given by GFB as in figure 2. Since LM in figure 9 represents the graph of (28), the CPF when illegals are excluded from the public transfer is the portion GM on this line segment. Notice how owners and indigenous workers benefit from the surplus created by the illegal immigrants—compare GM with AB in figure 1. Also notice that under both alternatives in that figure the redistributive policy equalises consumption of owners and indigenous workers in the rich country. And

[33]The proof of these results is available upon request.

although this conclusion requires a sufficiently high degree of aversion to inequality when illegal immigrants receive the public transfer, it holds under any positive degree of aversion when illegal immigrants are excluded. Stated otherwise, excluding the illegal immigrants from the public transfer eliminates any possibility of collapse for the welfare state under any positive degree of aversion to inequality. Our conclusions are further strengthened under costly border control where the threat of collapse increases when illegals are included, resources available for redistribution decline and the redistributive objective cannot be applied perfectly well by the government of the rich country thus leading to inequality. Finally notice that implementing the exclusion policy entails a hidden immigration agenda by the government of the rich country. For under this policy the rich country takes the toughest stance on immigration quota—a prohibitive one—with no intent whatsoever of enforcing it. This is in stark contrast to the policy adopted when illegals are included in the public transfer. The logic is that allowing illegal immigration under a policy of exclusion is an indirect approach to avoiding the constraint that prevents tax discrimination against legal immigrants inherent in a quota system of immigration control.

It is clear that the original residents of the rich country as a whole prefer the exclusion policy under the redistributive objectives of section four and a sufficient degree of aversion to inequality. Although the same is true for the indigenous workers alone in the rich country, owners will prefer the inclusion policy when border control cost is high enough or aversion to inequality is low enough to ensure higher rent than the one achieved at E_1 in figure 9. Indeed the owners globally prefer conditions leading to the collapse of the welfare state. Turning to the residents of the poor country, we notice that their consumption remains unchanged under the exclusion policy. We also notice that exclusion can hurt them when $C \geq 1$ as it precludes international transfers which are necessary for implementing an inclusion policy. But if our model was extended to diminishing marginal products in the poor country then all the indigenous workers of the poor country would prefer the exclusion policy for a sufficiently low C because it raises their wage by emigration.

15. Policy Parables

Consider the US immigration experience from the viewpoint provided by our model.

Until the 1920's there was little immigration control and public redistribution. If we represent the social preferences of that period by sufficiently low aversion to inequality then, for any cost of border control, the equilibrium policy is unrestricted immigration (point G in figure 5). The logic is that the immigrants are beneficial to the society as they increase national income and, in particular, the immigration is favoured by the owners as it provides them with cheap labour. This represents the 'Statue of Liberty' period.

The first serious attempts to control immigration and to provide public help for the poor in the US occured during the 1920s and 1930s. Imagine that there is a continually increasing degree of aversion to inequality which arises out of the political process. For a given cost of border control, say, $C = 0$, increasing aversion implies a shift of the equilibrium allocation from G toward F in figure 5. In other words the society begins to build a welfare state by restricting the immigration of less–skilled labour, thereby raising the wage of indigenous workers. At F there is no economic migration of labour, which roughly corresponds to the immigration restrictions that almost closed the US border during the 1930s. For higher degree of aversion to inequality these immigration restrictions are supplemented by transfers from the rich to the poor (points between F and E in figure 5). This period represents the rise of the welfare state.

Until recent times US immigration control was relatively easy because the vast majority of potential immigrants came from Europe on transatlantic liners with few ports of entry. Now, however, when the vast majority of potential immigrants can cross into the US anywhere along its border with Mexico, immigration control has become expensive. More generally, border control is now relatively difficult because of fast population growth in less developed countries, increased international economic disparities, better information in poor countries about the degree of those disparities, and an improved transportation technology. Taking these into account imagine that border control expense continually increases. At the beginning, as the CPF in figure 5 rotates clockwise, migration is still prohibited, the public redistributive sector diminishes and inequality between the rich and the poor grows. Before the redistributive transfer disappears the government economises on increased border control expenditure by allowing some entry—either legal or illegal. Owners favour the immigration as it makes them richer while workers resist that policy. This period of growing inequality represents the decline of the welfare state.

Now consider possible endings for this story as border control expenditure still grows. It can become so large that paying potential immigrants to stay at home would be cheaper than building walls to keep them out (a CPF represented by GI in figure 5). For a sufficiently small degree of aversion to inequality the rich country returns to point G where there is neither redistribution nor border controls. This would correspond to the demise of the welfare state. For a larger degree of aversion to inequality an alternative ending is the informal federation of the two countries, that is, a common labour market implemented by the absence of border controls and a common welfare policy through international transfers.[34]

[34]The transfers can be less explicit, for example, trade concessions that would not otherwise be in the interest of a country such as the US.

A. APPENDIX

A.1. Feasibility. In this appendix we characterise the CPF for the case $C > 0$ where illegal immigrants receive the public transfer. We denote $\widehat{L}_1$ the population of indigenous workers and legal immigrants, so that $\widehat{L}_1 = L_1^{\circ}$ represents the imposition of prohibitive quota. We assume that if there is migration it is legal because, as noted in the main text, the rich country is indifferent to immigrant type while migrants prefer legal immigration. Choosing to support a population partition at which workers in the rich country are richer than workers in the poor country—a binding quota—is costly. Upon rearrangement of (16) we find that the minimum border control expenditure required to support the population partition L_1 is given by $x_1^l - E/CL_2 = x_2^l$ where $E/CL_2 = m$. Feasible population partitions and consumption allocations depend first on whether there is migration and, if there is, on the direction that migration takes. We therefore proceed by discussing three separate cases (A, B, C) specified according to whether the initial population is smaller than, equal to, or larger than the migration equilibrium partition. For each case we determine the constraints on instruments and equilibrium consumptions of workers in the two countries which are consistent with the case. Throughout we use a superscript e to denote variables at a migration equilibrium.

CASE A^e ($L_1^{\circ} < L_1^e$): In this case there is legal immigration to country one, which requires that $x_1^{l\circ} - x_2^{l\circ} > 0$ and that $\widehat{L}_{1|\mathrm{A}} > L_1^{\circ}$. Using (4) and (9) on the inequality we find

$$w_1^{\circ} + \sigma_{\mathrm{A}} > \overline{w}_2 + S_{\mathrm{A}}/L_2^{\circ}. \tag{29}$$

Given $\widehat{L}_{1|\mathrm{A}}$, σ_{A}, and S_{A} consistent with (29), individuals from country two will emigrate for as long as $x_1^l > x_2^l$ and $L_1 < \widehat{L}_{1|\mathrm{A}}$. Assuming stability of the migration process, $x_{1|\mathrm{A}}^l - x_{2|\mathrm{A}}^l$ decreases as $L_{1|\mathrm{A}}$ increases. By $w_1' \equiv \partial w_1/\partial L_1 < 0$ and as long as S_{A} is not too large the migration process must be stable (at $S_{\mathrm{A}} = 0$ it is stable). Therefore a migration equilibrium involving only legal immigrants is attained at

$$x_{1|\mathrm{A}}^{le} \geq x_{2|\mathrm{A}}^{le} \text{ and } L_{1|\mathrm{A}}^e \leq \widehat{L}_{1|\mathrm{A}} \text{ such that } \left(x_{1|\mathrm{A}}^{le} - x_{2|\mathrm{A}}^{le}\right)\left(L_{1|\mathrm{A}}^e - \widehat{L}_{1|\mathrm{A}}\right) = 0. \tag{30}$$

With $x_{1|\mathrm{A}}^{le} > x_{2|\mathrm{A}}^{le}$ we have $L_{1|\mathrm{A}}^e = \widehat{L}_{1|\mathrm{A}}$. With $x_{1|\mathrm{A}}^{le} = x_{2|\mathrm{A}}^{le}$ chosen, $L_{1|\mathrm{A}}^e < \widehat{L}_{1|\mathrm{A}}$ is possible but this does not increase what is feasible (non–binding quota) so for simplicity we assume $L_{1|\mathrm{A}}^e = \widehat{L}_{1|\mathrm{A}}$ in all cases. If $x_{1|\mathrm{A}}^{le} - x_{2|\mathrm{A}}^{le} > 0$ then enforcing $L_{1|\mathrm{A}}^e = \widehat{L}_{1|\mathrm{A}}$ costs—if $E_{\mathrm{A}} = 0$ then legal immigration would be supplemented by illegal immigration. The minimum border control expenditure required to prevent illegal migration is given by

$$x^{le}_{1|A} - E_A/CL^e_{2|A} = x^{le}_{2|A}. \tag{31}$$

With (31) imposed by $E_A \geq 0$ and $L^e_{1|A} = \widehat{L}_{1|A}$, (30) is satisfied and, by migration stability, (29) is satisfied. So for given S_A, E_A and σ_A, (31) determines a $L^e_{1|A} = \widehat{L}_{1|A}$. These then determine the equilibrium consumptions for workers in each country by (4) and (9). Worker consumptions, in turn, together with (3) and (7) can be used to determine the equilibrium consumption for owners. The logic of (31) is that when its LHS is larger residents of the poor country could benefit by illegal immigration, and when it is smaller the rich country spends more than required on border control in order to support $L^e_{1|A} = \widehat{L}_{1|A}$.

CASE B^e ($L^o_1 = L^e_1$): This case requires that there is no migration. The minimum expenditure that prevents illegal immigration from 2 to 1 at the initial partition is given by

$$x^{lo}_{1|B} - E_B/C(L^o_2) = x^{lo}_{2|B}. \tag{32}$$

Since country 2 has no incentive to use border controls we also require $x^{lo}_{1|B} \geq x^{lo}_{2|B}$ because, otherwise, there would be migration from 1 to 2. By the restriction $E_B \geq 0$, imposing (32) implies $x^{lo}_{1|B} \geq x^{lo}_{2|B}$. Once $L^e_{1|B}$ is determined by the definition of the case, equilibrium consumptions for workers and owners can be determined as before.

CASE C^e ($L^o_1 > L^e_1$): Applying an argument exactly analogous to that of case A^e, we obtain

$$w^o_1 + \sigma_C < \overline{w}_2 + S_C/L^o_2 \tag{33}$$

$$x^{le}_{2|C} \geq x^{le}_{1|C} \text{ and } L^e_{2|C} \leq \widehat{L}_{2|C} \text{ such that } \left(x^{le}_{2|C} - x^{le}_{1|C}\right)\left(L^e_{2|C} - \widehat{L}_{2|C}\right) = 0. \tag{34}$$

But as noted under case B^e country 2 has no incentive to impose a restrictive quota, costly or otherwise, so we choose $\widehat{L}_{2|C} = \overline{L} > L^e_2$ (which is not restrictive) and therefore

$$x^{le}_{2|C} = x^{le}_{1|C}. \tag{35}$$

The population partition is then given as an implicit function of (35) and the consumption allocation for workers and owners can be determined as before. The logic here is that if $x^{le}_{1|C} > x^{le}_{2|C}$ with $L^e_{1|C} < L^o_1$ then workers from 1 have migrated against their own interest and if $x^{le}_{1|C} < x^{le}_{2|C}$ insufficient workers have migrated from 1.

A.2. The CPF. Determination of the rich country's CPF will be based on the three cases above. This approach is necessary because the constraints in the optimisation problem change (consider (31) and (35)). Each case will determine a CPF conditional on the case. These conditional CPFs will then be compared to determine the CPF for the rich country.

CASE A^{e^*} $(L_1^o < L_1^{e^*})$: The problem is to choose $\left(x_{1|A}^{le}, x_A^{te}, L_{1|A}^e, S_A \geq 0, E_A \geq 0\right)$ that maximises x^{te} subject to

$$\begin{aligned} x_1^{le} &= \tilde{x}_1 && (a) \\ X^e &= L_1^e x_1^{le} + \overline{T} x^{te} + S + E && (b) \\ x_1^{le} &\underset{(31)}{=} \overline{w}_2 + S/L_2^e + E/CL_2^e && (c) \end{aligned} \tag{36}$$

where $\tilde{x}_1$ is a predetermined level of consumption for workers in country 1, where (36(b)) comes from using (3) and (4) in (7) and where (36(c)) uses (9). The necessary conditions for this problem are

$$\begin{aligned} x^{te}: && 1 - \lambda_A^{e^*}\overline{T} &= 0 && (a) \\ x_1^{le}: && \varphi_A^{e^*} - \lambda_A^{e^*} L_{1|A}^{e^*} + \mu_A^{e^*} &= 0 && (b) \\ L_1^e: && \lambda_A^{e^*}\left(w_{1|A}^{e^*} - x_{1|A}^{le^*}\right) - \mu_A^{e^*}(S_A/(L_{2|A}^e)^2 + E_A/C(L_{2|A}^e)^2) &= 0 && (c) \\ S: && -\lambda_A^{e^*} - \mu_A^{e^*}/L_{2|A}^{e^*} \leq 0,\ S_A \geq 0 \text{ and } (\lambda_A^{e^*} + \mu_A^{e^*}/L_{2|A}^{e^*})S_A &= 0 && (d) \\ E: && -\lambda_A^{e^*} - \mu_A^{e^*}/CL_{2|A}^{e^*} \leq 0,\ E_A \geq 0 \text{ and } (\lambda_A^{e^*} + \mu_A^{e^*}/CL_{2|A}^{e^*})E_A &= 0 && (e) \\ \varphi: && x_{1|A}^{e^*} - \tilde{x}_1 &= 0 && (f) \\ \lambda: && X_{1|A}^{e^*} - L_{1|A}^{e^*} x_{1|A}^{le^*} - \overline{T} x_A^{te^*} - S_A - E_A &= 0 && (g) \\ \mu: && x_{1|A}^{le^*} - \overline{w}_2 - S_A/L_{2|A}^{e^*} - E_A/CL_2^e &= 0 && (h) \end{aligned} \tag{37}$$

where φ, λ, and μ are the multipliers associated with the first, second and third constraints in (36) respectively.

If $S_A = E_A = 0$ then (37(c, f, h)) give $\tilde{x}_1 = x_{1|A}^{le^*} = w_{1|A}^{e^*} = x_{2|A}^{e^*} = \overline{w}_2$, implying $L_{1|A}^{e^*} = L_1^*$. These then can be used in (37(g)) to determine $x_A^{te^*}$. Because $x_{1|A}^{le^*} = w_{1|A}^{e^*}$ we have $\sigma = 0$. These apply only to $\tilde{x}_1 = \overline{w}_2$, the rest of the analysis in case A^{e^*} applies to $\tilde{x}_1 > \overline{w}_2$ (recall $\tilde{x}_1 = x_1^l < \overline{w}_2$ is not consistent with the case).

If $\tilde{x}_1 > \overline{w}_2$ then from (37(f,h)) at least one of S_A or E_A must be positive. We now determine the type of immigration control employed. When $C < 1$, given that at least one of S_A or E_A must be positive, we have from (37(d,e)) that $E_A > 0$ and $S_A = 0$. When $C > 1$ we have $E_A = 0$ and $S_A > 0$. Finally, when $C = 1$ the rich country is indifferent between immigration control regimes and we assume international transfers are employed as the poor country would prefer them.

CASE $A^{e^*}(1)$ $\left(L_1^o < L_1^{e^*}\right)$ and $C \geq 1$:

Here $S_A > 0$ and $E_A = 0$. From (37(d)) $-\lambda_A^{e^*} L_{2|A}^{e^*} = \mu_A^{e^*}$. Using this and (37($f$)) in (37($c$)) gives $w_{1|A}^{e^*} - \tilde{x}_1 + S_A/L_{2|A}^{e^*} = 0$. Combining it with (37($f,h$)) we have $w_{1|A}^{e^*} = \overline{w}_2$ implying $L_{1|A}^{e^*} = L_1^*$. Taking into account $w_{1|A}^{e^*} - \tilde{x}_1 + S_A/L_{2|A}^{e^*} = 0$, (4) and (9) we find that if $\tilde{x}_1 - \overline{w}_2 > 0$, $S_A = \sigma L_2^* > 0$, $x_{1|A}^{le^*} = x_{2|A}^{le^*} = \tilde{x}_1$ and $x_A^{te^*} = (X_1^* + X_2^* - \overline{L}\tilde{x}_1)/\overline{T}$, which implies

$$\frac{\partial x_A^{te^*}}{\partial \tilde{x}_1} = -\frac{\overline{L}}{\overline{T}} \, . \tag{38}$$

CASE $A^{e^*}(2)$ $\left(L_1^o < L_1^{e^*}\right)$ and $C < 1$:

Here $E_A > 0$ and $S_A = 0$. From (37(e)) $-\lambda_A^{e^*} C L_{2|A}^{e^*} = \mu_A^{e^*}$. Using this and (37($f$)) in (37($c$)), we have

$$w_{1|A}^{e^*} - \tilde{x}_1 + E_A/L_{2|A}^{e^*} = 0. \tag{39}$$

Conditions (39) and (37(g,h)), with (37(f)) substituted in, represent a system of three equations in three unknowns $(L_{1|A}^{e^*}, E_A, x_A^{te^*})$. However, this system is recursive. Using (37(h)) to eliminate $E_A/L_{2|A}^{e^*}$ in (39) we derive

$$C(\tilde{x}_1 - \overline{w}_2) = \tilde{x}_1 - w_{1|A}^{e^*} \tag{40}$$

which is one equation in one unknown $L_{1|A}^{e^*}$. First it is clear that $\overline{w}_2 < w_{1|A}^{e^*}$ because $\tilde{x}_1 > \bar{w}_2$ and $C < 1$ so this case applies only to $L_1^o < L_{1|A}^{e^*} < L_1^*$. Equation (40) yields a unique solution for $L_{1|A}^{e^*}$ as it is linear in $w_{1|A}^{e^*}$ and $w_{1|A}^{e^*\prime} < 0$. From this we obtain

$$\frac{dL_{1|A}^{e^*}}{d\tilde{x}_1} = \frac{1 - C}{w_{1|A}^{e^*\prime}} < 0. \tag{41}$$

Because (37(g)) is linear in E_A and does not involve $x_A^{te^*}$, it yields a unique E_A given the unique $L_{1|A}^{e^*}$. Taking the derivative of this equation and using (41) yields

$$\frac{dE_A}{d\tilde{x}_1} = C L_{2|A}^{e^*} - \frac{E_A(1 - C)}{L_{2|A}^{e^*} w_{1|A}^{e^*\prime}} > 0. \tag{42}$$

These unique solutions can then be introduced to (37(g)) which is linear in $x_A^{te^*}$ to derive a unique solution for $x_A^{te^*}$. Upon differentiation, and using (40)–(42) we obtain

$$\frac{dx_A^{te^*}}{d\tilde{x}_1} = -\frac{L_{1|A}^{e^*} + CL_{2|A}^{e^*}}{\overline{T}} < 0. \quad (43)$$

Notice that this slope approaches the slope in (38) as $C \to 1$, and for $C < 1$ it is steepest at $L_{1|A}^{e^*} = L_1^*$. In what follows the curvature of this segment of the CPF will be important. Using (41) the second derivative is

$$\frac{d^2x_A^{te^*}}{d\tilde{x}_1^2} = -\frac{(1-C)^2}{\overline{T}w_{1|A}^{e^*\prime}} > 0. \quad (44)$$

That is, this segment of the CPF is not concave.

CASE B$^{e^*}$ $(L_1^\circ = L_1^{e^*})$: The problem is to choose $\left(x_{1|A}^{le}, x_A^{te}, S_A \geq 0, E_A \geq 0\right)$ that maximises x^{te} subject to

$$\begin{aligned} x_1^{le} &= \tilde{x}_1 && (a) \\ x_1^{le} &\underset{(32)}{=} \overline{w}_2 + S/L_2^\circ + E/CL_2^\circ && (b) \\ X^\circ &= L_1^\circ x_1^{le} + \overline{T}x^{te} + S + E. && (c) \end{aligned} \quad (45)$$

Thus the problem is as in case A$^{e^*}$ except that $L_{1|B}^e = L_1^\circ$, so L_1° replaces L_1^e in the constraints and $L_{1|B}^e$ is not a choice variable. With these modifications the necessary conditions are in (37).

If $S_B = E_B = 0$ then the system is solved by $\tilde{x}_1 = x_{1|B}^{e^*} = x_{2|B}^{e^*} = \overline{w}_2$ (by (37(f,h))), $L_{1|B}^{e^*} = L_1^\circ$ (by the definition of the case), and $x_A^{te^*} = (X_1^\circ - L_1^\circ\overline{w}_2)/\overline{T}$ by (37(g)). The underlying $\sigma_B = \overline{w}_2 - w_1^\circ < 0$. These apply only to $\tilde{x}_1 = \overline{w}_2$ while the rest of the analysis applies to $\tilde{x}_1 > \overline{w}_2$.

If $\tilde{x}_1 > \overline{w}_2$ then from (37(h)) at least one of S_A or E_A must be positive.

CASE B$^{e^*}$(1) $(L_1^\circ = L_1^{e^*})$ and $C \geq 1$: Here we have $L_1^\circ = L_{1|B}^{e^*}$, and $E_A = 0$. From (37(h)) $S_A = (\tilde{x}_1 - \overline{w}_2)L_2^\circ > 0$, $x_{1|A}^{le^*} = x_{2|A}^{le^*} = \tilde{x}_1$ and $x_A^{te^*} = (X_1^\circ - \overline{L}\tilde{x}_1)/\overline{T}$, which also yields (38). From (4), $\sigma_B = \tilde{x}_1 - w_1^\circ$.

CASE B$^{e^*}$(2) $(L_1^\circ = L_1^{e^*})$ and $C < 1$: Here $L_1^\circ = L_{1|B}^{e^*}$ and $S_A = 0$. By a similar (but simpler) argument to that applied for case A$^{e^*}$(2), the solution is $E_A = C(\tilde{x}_1 - \overline{w}_2)L_2^\circ > 0$ for $\tilde{x}_1 > \overline{w}_2$, $x_{1|A}^{le^*} = \tilde{x}_1$, $x_{2|A}^{le^*} = \overline{w}_2$, and

$$x_B^{te^*} = (X_1^\circ + CL_2^\circ\overline{w}_2 - (L_1^\circ + CL_2^\circ)\tilde{x}_1)/\overline{T} \quad (46)$$

which yields

$$\frac{dx_{B}^{te^*}}{d\tilde{x}_1} = -\frac{L_1^\circ + CL_2^\circ}{\overline{T}} < 0. \tag{47}$$

From (4), $\sigma_B = \tilde{x}_1 - w_1^\circ$

CASE C^{e^*} $\left(L_1^\circ > L_1^{e^*}\right)$: The problem is to choose $\left(x_{1|C}^{le}, x_C^{te}, L_{1|C}^{e}, S_C \geq 0, E_C \geq 0\right)$ that maximises x^{te} subject to (36) with the difference that E now does not appear in (37(c)). As a result the necessary conditions are modified by dropping the E terms for the choice of L_1^e and μ, and the μ_A^e term for the choice of E. By (37(a,e)) $E_C = 0$. If $S_C > 0$ we have by (37(d)) $\mu_C^{e^*} = -\lambda_C^{e^*} L_{2|C}^{e^*}$. Using this in (37($c$)) and combining that with (37(h)) we find $w_{1|C}^{e^*} = \overline{w}_2$, which is not consistent with the definition of the case $L_1^\circ > L_1^{e^*}$ and the assumption that $L_1^\circ < L_1^*$. With $S_C = 0$ we find the same inconsistency between the third and last conditions, $L_1^\circ > L_1^{e^*}$ and $L_1^\circ < L_1^*$. Thus case C^{e^*} is empty for $L_1^\circ < L_1^*$. The intuition follows. Consider $S_C = 0$. Once $\sigma = \overline{w}_2 - w_1^\circ < 0$ so $x_{1|C}^{le^*} = \overline{w}_2$ at L_1° then a reduction of σ leads to migration from 1 to 2 and reduces output in country 1, leaves workers indifferent—all workers irrespective of residence must receive $\overline{w}_2$ which means that owners are necessarily hurt. A policy of $S_C > 0$ exasperates the problem because it uses consumption resources in the rich country and leads to outmigration. Thereby $L_1^\circ > L_1^{e^*}$ is not consistent with the consumption possibilities frontier.

A solution to cases A^{e^*} or B^{e^*}determines a point on the CPF conditional on the case. We must determine which case generates the highest consumption level for owners given the consumption of indigenous workers. This is then a point on the consumption possibility frontier for the rich country. We must be careful to compare the appropriate sub–cases.

For $C \geq 1$ cases $A^{e^*}(1)$ and $B^{e^*}(1)$ apply. Figure 5 can be used to make the comparison. Points G and H correspond to feasible allocations for cases A and B respectively as they involve no immigration control costs irrespectively of C. Since point H is below point G and the conditional CPFs have the same slope given by (38) case $A^{e^*}(1)$ dominates $B^{e^*}$for all distributions and the CPF for $C \geq 1$ is GI.

Figure 4 illustrates a comparison between cases $A^{e^*}(2)$ and $B^{e^*}(2)$ which apply to $0 < C < 1$. For $B^{e^*}(2)$, using $X_2^\circ = L_2^\circ \overline{w}_2$, we have (46) which is graphed as HB_1 in figure 3. For case $A^{e^*}(2)$ a possible graph of $x_A^{te^*}$ as a function of $\tilde{x}_1$ is given by GF_1. The slope at point G where $L_1^e = L_1^*$ is the steepest and increasing in C, and it goes to the slope at point F_1 as $L_1^e \to L_1^\circ$. Thus the graph of the CPF is FD_1B_1 in figure 3 for $0 < C < 1$.

Figure 2 also shows the CPF for costless border control as GFB. Point G is a feasible allocation for any C. As $C \to 0$ the slope of the convex segment GF goes to $-L_1/T$ by (43). The slope of the linear segment goes to $-L_1^\circ/T$ by (47). Denote points like F_1 in figure 4 as F_i. Segments GF_i, which correspond to $C > 0$, are clockwise rotations of GF through G and segments F_iB_i are clockwise rotations of a segment of HB through H.

Points F_i will play a role in what follows. Such points can be located by using (40) as we let $L_{1|A}^{e^*} \to L_1^\circ$. Upon rearrangement we find

$$\tilde{x}_{1|F_i} = (w_1^\circ - C\overline{w}_2)/(1 - C). \tag{48}$$

First note that as $C \to 0$ this approaches point F in figure 3, where $\tilde{x}_1 = w_1^\circ$. Second, from (48), $\tilde{x}_{1|F_i}$ increases in C. Points F_i can be above, at, or below the equal consumption line. For $C = 0$ point F is above the equal consumption line because $w_1^\circ < r_1^\circ$. Solving for the $x_B^{te^*}$ at the equal consumption line from (46), then setting that equal to $\tilde{x}_{1|F_i}$ from (48) and rearranging yields C_2 such that $0 < C_2 = (r_1^\circ - w_1^\circ)/[\overline{L}(w_1^\circ - \overline{w}_2)/\overline{T} + (r_1^\circ - \overline{w}_2)]$. The inequality follows because all terms are positive. Letting the $x_B^{te^*} = 0$ in (46), using $\tilde{x}_{1|F_i}$ from (48) and rearranging yields C_3 such that $C_2 < C_3 = r_1^\circ/[\overline{L}(w_1^\circ - \overline{w}_2)/\overline{T} + r_1^\circ] < 1$. The first inequality follows after rearrangement and taking into account that $w_1^\circ - \overline{w}_2 > 0$, while the second because all terms are positive. Once C reaches C_3 then the conditional CPF under case $A^{e^*}(2)$ dominates that under case $B^{e^*}(2)$ for all distributions. The CPFs for these set of Cs are shown in figure 5 (FD_2B_2 and FD_3) respectively.

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