Immigration and Economic Welfare: Resource and Environmental Aspects*

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The relation between immigration and the economic welfare of residents is analyzed for resource-rich economies (such as Australia) both under competitive conditions and when various distortions are present. Immigration provides efficiency gains for residents under distortion-free competition for standard ‘gains from trade’ reasons. Such reasons, however, tend to be ignored by immigration and ‘optimal population’ theorists who raise the issue of restricting immigration without explicitly referring to the distortions. In situations where distortions and externalities are present, we argue that it is generally preferable to devise policies which specifically target the distortions than to restrict immigration.

1 Introduction

What are the effects on economic welfare of an increased population, due to immigration, when natural resources and the environment are factors limiting consumption and production possibilities? This question arises in resource-rich countries such as Australia, Canada and the United States of America which currently have relatively high levels of net immigration intake. To analyze this it is necessary to clarify:

• The group whose welfare is being considered. Is it the population of people who existed prior to immigration (‘the existing population’) or is it the population inclusive of newcomers?
• The social welfare function used. Is it utilitarian and, if so, does it depend on average or total utilities?
• The character of the economy being considered. How competitive is it? What types of distortions (if any) are relevant?

• The way new people ‘become part’ of the society. How do immigrants gain a share of output in the economy?

To simplify matters most analysis in this paper is cast in terms of two periods: ‘now’ (when population is given) and the ‘future’ (when it varies in accord with immigration policy).

For specificity assume that immigration policies are described in terms of an immigration quota defined to be the fraction of people who would voluntarily migrate to the country, in the absence of any fee or restriction, that are in fact allowed to migrate by public immigration authorities. Further suppose that people will seek to migrate if the wage they would receive exceeds some critical reservation level. Immigration authorities then select a quota to maximize social welfare. An open-door policy corresponds to laissez faire while a zero quota is the policy of accepting no migrants.1

1 For the most part this immigration framework can also be used to analyze endogenous fertility processes (the welfare effects of natural population increase): in several places it is shown how this generalization can be implemented.

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The economies envisaged are essentially competitive and decentralized. Because of particular interest in resource and environmental issues these economies are supposed to exploit both exhaustible and renewable resources (oil, fish). The existence of congestion externalities in the production or consumption of certain goods (for specificity we take the case of road congestion), as well as pollution externalities associated with production and consumption of outputs (air pollution), are also allowed for. The basic concern is whether the existence of finite or renewable resource stocks and the presence of environmental externalities have any effect on the size of the socially desirable immigration quota.

The analysis mainly considers welfare criteria which account both for existing residents in a society and immigrants. An explicit social welfare function is not necessary, however, since attention is restricted to welfare comparisons which constitute (or do not constitute) potential Pareto improvements. The analysis never 'averages' welfare measures across the two groups of agents here because such procedures lead to logical and ethical absurdities such as 'Mere Addition Paradoxes': see Parfit (1984).2

For the most part, simple welfare surplus measures are used to assess welfare changes. To avoid repetition and to clearly define scope the analysis explicitly ignores distributional issues within existing resident and immigrant groups—or equivalently supposes the requisite lump-sum transfers can be made. This in no way indicates an attempt to downgrade the importance of distributional issues—these are vital if concern lies with the distribution of income between wage-earners and property-owners—but here concern is exclusively with efficiency aspects. Thus welfare increase (for a particular group) is defined to occur if and only if the gainers in the group benefit more than the losers (in the group). A welfare improvement, according to this definition, corresponds to a Potential Pareto Improvement (PPI).3 While this criterion is controversial it is worth noting that the argument of treating a 'dollar as a dollar' (Ng, 1984) lends support to it. Unless redistributive effects are huge it is best to pursue distributional objectives through the tax-transfer system.

Finally, analysis is restricted to efficiency rather than distributional issues because it seems infeasible to realize the Pareto-type gains from factor movements without necessarily invoking lump-sum compensations—at least when taxes/subsidies on factors and consumers do not discriminate on the basis of an individual's national origin: this has recently been established by Brecher and Choudhri (1990). Thus the Dixit and Norman (1986) approach of using commodity taxes/subsidies to ensure free-trade is superior to autarchy, while capable of being adapted to deal with trade in factor services and even immigration of the owners of these services, can only guarantee Pareto improvements provided immigrants are taxed by their original country regardless of where they currently reside. This last possibility seems so unrealistic it is disregarded.

Section II develops a welfare analysis of immigration in the absence of distortions (including externalities). The arguments, while elementary, seem to have been consistently misunderstood in the literature—thus it will be argued, for example, that the standard case for restricting immigration to offset 'resource dilution' effects and the arguments for auctioning the immigration quota are based on the existence of an implicit 'common property' distortion. Section III explicitly introduces various externalities and transactions costs and reconsider the arguments for restricting immigration. Section IV summarizes conclusions and final comments.

II The No Distortions, No Externalities Case

In the absence of any domestic distortions and with a perfectly elastic supply of immigrants, elementary microeconomic arguments suggest that an 'open door' immigration policy must simultaneously optimize the welfares of both existing residents and of immigrants. The reason is simple: 3

2 Thus, even if equal weights are attached to both groups of agents, social welfare is never computed as average welfare per agent where the average is computed inclusive of immigrants. Such a procedure would lead to the logically absurd implication that a welfare change that makes no one worse off might be rejected as welfare-reducing. For example, if 17 million Australians receive utility of 20,000 utils per head and one million unskilled migrants upon (happily and willingly) entering Australia created a society where the original 17 million received (as before) 20,000 utils but the migrants received only 19,000 utils, then on the basis of average utilities inclusive of migrants, welfare has fallen even though no one is worse off but one million are better off. This is a stark 'Mere Addition Paradox'.

3 Though this correspondence may not be perfect due to the 'Broadway Paradox', this is not a significant issue in practice. See Ng (1990).
with a larger population the opportunities for mutually advantageous trades among existing residents are increased—with more trading offers, existing resident welfares are increased for the conventional gains-from-trade reasons that are discussed in elementary textbooks (see, for example, Alchian and Allen, 1977, pages 188–90). Furthermore, since for now no external costs are allowed to impinge on existing residents, these residents must be better off overall. Immigrants must be better off since they voluntarily migrate, assuming that on average they are well-enough informed to anticipate the economic conditions facing them in their new country.

This argument can be formalized using the Berry and Soligo (1969) ‘welfare triangle’ argument: see Figure 1. Here the value of labour’s marginal product is indicated on the vertical axis and the number of workers (assumed, for simplicity, to equal population) on the horizontal axis. The demand for labour is indicated by the curve ACF. the pre-immigration population of workers by $N_0$ and population after immigration by $N_1$. Then, with competitive labour markets where workers are paid the value of their marginal products, additional immigrants will be paid wages of total value of the area EFHG. The total value of their contribution to production will however be the area of CFHG. The difference between these areas (namely the area of the curvilinear triangle CEF) is the excess of the increased rental payments to non-labour inputs used in production processes (land, capital, raw materials) over the reduction in wages. These rental payments will typically accrue to existing residents who are therefore, on average, better off by this ‘welfare triangle’.

There are two types of qualifications that one might wish to raise in applying this analysis to actual economies with tax distortions and the possibility of foreign-ownership of resources:

1. The need to account for the existence of taxes on rental incomes and redistributive public expenditures. Taxes can redistribute income to immigrants as well as existing residents which can mean that immigration need not confer net average benefits to existing residents. Furthermore, to the extent that current publicly available benefits (e.g. roads, libraries) are funded out of past community savings rather than current taxes, public expenditures themselves represent a redistribution from existing to new residents.

2. The need to deal with the presence of foreign-owned, non-labour factors of production. If non-labour factors are owned by non-residents, the induced increase in rentals will accrue to foreigners and existing residents will be worse off as a result of immigration because they experience only a fall in wages without any accompanying increase in rental incomes. This accords with conventional theory (see Bhagwati and Brecher, 1980) which shows that free trade (internationally) can be immiserizing in the presence of foreign-owned factors.

These are important though not compelling arguments against the optimality of an ‘open door’ policy in a competitive economy. Taxes on rentals and rental payments to foreigners represent a leakage from the triangle ADF in Figure 1. It is straightforward to see that this leakage does not need to be large to dominate the welfare triangle CEF. On the other hand, public spending and tax policies are matters subject in large part to the political will of residents. Moreover, as an empirical matter, even with given policies in this regard, the redistribution of rents to new immigrants will only be significant if migrants ‘free ride’ the public goods sector (e.g. the social security system) more than existing residents by paying a proportionately lower ratio of taxes to public benefits received. The evidence from many studies suggests the reverse is true: immigrants make above-average contributions towards taxes supporting public expenditures.

In a study of the US experience by Simon (1989),
immigrants have high levels of workforce participation due to low old-age dependency and relatively low fertility among women. This means that immigrants tend to pay above-average levels of tax and to utilize relatively low levels of social security. For the US, Simon (1989) estimates that the lifetime net contribution of immigrant families to the public coffers due to these factors is between 1.4 and 1.9 times average US family incomes while the use of publicly-owned capital that is funded out of resident savings does impose a cost on natives equal to .21 of US family incomes. This is much less than the figure attributable to social security savings so, on balance, immigration provides a significant net benefit in terms of the public coffers.  

Similarly the fraction of rental incomes accruing to foreigners is determined by tax policies. Moreover, it seems reasonable to conjecture that it is largely non-traded fixed assets (e.g. housing and both agricultural and urban land) that will experience the most substantial rental increases with immigration. These assets are overwhelmingly resident-owned. The rents yielded on assets that are traded internationally will presumably be less constrained by supply than for fixed non-internationally-traded assets so that immigration will have its most dominant effects on the latter. In addition, to the extent that future immigration benefits are anticipated at the time domestic assets are sold to foreigners, the benefits will be capitalized into asset sale prices so that existing original owners will receive the (appropriately discounted) net immigration benefit.

If immigrants wish to acquire holdings of land, housing, business premises or financial securities the only way they can do this is to purchase the assets they wish to acquire. These purchases must be made on terms that are favourable to (vendor) existing residents who must therefore be made better off as a result of the transfers. Other existing residents who wish to purchase these same assets may be worse off in the sense that they now have to pay immigration-increased prices for them (for example, young couples purchasing their first home) but the extent to which they are worse off is less than the extent to which asset-owners are better off so that immigration does provide a PPI, and hence a welfare improvement in our terms, for existing residents. Thus there arise exchange advantages accruing to existing residents from asset markets as a consequence of immigration.

Empirically there have been a number of attempts to estimate the numerical value of the 'immigration triangle' benefits. Simon (1989, pages 149-52) argues that, for a number of specific countries, these welfare triangle effects are small enough to be ignored for 'practical purposes'. Hamilton and Whalley (1984), on the other hand, estimate that the net welfare gain from the elimination of immigration controls globally may exceed current world GNP. This suggests that the reform of immigration policies in the direction of increased labour mobility may be the single most important issue facing the global economy particularly from the viewpoint of developing countries.

Further, it is worth mentioning that this type of welfare analysis can be used to show the general optimality of laissez-faire in population derived from natural increase. Provided a family wants the children it gets and willingly pays for their up-

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4 These findings are presented in detail in Simon (1989), chapters 4-7) where comparable although less comprehensive findings are also presented for Canada and Australia. Tulpuj (1984), according to Simon, calculated that migrants lower the necessary taxes paid by Australian residents to finance government spending on health, education, social security and welfare. This interpretation has however been criticized by Whiteford (1991) who also rejects much of the Simon work itself. Whiteford however supports the general conclusions of earlier studies: immigrants are not an over-represented burden on Australian welfare payments. The ratio of average social security benefits received to average taxes paid by Australian immigrants is around 2.18 which compares favourably with the figure of native-born Australians of 2.31. In recent years the 'family reunion' component of immigration has grown and, as Birrell (1990, page 53) points out, has imposed some strains on the Australian social security system.

5 Thanks are due to Ted Spicer and Rod Tyers on this point. With perfect foresight of the immigration program, original sellers of claims on Australian assets to foreigners would be fully recompensed for future immigration benefits. This may not be so helpful in a setting where immigration levels themselves are highly uncertain because they are a decision variable.

6 This is easily shown using 'surplus' arguments. If the demand for housing increases as a consequence of immigration it is easy to see by inspecting the demand curve of existing residents (which should not shift if we ignore second-order general equilibrium effects of immigration) that the reduction in consumer's surplus accruing is existing residents is more than offset by the increase in seller's surplus accruing to the same group so that immigration provides a PPI for them.
bringing, and provided that these children do not impose external costs on others (for example, through publicly-subsidized education) and that, once these children grow up and enter the workforce, they are paid the value of their marginal products, society as a whole benefits in net terms by the welfare triangle such children generate. Thus, under these conditions population increase provides a PPI in society's welfare as demonstrated in more formally-exposed 'consumption-loan' models (see for example Pazner and Razin, 1979).

Finally, the general issue of the optimality of an 'open door' immigration policy when there are no domestic distortions can be cast in terms of the conditions for an increase in a factor supply to be 'immiserizing' (see for example Bhagwati, 1958). The issue here is whether economic growth can make a society worse off by inducing unfavourable movements in the terms of trade which offset 'gains from trade' advantages. The general conclusion is that, in the absence of 'distortions' (i.e. domestic consumption or production externalities, tariffs for a 'small' country, the non-existence of optimal tariffs for a 'large' country) growth can never be immiserizing. One must be careful however to distinguish the welfares of existing residents and newcomers. Bhagwati and Srinivasan (1983) claim that a country can be immiserized 'under less stringent conditions' when the source of growth is population increase since 'Even when GNP increases, per capita GNP can fall when population has grown' (op.cit. page 253). As footnote 2 illustrates, in the context of immigration, welfare cannot be supposed to fall overall simply when average welfare measures fall. The key issue (given informed voluntary immigration) is whether existing residents will be disadvantaged or not.

The argument that immigration makes existing residents worse off via worsening terms of trade is itself debateable. This viewpoint stems from the assumption that while immigration increases import demands it does not increase export opportunities. Hence, for countries like Australia which are price-takers in import markets but price-makers in at least some export markets, it is sometimes alleged that increased import demands due to immigration worsen the terms of trade and add to foreign debt. At best this is a one-sided assumption since immigrants who bring in capital, skills, entrepreneurial abilities and external connections expand export capabilities as well as increasing import demands. Moreover, even if immigrants contribute more to demand than supply, the resulting borrowing and capital account deficit does not, in the absence of externalities in capital markets, indicate a 'problem' that needs to be 'corrected' (this is a particular case of the Pitchford, 1989, 'foreign debt irrelevance' argument).

In fact, if transport costs and the existence of other nation-state imposed barriers to trade are accounted for and the world is viewed as a general equilibrium system, then immigration reduces both transport costs and other barriers between pre-existing residents and new immigrants. One should expect both existing residents and new immigrants to be better off simply because impediments to trade have been removed. These latter types of effects are analogous to improvements in telecommunications and transport technologies.

(i) Auctioning the Immigration Quota

The analysis above makes it clear that, with no domestic distortions and a perfectly elastic supply curve of immigrants, there is no sound basis for the claims of Harrison (1989), Logan (1989) and others for auctioning off the 'optimally'-determined Australian immigration quota. In the absence of distortions any fixed quota that is auctioned off at a non-zero price generates less benefits (on average) for existing residents than an 'open door' policy with no fee being charged for entry.

The Harrison argument contends (as does this paper) that the 'optimal immigration quota' should be determined where the marginal benefits to Australians from immigration are equated to the marginal costs faced by immigrants in coming.

However, contrary to most approaches, Harrison sees the attempt to immigrate to Australia as being essentially similar to the endeavour by an agent to gain 'club membership'. The 'club' in question is a fictitious 'Australian club' for which, once 'membership' has been granted, new members (i.e. immigrants) automatically gain gratis the average benefits received by existing members (i.e. existing Australian residents). Since these average benefits exceed the marginal benefits derived from immigration at the 'optimal quota' it follows that immigrants can be induced to pay a fee for 'club membership'. The Harrison argument is, then, that the value of these membership fees can be maximized by auctioning off the immigration quota and then transferring resulting revenues to existing Australian residents thereby compensating them for the effect of immigrants in reducing average Australian living standards.

There seems nothing logically wrong with this
argument once its premise that new immigrants will receive average Australian benefits upon entry is accepted. However this premise seems an unrealistic view of the way immigration works in Australia, at least if Australia is viewed as an approximately competitive economy.

In fact, relative to wage and non-labour factor incomes, immigrants to Australia are given little gratis upon entry. By and large, as argued above, they must work for their income and purchase assets in Australia using their savings. With competitive labour markets, where immigrants are paid the value of their marginal rather than average product, it can be shown that, provided the supply of immigrants is perfectly elastic at a given 'reservation wage' (this corresponds exactly to Harrison's assumption of a fixed marginal cost of coming to Australia), an 'open door' immigration policy yields higher average economic benefits to existing Australians than any immigration policy involving a quantitative restriction and any sort of 'entry fee' whether determined by an auction or not.

Figure 2 illustrates the value of the marginal product of labour, $MP_w$, in Australia at various population sizes. The existing population is $N_0$ so, assuming labour is paid its marginal product, the current wage is $W_0$. The reservation wage of immigrants is $W_1$ which is supposed fixed and less than $W_0$.

Suppose a fee of $MT$ is imposed on immigrants which yields revenue $RSTM$ and which restricts the post-immigration population to $N_2$. This revenue can be transferred to existing residents and improves their welfare by transferring to them the windfall gains that would have accrued to successful immigrants who would have gained admission were there a quota but no entry fee. The curvilinear triangle $ERM$ gives the 'welfare triangle' of benefits that accrues to existing residents on the basis of the Berry and Soligo (1969) analysis of Figure 1. Thus the aggregate gains to existing residents from the quota are the area $ESTM$.

The proof of the suboptimality of the quota-fee policy (and equivalently of the quota-auction arrangement) derives from the fact that the area $ESTM$ is less than the area $EFS$. Put simply, a quota-fee arrangement leaves some potential gains to existing residents unexploited. With the fee $MT$ these unexploited gains are given by the area of the curvilinear triangle $MTF$. Thus, ignoring distributional effects among existing residents, the way to maximize the economic welfare of existing residents is to eliminate these unexploited gains by setting a zero entry fee and thus moving the wage-population equilibrium to $F$ where the total net gain to existing residents is measured by the area $EFS$ which is the maximum gain possible.

The point $F$ corresponds to the 'open door' immigration policy. In fact, the Harrison proposal to set a quota where the marginal benefits from immigration equal the marginal costs will realize exactly this 'open door' equilibrium. However, since we now suppose that new immigrants receive the values of their marginal rather than average products, there is no incentive to pay any entry fee so the aggregate money value of the quota is zero.

7 It has also been demonstrated that there is no case for a tax on immigrants with a fixed reservation wage. It is also clear that, in the absence of externalities and economies of scale, there are no arguments for subsidizing immigrants, and hence reducing their reservation wage—at least from the viewpoint of existing residents. Such a policy does generate a welfare triangle but, geometrically, it also generates a larger rectangle of costs to the existing community. For the case of natural population increase, the possibility of ruling out the existence of an optimum subsidy is by no means so clear. If parents' fertility behaviour is determined by their private marginal costs and benefits of having children and if such children contribute a welfare triangle to society then couples will have fewer than the socially desired number of children, as pointed out by Simon (1977). Hence there may be a case for a subsidy directed to parents.
Even though Harrison determines the formally correct level of the immigration quota when labour markets are competitive, his inference that this quota can be sold is misleading since, in the absence of precise knowledge of marginal cost and benefit schedules, it might suggest as plausible a relatively restrictive immigration quota that is then sold or auctioned, rather than the socially preferable laissez-faire ‘open door’ policy. The Harrison argument also deserves questioning because of its inference that, in the absence of unpriced externalities and public goods, immigrants derive unpaid-for benefits from a host country rather than being paid exactly their contribution to that country’s welfare.

If the supply curve of immigrants is less than perfectly elastic, so that the immigrant’s reservation wage is not fixed but rather increases with the level of immigration, then there may be a case for restricting immigration and imposing a fee. This case is analyzed in terms of Figure 3.

In this figure the supply curve $S$ of immigrants is upward-sloping and $MC$ is the curve marginal to $S$ (to be precise it is the derivative of $SN$ with respect to $N$). In this case the rationale for a positive immigration fee in restricting immigration is analogous to the rationale for the restrictive employment policies of a monopsonistic firm (and, for that matter, to the formula for the optimum tax on foreign borrowings by an economy facing an imperfect international capital market. See, for example, Bardhan, 1967). In this event the optimal immigration fee, from the viewpoint of the average economic welfare of existing residents, is determined where $MC$ equals the value of labour’s marginal product. $MC$ however exceeds the economy’s prevailing real wage because marginal increases in the level of immigration now alter the wage that must be paid not only to workers at the margin but to intramarginal workers as well. The optimal immigration fee leaves apparently unexploited gains to existing residents equal to the area $MNJ$ but it is not possible to extract these gains without ‘price-discrimination’, i.e. without paying different workers different wages for doing the same job.

Note that regardless of the elasticity of the immigrant’s reservation wage, if a sub-optimal quota is to be imposed then charging a fee for entry is preferable to not charging since the latter is equivalent to free entry for those accepted and an infinite fee for those rejected. The only group disadvantaged by a fee policy compared to free entry subject to a quota are those who would have gained entry for free under the latter system. In fact, auctioning therefore works as a good ‘second best’ policy although one that is definitely inferior (in the absence of distortions and given a fixed reservation wage) to an ‘open door’ policy. Further discussion of the ‘optimal immigration quota’ is given in Clarke and Ng (1991c) while the general case for fees is discussed in Clarke (1992).

In response to these objections, Harrison (1991) has introduced public goods, unpriceable external costs and the issue of non-discriminatory reimbursements into an amended formulation. These change the story somewhat but we make three comments: (i) if the US evidence of Simon (1989) referred to above is relevant then, in terms of tax-savings alone, residents gain from immigration; (ii) with unpriceable externalities there is a case for restricting immigration for the reasons we discuss below in Section III(iii); (iii) if discriminatory reimbursements are ruled out then an entry-fee alone will not lead to efficiency in resource use—it needs to be supplemented by appropriate pricing: III(i) below establishes this as the appropriate second-best policy.

(ii) Resource Dilution Effects

At the core of most conservationist objections to liberal immigration policies is the inference that ‘more people’ implies ‘less resources per head’ implies ‘lower living standards’ for existing people. This is an old idea in economics dating back at
least to the Reverend Thomas Malthus in 1798. The views have more recently been revived by the Club of Rome and other groups.

As it stands, the general argument is accepted by few, if any, modern economists. The reason is simply that over the past 200 years population has increased dramatically but living standards have improved overall rather than declined. The reasons for this are variously described as being increasing returns to other productive resources such as capital, the effects of technical progress, new resource discoveries and the possibility of substituting other resources, or non-resource inputs for those in increasingly short supply.

It seems plausible to argue, however, that much theorizing about the welfare effects of population increase on resource issues has an inappropriate Malthusian bias and that most of the applied immigration literature that is concerned with resource issues reflects this bias. The theoretical aspects are concentrated on here.

A major theoretical difficulty in much of this work is, as with the proposals for auctioning the immigration quota, related to the view that newcomers to a society automatically gain, gratis, an equal share in the wealth that the society generates. In fact, it is easy to see that once this view is abandoned, even if we accept the Malthusian view that output per head will decrease with immigration or natural population increase (a proposition that on the basis of historical experience seems implausible in countries like Australia, at least in the longer term), it is still false to infer that, in the absence of externalities, existing residents will suffer reduced living standards as a consequence of population growth.

The reason is simply that, as discussed above, a competitive economy's renewable and non-renewable resources are currently owned by existing residents and this group can never be made worse off by being given expanded opportunities to trade the resources they own. If newcomers wish to own such resources they must typically purchase them on terms that are favourable to vendors. If they are given them gratis (for example, parent bequests to progeny) then again, if this is voluntary, existing people cannot on average be made worse off as a consequence of population growth.

This argument can be made transparent in terms of the standard 'homogeneous biomass' model of, for example, a fish population's optimal exploitation from the viewpoint of maximizing shareholder wealth. Ignoring costs and supposing that fish harvesters cannot maximize static returns without eventually wiping out the stock, it can be shown that the optimal stationary exploitation program is a constant harvest policy depending only on discount rates and hence independent of demand (see Clarke, 1990). Then an increase in demand due to population growth, by increasing the marketability of fish harvested, will increase the net economic advantage to existing residents by generating a positive welfare triangle for them in every future period.

The same type of argument can be developed with respect to an exhaustible resource although in general there is then the need to account for complex, though rather inessential, effects of increased demand on optimal extraction time-paths. The basic effect on finite resources of population growth is to increase their value and hence the incentives to provide and preserve them. Thus population growth provides increased incentives to reclaim marginal agricultural lands and

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8 For example, in the 30 years to 1989 the world's population has grown from 3.0 to 8.2 billion. Yet over the 25 years to 1989 the average crude death rate has fallen from 13.3 to 9.9 per thousand, life expectancy at birth has risen from around 55 to 61 years and food production per capita has risen by more than 12 per cent. See the World Resources Institute (1988).

9 The empirical literature on Australian population and resource issues provides overwhelming support for the idea of an inappropriate Malthusian bias. Much of it is cast in terms of attempts to identify 'resource constraints' (agricultural land, urban land, water) which will limit the capacity of the country to 'absorb' more people. Thus in the Introduction to the recent essays on Australia's desired population edited by Day and Rowland (1989) the authors see the question of the 'timing' of a Malthusian crisis in the relation between population and resources, rather than the existence of such critical resource levels per se, as 'the fundamental point of disagreement' between 'conservationist' and 'national development' schools. For further discussion see Clarke et al. (1990, Chapter 1).

10 In the absence of population growth the Pareto-optimality of competitive equilibrium for economies with exhaustible resources was first advanced by Hotelling (1931) with a more complete proof offered by Weinstein and Zeckhauser (1975). The latter draws attention to the standard 'no distortions' assumptions required to establish the result: the completeness and accessibility of markets, the absence of externalities and public goods. These same assumptions are necessary in a setting where population growth is admitted.
to protect those subject to degradation pressures (see Clarke, 1992b). More people also means an increased demand for wilderness resources and hence in equilibrium an increased provision of such areas. This basic argument can be replicated for any depletable resource.

Perhaps this point is being laboured but it seems important to be as clear as possible. The bulk of the 'optimal population and resource' literature, both from a classical 'average utilitarian' viewpoint (see Pitchford, 1974) and a 'total utilitarian' viewpoint (see for example Dasgupta, 1969, Dasgupta and Mitra, 1982) is complex and inconclusive. Even though externalities and other types of distortions are generally not explicitly introduced, and thus the frameworks chosen do not seem to differ in essentials from the current framework, there seem to be few insights forthcoming other than the conclusion that, under various assumptions, there exists an optimal population. The implication is that population growth beyond this optimum must be welfare-reducing while increments towards that level will increase welfare. The present approach, by emphasizing conditions (no 'distortions') that need to be met for population increase to be welfare-improving, provides a means for assessing the desirability of such policies as an immigration program. The question remains, however, of reconciling the 'optimal population' viewpoint with the present framework.

Much of the dispute between the different 'optimal population' approaches centres on the ethical desirability of maximizing average welfare and we have already revealed our own view that such a procedure is indefensible in the sense of implying ethically absurd 'Mere Addition Paradoxes'. This should not be taken to imply an endorsement of the alternative 'total' procedures—

at least when the latter involves (as it does in the references cited) merely aggregating (equal) per capita utilities.

The difficulty here is that the assumption of equal consumption utilities, while simplifying the income distribution aspects of these models, conceals the fact that immigrants and the progeny of existing residents in a society must purchase (or receive as bequests) their share in social wealth whereas existing residents will already own such a share. This asymmetry needs to be accounted for in any assessment of the welfare consequences of such newcomers.

In fact, the presumption that newcomers in a society receive the value of their average product may imply a fixed 'optimal population' basically because it introduces, by assumption, a distortion into decentralized market economies with labour no longer being paid the value of its marginal product. In fact, with labour being paid its average product, the distortion introduced corresponds to assuming a common property externality. It is this policy-imposed distortion which leads to the divergence between our results and those of 'optimal population' theorists. This implicit distortion allows the latter theorists to deduce specific desired bounds on population.

Meade (1961, page 89) argued that it was logically desirable to suppose labour inputs were paid their average products because (to use our language rather than his) the welfare triangle argument for the optimality of an increased worker population required lump-sum compensations to compensate workers for their reduced wages by redistributing income from property-owners. This was necessary if no one was to be made worse off by the population increase. But once this is done, Meade argued, why should the redistribution not be extended to new workers? This type of argument, however, relates to the fundamental difficulty of attempting to derive a satisfactory criterion for how welfare increases. It can scarcely be advanced as a useful way of describing how new immigrants derive their economic status in a new country.

In fact, even if lump-sum transfers are required to realize the pure Pareto-gains from free factor movement there is no need to go to the extreme of assuming complete equality of incomes. Moreover, it is questionable whether new people (immigrants or children) do need to be compensated. People, for example, migrate to a new country because they will be better off so they scarcely require compensation.
III Immigration with Domestic Resource Distortions

The economic effects of immigration are now considered in the presence of III(i) a domestic congestion externality and III(ii) a domestic pollution externality where social costs change with increased pollution and III(iii) transactions costs in enforcing property rights. In cases III(i) and III(ii) the thesis is advanced that, provided efficient pricing is used to close the gap between the private and social costs of using the resources and that existing residents own the resources that are subject to the efficient pricing rules, existing resident welfare is again maximized with an 'open door' immigration policy perhaps subject to the qualification of an entry-fee tax on the admission of immigrants. In case III(iii) a restricted case is established for using population policies rather than pricing policies for dealing with external costs.

(i) Domestic Congestion Externalities

Following Clarke and Ng (1990b), the effect of population growth on the usage of a resource that is subject to a congestion externality is now analyzed, i.e. the possible divergences between the private and social costs of consuming the resource that stems from 'crowding' (e.g. traffic congestion, congestion in national parkland, excess use of a renewable resource such as the 'open access' fishery and certain types of pollution problems). For specificity, the standard case of road congestion is taken for much of the discussion.

As shown in the previous section, provided an economy is subject to no distortions, laissez faire in relation to population growth is optimal. The basic idea here is simply that, in the absence of externalities, additional people make an economy better off by increasing an existing society's trading possibilities. It is reasonable to conjecture on the basis of the 'immiserizing growth' theory that, provided appropriate pricing policies are used to offset the effects of externalities, the same type of welfare improvement with population increase will obtain. Conditions are now provided for this to be the case.

Consider Figure 4 where $Q$ is total road usage and $D_1$ is the demand for road use by existing people. The average cost curve, $AC$, measures the time, petrol and other costs associated with road usage. The corresponding marginal cost curve is $MC$. Without road pricing the equilibrium demand for travel is at $Q_0$ where consumers are just indifferent between travelling or not. At this level of demand however marginal costs exceed original benefits due to the existence of an unpriced 'congestion externality'. To maximize net social benefits the level of road usage should be restricted to $Q_1$ where marginal benefits from travel equal marginal costs. This demand level can be achieved by taxing road usage at the rate $t_1 = E_1A$ which is the difference between marginal and average costs at the road usage level $Q_1$. This type of analysis is developed more fully in Walters (1961) and Porter (1978).

Now suppose a discrete jump in population size shifts the demand curve to $D_3$ in Figure 5. Note that, excluding secondary general equilibrium effects of the population increase on original demands, the demand curve of original citizens remains fixed at $D_1$ with this change. If optimal road pricing is re-established at the new increased level of total demand, the tax rate on travel increases to $t_2 = E_2B$ which increases the tax-inclusive price of travel from $P_1$ to $P_2$ and reduces the consumption of existing citizens from $Q_1$ to $Q_3 = P_2/H$.

Existing citizens are thus made worse off through the increased tax charges and congestion costs they face by an amount equal in money value to the amount of consumer's surplus they lose (the area $P_2P_1E_1H$). However the tax revenue yielded by optimal taxes increases by $t_2Q_2 - t_1Q_1$. It has been shown that, with downward-sloping demands and a $MC$ curve which is upward-sloping and above
AC at any output (this must be the case when congestion is present), the increase in tax revenue yielded by optimal taxes in the face of the population increase exceeds in value the loss in consumer surplus experienced by the existing population. For proof see Clarke and Ng (1991b).

Thus, if existing citizens own the resources giving rise to the increased tax revenues and receive these revenues as incomes, they will be better off in average net monetary terms even though they face higher costs of using the resources themselves and increased congestion costs. Under these conditions population control is generally not a wise approach to dealing with congestion externalities. A better procedure is to (where possible) define property rights on the resources that society uses and to efficiently price usage of these resources. The feasibility of property right and pricing reforms depends on the size of associated transactions costs—an issue discussed further below.

This analysis can be applied to externalities deriving from a failure to define property rights on a resource, for example, the free-access fishery and types of pollution emission that do not involve increased social marginal costs when population increases (the analysis above deals with the situation where MC does not shift with increased population). In these cases $D_1$ and $D_2$ define the marginal benefits accruing to society from the exploitation of the respective self-renewing resources. $Q$ then refers to harvest rates and rates of pollution emission respectively. The average cost curve AC reflects the actual costs borne by harvesters and polluters respectively and MC the corresponding marginal costs. With these nomenclature changes essentially the same analysis given carries through and, again, existing citizens are better off in average net monetary terms with higher population and hence resource demands provided they own the resources that are efficiently priced.

Most importantly here it is clear that population growth may be immiserizing for existing residents if the externality is not efficiently priced in accord with traditional theory. Thus, if in the above example road usage is unpriced, then total equilibrium road usage will shift from $E_0$ to $E_1$ in Figure 5 and existing residents will enjoy reduced consumer surplus with no compensating increase in tax revenues, i.e. they will be worse off unless there are other benefits from the higher population such as reduced per capita costs of providing social overheads.

The analysis here is predicated on the possibility of making discriminatory reimbursements to residents following an immigration-induced shift in demand. This is only realistic in a pluralist democracy if residents own the resources utilized. If resources are publicly owned and immigrants quickly gain voting rights, then the assumption of discrimination in reimbursement seems questionable. In this event, immigrants can be charged an entry fee equal to the congestion taxes they will incur post-entry. They would again be subject to this charge when they utilize the congested resource but now redistribution can occur which need not be discriminatory and which will ‘cancel out’ the effects of this second round of charging. Residents again will be better off as a result of immigration without the need for discrimination. Entry fees are not (as in Harrison, 1991) an alternative to efficient-pricing but a supplementary policy ensuring efficient resource use and gains to residents from immigration without discriminatory reimbursements: for further discussion see Clarke (1992).

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12 We are indebted to Richard Arnott for this suggestion.
(ii) Domestic Pollution Externalities with Changed Pollution Costs

Population increases impact on certain types of pollution externalities not only via increased benefits derived from any given level of pollution (the social marginal benefits from the pollution schedule shifts upwards) but also via the increased social costs faced by the total community as the result of the pollution (so the total community marginal cost schedule moves up also). Thus with respect to air pollution from factories, the existence of more worker-migrants increases the value of the marginal product of pollution discharges so marginal benefits rise at any chosen pollution level. At the same time a given level of pollutants in the atmosphere now causes more health problems among the larger population so marginal costs (inclusive of the costs experienced by new migrants) also rise. Pollution is thus viewed as an 'undepletable detrimental externality' so, for example, a doubling of population will be associated with a doubling of the marginal aggregate social damages associated with air pollution. Some then argue (see for example Kennedy, 1990) that, comparing the Pareto efficient pollution charges levied before and after the population increase, existing residents may be made worse off by population growth even if they are fully compensated by the revenues collected on the basis of the charges. This seems paradoxical since it seems to suggest that existing residents have been made worse off even though they now have improved trading possibilities and external costs have been corrected by a tax.

In fact the Kennedy (op.cit.) conclusion stems from a failure to distinguish the welfare of existing residents from that of the total population or (equivalently) from making Pareto-efficiency comparisons across two non-comparable sets of individuals. Note that the optimal price set on pollution discharges here does not correspond to some market equilibrium but is rather a policy variable set on the basis of society’s welfare function. Suppose the social welfare function is defined only on the welfares of existing residents. Then existing residents will choose a tax rate \( t_1 \), to maximize the total tax revenue plus their own net (of tax and pollution costs) benefits. Existing people will then be necessarily better off provided they are reimbursed the aggregate proceeds of this tax. Supposing the social welfare function is defined on the welfares of all members of society (inclusive of immigrants) then it should not be surprising to find that, in certain cases, such compensation of the Pareto-efficient tax \( t_2 \) is impossible—nor should it be expected to be because now (by hypothesis) existing residents derive additional compensatory utility from knowing that the welfare of immigrants has been accounted for. If the \( t_2 \) tax yields greater aggregate (inclusive of immigrants) benefits than the \( t_1 \) tax then immigrants and existing residents should be able to determine an appropriate additional tax levied on immigrants, at the time of entry, that would compensate existing residents for the fact that they would lose out on a compensation deal based on the tax \( t_2 \) compared to the tax \( t_1 \). Such a deal would make existing residents even better off so that certainly immigration will not reduce their welfare. Should, for whatever reason, such a tax prove impossible to negotiate then existing resident welfare will be advanced by the tax \( t_1 \).

In the next section the issue of determining optimal ‘entry charges’ on immigrants to deal with the additional external costs they may impose is discussed.

(iii) Transactions Costs in Enforcing Domestic Property Rights

Assuming optimal resource and externality pricing it is argued that existing residents cannot be made worse off as a result of immigration. A more sophisticated counter-argument against the ‘open door immigration policy accepts this argument but contends that, in the real world, we do not have optimal charges of various sorts so that immigration makes existing people worse off through such things as increased environmental degradation. Hence immigration should be restricted. In the absence of transactions costs in enforcing property rights on resources and the environment, the fallacy in the last step of this argument is easy to see. Suppose a country had no law prohibiting murder. If there were no costs in prosecuting murderers then, following the previous line of reasoning, one could argue that immigration should be restricted since it would increase the number of murders. Surely the right proposal here is to legislate against murder rather than to restrict immigration.

What happens if there are significant transaction costs? If these are large enough to offset the efficiency advantages stemming from efficient pricing then it would be wrong to respond automatically with a call to restrict immigration. If high
monitoring and enforcement costs preclude the use of efficient pricing then resort can usually be made to various regulatory processes or incentive schemes that have both pricing and regulatory components. In terms of well-known policy theories for dealing with 'distorted' economies it is always preferable to choose as a 'second best' policy an intervention that offsets the distortion directly.

If such 'second-best' options are somehow precluded then it must still be questioned whether the externalities are significant enough to limit immigration or to control natural population increase. As Ng (1986, page 255) has argued, population control is very costly in terms of its own transactions costs, in limiting the free choice of families and in denying the birth of happy individuals so that transactions costs of enforcing efficient pricing, in this case, are unlikely to provide a convincing rationale for controls on natural population increase. What is crucial in this type of setting are relative transactions costs.

This argument is perhaps weaker with respect to immigration since the transactions costs on restricting immigration via quotas are presumably quite low. In addition, the costs of such restrictions in terms of denying freedom of choice to those seeking to emigrate fall on people other than existing residents. To be clear, existing people do lose the welfare triangle that would have been conferred by the excluded immigrants. Hence, in optimally restricting immigration to account for unpriced externalities it is necessary to balance these costs against the benefits to existing residents. This can be done, in principle, as in Figure 6 where the actual value of labour’s marginal product $VMP$ is distinguished from that computed after adjustment for the marginal value of non-priced external costs $VMP_{(adj)}$. For simplicity, the reservation wage of immigrants is supposed fixed at $MC$. An 'open door' immigration policy is now no longer optimal and the immigration quota should be pegged at $N_{(adj)}$. This can be achieved either by fixing the entry fee $AB$ or by auctioning off the quota as suggested by Harrison (1989)—with foresight, both procedures yield the same level of benefits to existing residents.

Note that the basis for such an interventionist policy is unpriced externalities and the non-existence of feasible alternative regulatory schemes rather than the existence of public goods alone. If there are no externalities then public goods are only an issue influencing population choice if newcomers pay a smaller fraction of their income as taxes than existing people. It would be difficult to argue that this may (systematically) be the case for the progeny of existing residents and the already-cited US evidence suggests that the reverse is true for immigrants. In general, it is only if new immigrants impose more costs (in term of pollution, the use of social services, etc.) than the taxes they pay and the economic benefits they generate that they will be an economic burden to current people.

The general arguments here are consistent with the theory of policy-making in relation to what Bhagwati (1971) refers to as an economy subject to 'endogenous distortions' (production and consumption externalities). In such economies the socially optimal policy intervention is a tax-cum-subsidy policy directed specifically to the source of the distortion. In the case of an external production diseconomy, the first-best policy is to tax the firms generating the externality rather than generating a 'byproduct' distortion (viz, losing the welfare triangle) through restricting population. It is presumably only when population growth per se constitutes the source of the distortion (i.e. when externalities themselves cannot be priced for transactions costs reasons) that population and immigration policies should be used to deal with resource and environmental issues.

11 For simplicity, the costs of catching, prosecuting and perhaps deporting overstayers on temporary visas are abstracted from here. These costs may be quite high.
IV Conclusions and Final Comments

When looking at the set of public policies designed to deal with population issues on the one hand and resource issues on the other, one might begin to approach the issue of policy choice by listing 'instruments' and 'targets' and then evaluating the effectiveness of various policy instruments on the various targets. Thus the role of population policies to reduce environmental problems might be considered as well as the use of various resource and environmental pricing policies to influence population.

Analysis suggests an assignment of policy instruments to policy targets that is generally simpler than this. In fact, regardless of population/immigration policies, there are strong arguments for efficient resource pricing. Population and immigration policies seldom emerge as an efficient way of dealing with environmental and resource problems. This is so because population controls are a costly instrument for dealing with resource issues from the viewpoint of a pre-existing population.

Moreover, provided resource and environmental externalities are dealt with by efficient pricing policies, it is contended that existing people benefit from the viewpoint of a pre-existing population. The arguments here are independent of the existence of economies of scale in industry and, in fact, independent of whether or not population levels fall above or below what some would describe as 'optimal' levels.

In fact, rather than analyzing resource and population issues by carrying out a stocktake of a country's resource and environmental position and then computing an estimate of 'optimal population', the analysis has concentrated attention on the factors that ensure that continued population growth will be of economic advantage to current residents of a society. While some might contend that these pre-conditions are rather daunting (in particular, efficient pricing of all resources), the general viewpoint seems important because it shifts attention to pricing policies over which we as a community have control, rather than focusing on abstract and speculative concerns over what constitutes a desirable population.

The results of the analysis really come very close to confirming what should be expected to be the case on the basis of the standard competitive model. Given that many authors seem to have missed this point the approach, while essentially elementary, may be useful.

To conclude, it is worth emphasizing that the welfare conclusions derived above do depend on acceptance of the potential Pareto criterion (compensation principle) for assessing welfare changes. When wage differentials between countries are significant the question of actually compensating those who lose out as a consequence of immigration becomes more pressing.

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