International Capital Mobility, Infrastructure and the Effects of Labour Migration

Frank Barry
University College Dublin
Frank.Barry@ucd.ie

June 2001

Preliminary

Abstract
Globalisation, perhaps paradoxically, implies increased regionalisation: nation states come more and more to resemble regions of the global economy as international factor mobility increases. The present paper presents a new perspective on the modelling of regional economies. The fixed-cost element of public infrastructure is emphasised: this allows both the tax-base effect and congestion to be taken into account. International capital mobility is assumed, with an important distinction arising between constant-returns and increasing-returns technologies; for peripheral economies, access to the IRS technology is arguably through FDI. The paper also presents a new approach to the treatment of labour mobility. Taking Ireland as a long-standing example of a regional economy, the model is used to revisit a number of issues of practical and analytical interest.

Introduction

Regionalisation goes hand in hand with globalisation. Nation states come more and more to resemble regions of the global economy as the mobility of factors of production increases. Some factor or some characteristic needs to remain linked to a region however for the region to retain a geographic identity. In the present paper two options are explored in this regard. First, while substantial mobility of both capital and labour is allowed for, infrastructure remains a relatively fixed factor: it is assumed to take a very long time for public infrastructure to expand substantially in size. Secondly, I introduce a new way of modelling international labour mobility. Different regions have different characteristics, and workers value variety in terms of where they choose to work. This allows me retain the representative agent assumption, which is useful for welfare analysis, while allowing me discard the requirement, usually imposed by the mobility assumption, that the utility of working in each location must be the same. The value of this extra flexibility will become apparent later.

The paper proposes then a new way of modelling regional economies. As Ireland has exhibited strong degrees of both capital and labour mobility for at least a century and a half, I use the model to explore some new perspectives on a range of topics that have exercised students of the Irish economy. These include issues from economic history, such as the economic consequences of the massive depopulation of the 19th century, trade and growth issues such as the impact of the Single European Market and EU Structural Funds programmes, and macroeconomic issues such as the current and recent conduct of Irish fiscal policy.

Because I want to consider such a broad range of issues I use the term "international capital mobility" in the title of the paper. In considering the more current issues however, it will become clear that I have in mind its particular manifestation as FDI.

Section 1 begins with a brief overview of the conventional treatment of the economic effects of labour migration. Most of the debate that has followed on from this analysis has been concerned with the differential skill structures of the domestic and migrant populations. I propose to ignore the issue of skill structure completely, in

order to focus on other dimensions of importance, including in particular the underlying production technology of the economy.

1. Conventional Analysis of the Effects of Labour Migration

The conventional analysis holds that the welfare effects of free labour mobility are exactly analogous to those of free trade. Free trade, in the traditional view, typically damages one group of interests and benefits another, with the gains to the winners exceeding the losses of those who lose out. Figure 1 reproduces a diagram from Borjas (1995) on the effects of labour migration. D_L represents the aggregate labour-demand function, L_0 is the initial population and $L_0 + M$ is the population after group M immigrates. If the immigrants bring no new capital with them, the wage falls from w_0 to w_1. This hurts indigenous workers, operates to the benefit of employers/capital owners, and yields a net benefit to the initial population amounting to the area of the shaded triangle (since the new immigrants earn only the rectangle lying below the shaded triangle).[1]

Much of the discussion following on from this analysis has revolved around skill differences between the indigenous and immigrant populations. I propose to ignore this angle completely, in order to concentrate on others. The weaknesses of the analysis above that I wish to focus on are:

- That ownership of the capital stock is ignored,
- That no account is taken of congestion,
- That the production structure is oversimplified, and
- That the stocks of both capital and labour are exogenous.

Note that since immigration redistributes national income from labour to capital, this means that the nationality of ownership of the capital stock is important. This is how the argument can be squared with the view of economic historians such as O'Rourke (1995) that post-Famine emigration from Ireland played a large role in improving the living standards of those who remained behind. This is consistent with the Borjas view if the owners of capital are, say, absentee landlords whose welfare is not counted

[1] Given constant returns to scale and a domestically-owned capital stock, it is only in the case where immigrants exactly replicate the indigenous population in terms of skills and capital holdings per head that the indigenous population does not gain.

as part of national welfare. Given the proportion of Ireland's capital stock currently owned by foreign companies (with about half of manufacturing employment in such companies, which are substantially more capital-intensive than domestic firms), does this perhaps suggest caution as to what lessons we are to take from the Borjas analysis?

Besides the issue of skill differences, the impact of immigration on indigenous welfare can also be argued to depend on the other issues mentioned above.

To take congestion first, let us assume that the capital stock is fixed in the Borjas model. Clearly public infrastructure must also then be fixed. If inward migration is substantial enough in this case increased congestion must result, which reduces indigenous welfare in a way not taken into account in the diagram. This suggests that we must sceptical as to the value of short-run analysis in answering the questions raised.

If we take a longer-run perspective and think of the economy as perfectly open to international FDI, for example, then under constant returns to scale this ties down both the return to capital and the wage rate. In this scenario the labour-demand function is horizontal, and migration has no effect on either the wage or the return to capital. Changes in welfare must arise through other processes.[2]

2. The Model

2.1 *Building Blocks*

The model I propose to work with has the following building blocks:

- International capital mobility, which ties down the rate of return to capital.
- Some degree of returns to scale, whether constant or increasing.
- A stock of infrastructure, which can be subject to congestion.

[2] Dascher (2000) models land or housing as in fixed supply. He distinguishes between two types of households - home-owners and new entrants - both of whom supply labour. The first type benefits from immigration because of the upward pressure exerted on house prices, while the latter suffer from housing-market congestion. I will comment later on differences between his model and mine.

- A model of labour migration.

These issues are now dealt with in turn.

International Capital Mobility and the Structure of Production

The analysis of the implications of international capital mobility presented here are conventional. I assume that the domestic (small open economy) rate of return cannot deviate from the exogenous international rate:

1) $r = r^*$.

With the assets of the population held fixed throughout the analysis, the income from these assets is constant and can therefore be ignored, allowing us concentrate on labour income.

Assume the aggregate production function is of the Cobb-Douglas type, with returns to scale either constant (CRS) or increasing (IRS).

2a) $Y = A K^{\alpha} L^{1-\alpha}$

or

2b) $Y = A K^{\alpha} L^{\lambda}$, with $\alpha, \lambda < 1$, and $\alpha+\lambda > 1$

The return to capital is given by its marginal product. If production is CRS, equation (1) implies that the capital-labour ratio is fixed, and the wage is therefore also determined by equation (1). Only if the technology parameter in the production function changes can the wage change. In other words the labour-demand function is horizontal:

3a) Under CRS: $w = A\,[(1-\alpha)(r^*/\alpha A)^{\alpha/(\alpha-1)}] = A.[\text{constant}]$

If production is IRS, on the other hand, the labour-demand function implied by (1) is upward sloping:

3b) Under IRS: $dw/dL = A[\lambda K^{\alpha} L^{\lambda-2} (\alpha+\lambda-1)/(1-\alpha)] > 0$

I do not wish to imply that there is anything automatic about a country's aggregate production function exhibiting IRS. I associate the IRS production function, for a peripheral economy, with an ability to attract a particular kind of FDI. There are several reasons for this. First is the notion that there may be agglomerations associated with FDI, as in the theoretical model of Haaland and Wooton (2000) and the empirical results of Barry, Gorg and Strobl (2001). Second is the fact that the presence in the EU periphery of the sectors that tend to agglomerate in the core is associated with inward FDI.[3] Third is the notion developed by Gao (1999), that attracting FDI is the quickest way out of the Krugman-Venables U-curve trap.[4] Thus the aggregate production function will apply only if the macroeconomic, industrial, educational, industrial relations environments and others are all appropriate.

Infrastructure

Infrastructure can be assumed to influence utility directly or to influence it via the production function. The former option is assumed here. As in the recent work of Richard Harris (1995, 2001) I focus on the fixed cost element of infrastructure. Infrastructure is "lumpy", so that a country's income needs to reach some critical mass before some new infrastructural project can be undertaken. Given my assumption on capital mobility and production structure, it turns out not to matter whether this critical mass is defined in terms of national income or population size; I choose the latter. Once the population has reached critical mass, L*, the infrastructure is developed, raising welfare.[5]

As the population expands beyond critical mass there are two effects. First, the tax base expands so that the per capita burden of financing the infrastructure falls, raising individual utility. Secondly, however, the infrastructure becomes increasingly congested, which reduces utility. It seems reasonable to posit that the impact on utility as the population expands is inverse-U-shaped: congestion becomes a problem only well down the road.

[3] See Midelfart-Knarvik et al. (2000) for a list of such sectors. The point about ownership is based on work in progress by the present author and others.
[4] Krugman and Venables (1990, 1995) argue that as transport costs fall from very high to moderate levels, periphery welfare may fall as the growing relative importance of scale economies causes agglomeration at the core.
[5] I assume these costs are not sunk, so that if the population falls below critical mass the infrastructure is taken apart and sold off.

Denoting the small open economy (SOE) under discussion by use of subscript i, and expressing these effects in income terms, the income from working in the SOE is:

4) $y_i = w_i + \beta(L_i - L_i^*) - \gamma(L_i - L_i^*)^2$

with

5) $\beta(L_i - L_i^*) - \gamma(L_i - L_i^*)^2 > 0$ throughout the relevant range.

A Model of Labour Migration

Labour migration issues are typically handled in one or other of two ways. The most common approach is to assume that migration flows equalise the utility of working in alternative locations (different EU countries for example). This generates some overly restrictive results. Introducing inward migrants from outside the EU, for example, will simply displace EU citizens without impinging on their welfare. The alternative approach is to assume population heterogeneity, so that an increasing proportion of the population will be prepared to migrate as utility differences between locations increase; see e.g. Faini (1996) and Andersson and Forslid (2000). The heterogeneity assumption makes welfare analysis more difficult however.

The approach followed here is to retain the representative agent assumption but to assume a love of variety in terms of work locations.[6] Given a fixed number of hours available for work, Ls, agents choose to work l_i hours in each location i in order to maximise

6) $\sum_i l_i^{\theta}$

where $\theta < 1$, and $\sum l_i = L^s$.

[6] The love of variety implied by equation (6) is illustrated as follows. Say one faces the choice of working 25 hours in one location or 16 in one plus 9 in another. If $\theta = ½$, the utility associated with the

2.2 *The Model in Operation*

Private Sector Behaviour

Assume the overall utility function is Cobb-Douglas with two arguments: income derived from work in various locations, plus the utility of having a variety of locations to choose from.

Individuals therefore choose l_i to maximise:

7) $$U = (y)^{f} \left(\sum_i l_i^{q}\right)^{1-f}$$

where

8a) $$y = w_i + \sum w_{j \neq i}$$

if the population is below the level of critical mass, or

8b) $$y = w_i l_i + \beta(L-L^*) - \gamma(L-L^*)^2 + \sum(w_{j \neq i} l_j)$$

if critical mass has been attained and infrastructure is in place.[7]

Individuals in maximising utility take as given the wage, the tax base and the degree of congestion. The first order condition for utility maximisation is therefore:

9) $$[w_i - w_j + \beta(L-L^*) - \gamma(L-L^*)^2] + (y/\sum l_i^{\theta})[(1-\phi)/\phi]\,\theta\,[l_i^{\theta-1} - (L^s - l_i)^{\theta-1}] = 0$$

where I here assume that individuals have only two locations in which they can choose to work, i and j. From the first order condition comes the labour supply function:

10) $$dw_i \{(\sum l_i^{\theta}/y)[\phi/(1-\phi)][w_j(l_i + l_j)/y]\} = dl_i \{(\sum l_i^{\theta}/y^2)[\phi/(1-\phi)^2][w_i - w_j + \beta(L-L^*) - \gamma(L-L^*)^2]^2 - \theta(1-\theta)[l_i^{\theta-2} + (L^s - l_i)^{\theta-2}]$$

where the coefficients on both sides of the equation are positive, ensuring that the labour-supply function is upward sloping.[8]

---

former option is the square root of 25, i.e. 5, while the utility associated with the latter is the square root of 16 plus that of 9, i.e. 4+3 = 7.

[7] Note that the small open economy assumption allows us ignore the effects of possible SOE emigration on the tax base or degree of congestion in other possible host countries.

[8] For an equilibrium to exist of course it must rise more steeply than the labour-demand curve. This is assumed to be the case.

This analysis of labour supply thus far has been predicated on the assumption that the population is above the level of critical mass, so that infrastructure is in place. What if the population is below this level? We see that the first order condition will be slightly different (with the infrastructural terms missing from both y and the wage-gap expression). This will imply that to the left of the critical mass of population, L*, we have a different labour supply function lying closer to the wage axis.[9]

Since our model is slightly unusual in that the labour-demand function is upward sloping we need to examine its stability properties. Consider a random perturbation of wages, so that we start off with wages above the equilibrium level. Labour supply might appear to be less than labour demand at this point, suggesting disequilibrating upward pressure on wages. This is not the case however. Instead, with short-side clearing, the actual population is as read off the labour-supply curve. This population will not be offered the level of wages they require in order to stay in the country, which results in outward migration. Therefore we move down the labour-supply function, towards equilibrium.

The Socially Efficient Equilibrium

The equilibria just described are not Pareto efficient, for several reasons. First is that individuals in making their labour supply decisions do not take their effects on the infrastructural variables into account. This consideration can go in either direction. It may lead to an inefficiently low level of population if the tax base is too low. Alternatively congestion may be excessive.

A further consideration arises if the production function is IRS. In this case individuals do not take into account the impact of their labour-supply decisions on the level of wages in the economy.[10] Other things equal this leads to an inefficiently low level of population.

The first order condition for social efficiency is:

[9] This can be verified by differentiating the first order condition, holding w_i constant, to show that the impact of infrastructure on labour supply is positive.

$$11) \quad [w_i - w_j + \beta(L-L^*) - \gamma(L-L^*)^2] + l_i [(dw_i/dl_i) + \beta - 2\gamma(L-L^*)] + (y/\Sigma l_i^{\theta})[(1-\phi)/\phi]\,\theta\,[l_i^{\theta-1} - (L^s - l_i)^{\theta-1}] = 0$$

Equation (11) differs from equation (10) in terms of the marginal effect of increased population on the infrastructure variable $\{\beta - 2\gamma(L-L^*)\}$, which can be of either sign, and on wages (dw_i/dl_i). The latter is zero if production is CRS and positive if production is IRS. If these extra terms sum to zero, the unconstrained private outcome, quite by chance, yields social efficiency.

I will argue below that this indeterminacy over whether employment is too large or too small for social efficiency, far from being a weakness, is actually an appealing feature of the present analysis.

3. Effects of Emigration

The first issue we want to analyse concerns the welfare effects of emigration. Section 1 illustrated economic historian Kevin O'Rourke's (1991, 1995) argument that the Famine of the 1840s plus post-Famine emigration raised the wages of those who remained behind in Ireland and, on the implicit assumption that the capital stock was foreign owned, raised national income as well. This conclusion is quantified via the use of CGE models, which are of course programmed to accord with the intuition of those who construct them.

O Grada and Walsh (1994) implicitly express scepticism of the O'Rourke view by pointing to the fact that "during the 1950s, when emigration from Ireland was at a very high level, there was no narrowing of the Irish/British gap (in terms of GNP per capita, but also in terms of wages; table 4.20), whereas during the period of lower emigration from 1960 to 1980, Irish income rose from 50 percent of the UK average to 67 percent"; (page 128).

[10] Similar considerations arise in the "monopoly union" model: Oswald (1985). In that case (in which the labour-demand function slopes down) the union restricts the supply of labour in order to drive up wages. The loss to the economy is greater than the gain to the union in that case (negative sum game). The present case represents a positive sum game.

O'Rourke's model takes no account of the possibility of increasing returns. Much of modern development economics is based on IRS, however, and the study of 19th century Ireland surely takes us into the realm of economic development, as alluded to by O Grada (1994, especially chapter 13) for example.

Figure 2 formalises an alternative perspective to O'Rourke's, whereby the halving of the population between 1840 and 1900 contributed to the economy's failure to industrialise and develop.

Let Famine reduce the population from L_0 to L_1 "instantaneously", and let consequent emigration reduce it further to L_2. If L_0 was above the critical mass, then workers are unambiguously worse off at L_2. This is in fact the case even with CRS, given condition (5) above.

This is not to suggest that the requisite infrastructure was actually in place at the time of the 1840s famine. The Industrial Revolution was in motion however and Ireland could have been better placed to develop the infrastructure required to play a part in it if such dramatic population decline had not occurred. Whelan (1999) presents an economic geography model that illustrates how the combination of the Famine, developments in transportation and the increasing demand for industrial products could have worked together to cause persistent depopulation and relative industrial decline. The present result is clearly related to this. The Whelan paper is of the Krugman-type however, where population size is crucial to the generation of agglomeration economies because output is largely non-tradeable.[11] The size of the home market will clearly be less important in a free-trade environment. The advantage of the perspective advanced in the present paper is that it does not depend on the non-tradability of output.[12]

The present model reflects the argument of Kelley (1988) who wrote that while growth in per capita output in many developing countries would have been more rapid in an environment of slower population growth, a positive effect could arise "where

[11] Ireland's population relative to the UK fell from 31 percent in 1841 to 17 percent in 1871 and less than 10 percent in 1911; O Grada (1994, page 345).

possibilities for scale economies are substantial, and where markets and other institutions (especially governments) allocated resources in a reasonably efficient way over time and space".

3. The Single European Market

How might the development of the Single Market be reflected in the present model? Let us assume production is IRS, so that the labour-demand curve is upward sloping. In the analysis of Krugman and Venables (1990, 1995) the main determinant of whether peripheral economies gain or lose from further market integration depends on whether they gain or lose IRS sectors. In endogenous growth models a similar ambiguity arises depending on whether they gain or lose human-capital and R&D-intensive sectors; Barry (1996). In my simple model, the Single Market is reflected in a change in the technology parameter A in the production function of equation (2). Whether the slope in equation (3) rises or falls depends on how A is affected, which in turn depends on how these various concerns balance out (Figure 3). If the economy loses these crucial sectors, the labour-demand function becomes flatter, wages and employment fall and there is an unambiguous deterioration in welfare.

Of the four peripheral economies they studies, Barry, Bradley and Hannan (2001) suggest that Greece may have experienced this adverse outcome. They show however that the development of the Single Market was associated with a dramatic increase in US investments in the EU, and that Ireland captured a substantial proportion of these. Furthermore the sectors into which these investments flowed appeared to be those identified as important in the economic-geography and endogenous-growth literatures. These increased inflows in turn may have allowed Ireland achieve a critical mass of such firms in certain sectors, allowing agglomeration and demonstration effects to come into play. If we view the aggregate production function as a weighted average of CRS and IRS sectors, this would have increased the slope even further.

[12] A fuller representation of this view would propose that adequate infrastructure is a pre-requisite to be able to attract IRS sectors.

For an economy such as Ireland then, the SEM can be argued to have raised both wages and employment, with the movement up the labour-supply curve representing an unambiguous improvement in welfare.

Would the initial population be better off with or without this further population increase? The answer depends on whether the initial equilibrium labour force was above or below the socially efficient level. If above, then the increase in population reduces their welfare; if below, it increases it.

This result can be compared to the analysis of Dascher (2000), which is similar in a number of respects. In Dascher, indigenous households own land which immigrant households must purchase (for housing); migrant's utility cannot deviate from the level available elsewhere; production is CRS and there is no congestion. The equivalent SEM shock in his model raises labour-demand and wages, which is beneficial for the resident population. The resulting immigration then raises land prices which benefits the initial population further. In his model therefore immigration cannot but benefit the indigenous population. In the present model, by contrast, the opposite is also possible since congestion can arise.

4. Structural Funds

The EU Structural Funds programme essentially provides free infrastructure for the more peripheral EU economies. In diagrammatic terms therefore, the programme can be thought to shift us from L_s1 in Figure 4 to L_s2, with a consequent unambiguous increase in utility. As the utility level at point 1 on L_s1 is the same as that at point 2 on L_s2, the distance between points 2 and 3 can be taken as a measure of the value of the donated infrastructure to the group who are suppling labour at these points (which we may associate with the initial or domestic population). The new equilibrium is at point 4 rather than point 3 however.

In the case of donated infrastructure, there is now no tax-base effect. Inward migration raises wages and generates congestion. Since one of the advantages of inward migration that we have recognised heretofore is missing, one is more likely to end up in the present case in an equilibrium with congestion.

Inward migration is less desirable from the viewpoint of the initial population when the tax base effect is removed. To state this result in more general terms, immigration confers greater benefits when the recipient economy has a high debt-to-GDP ratio, since working immigrants raise GDP while the debt has been accumulated before their arrival so there is no reason to presume they will raise it further.

5. Recent Irish Fiscal Policy

One of the factors behind Ireland's dramatic growth over the last 15 years or so has been the cuts in income tax that supported the tri-partite national wage (or "social partnership") agreements of the period. If one thinks of labour-market openness in the most basic terms, whereby the domestic after-tax wage is set by that available abroad, it is clear that this implies that all the benefits of income-tax reductions accrue to employers, generating substantial employment generation effects.

Past of the reason for the recent acrimony between the Irish government, on the one hand, and the EU Commission and Ecofin on the other has been that the Irish government remains committed to the view that continued tax reductions are an important instrument for increasing labour supply. In a recent paper Barry and Fitz Gerald (2001) challenge that view. We argue that infrastructural congestion (reflected in this case in an annual house price inflation rate of 10 percent over the last decade) has now made labour-supply highly inelastic.

This is reflected in the following macromodel simulations carried out at the Economic and Social Research Institute.

Table 1: **Effects of a £500 million cut in income taxes**

	Elastic labour supply curve		Rising labour supply curve with no migration	
Year	1	3	1	3
Consumer Prices	-0,01	-0,03	0,05	0,13
Wage Rates	-0,9	-1	0,35	0,35

Source: Barry and Fitz Gerald (2001)

The table suggests that in the past, when skilled labour was in highly elastic supply because of the openness of the labour market, the real incidence of tax cuts was on the business sector, generating an expansion in supply. With an inelastic supply of labour, on the other hand, tax cuts accrue to employees as an increase in disposable income, demand-side effects dominate supply-side effects, and the economy overheats.

This same point arises in the present model. Though labour supply here is less than perfectly elastic even without congestion (because of the love-of-variety assumption), increased congestion reduces the employment effects of tax cuts.

To see this, define the w_i term encountered thus far as the gross wage. It is the net wage, $w_i - \tau$, that enters into the definition of income, y. This gives a slightly amended first-order condition determining individual behaviour, from which we find:

12) $$dl_i/d\tau = (\sum l_i^{\theta}/y^2)\,[\phi/(1-\phi)]\,[w_j\,(l_i + l_j)]\,/$$
$$\{\,\theta(\theta-1)\,[l_i^{\theta-2} + (L^s - l_i)^{\theta-2}] - (\theta^2/\phi\sum l_i^{\theta})[l_i^{\theta-1} - (L^s - l_i)^{\theta-1}]^2\,\} \quad < \quad 0$$

Thus tax cuts will indeed stimulate labour supply and raise employment.

We now want to ask what impact increased congestion will have on this. From equation (4), increased congestion can be modelled as an increase in the value of the parameter γ.

Denoting the denominator of the expression for $dl_i/d\tau$ as V, we find:

13) $$d\,(dl_i/d\tau)/d\gamma = 4(L_i - L_i^*)/V\,[w_j\,(l_i + l_j)]\,[\phi/(1-\phi)](\sum l_i^{\theta}/y^3)\,l_i < 0 \text{ (since } V<0).$$

Since $dl_i/d\tau$ is itself negative, this result shows that $dl_i/d\tau$ approaches zero as congestion increases, as in the analysis of Barry and Fitz Gerald (2001).

6. Promoting Migration from Outside the EU

One final question which we ask of the model concerns the current plan of the Irish government to issue a large number of work visas to non-EU-nationals. This has been criticised by some as being concerned simply with GDP growth rather than with growth in terms of per capita (of the initial or "indigenous" population). Recall that in the conventional analysis of Section 1 wages will be driven down but the loss to

labour will be more than dominated by the increased returns to capital. From the viewpoint of labour this is unambiguously bad, and this may be the case for overall national welfare as well if a sufficiently high proportion of the capital stock is foreign-owned.

Our analysis suggests that other scenarios are also possible. The policy may be in labour's interest if production is IRS, in which case a larger labour force can support higher wages. How is this to be balanced against the danger of further congestion however?

It will be clear that the present model does not yield an unambiguous answer to this question. The answer depends on whether the initial labour force is greater or less than the efficient level. The response of the initial population (of EU citizens) will differ in the two cases. Whether they are better or worse off after the proposal has been implemented can be gauged from their response. If they are made worse off, their supply of labour to the SOE will decline; if better off, it will expand.

To analyse this policy, let $L_i = l_i + J$; i.e. the initial population (of EU citizens) which has the free choice to live and work in the SOE, plus the non-EU migrants. We can assume, realistically, that non-EU migrants will avail of the offer to work in the SOE since the utility or income from working in their home economies can be taken to be substantially lower than in the SOE.

Differentiating the private first order condition, equation (9), with respect to J, noting that $dL_i/dJ = (dl_i/dJ) + 1$ and $dw_i/dJ = dw_i/dL_i\,[(dl_i/dJ) + 1]$, we find:

$dl_i/dJ = -X/(X-Z)$

where $X = (\sum l_i^{\theta}/y)\,[\phi/(1-\phi)]\,[w_j\,(l_i + l_j)]\,[\,(dw_i/dl_i) + \beta - 2\gamma(L-L^*)\,]$

and $Z = \{(\sum l_i^{\theta}/y^2)\,[\phi/(1-\phi)]\,[w_i - w_j + \beta(L-L^*) - \gamma(L-L^*)^2\,]^2\,[1/(1-\phi)]$

$- \theta(\theta-1)\,[l_i^{\theta-2} + (L^s - l_i)^{\theta-2}]$

Z is positive, while the sign of X depends positively on the sign of the externalities terms: $(dw_i/dl_i) + \beta - 2\gamma(L-L^*)$. It is immediately clear then that if we are already by chance at the social optimum, where $(dw_i/dl_i) + \beta - 2\gamma(L-L^*) = 0$, some marginal

immigration from outside the EU will leave EU labour supply and welfare unchanged.[13]

If we are already above the socially efficent level of the labour force, in the sense that $(dw_i/dl_i) + \beta - 2\gamma(L-L^*) < 0$, then dl_i/dJ is of course negative (and less than one in absolute value). Bringing non-EU workers into the economy causes such congestion that EU citizens are literally crowded-out! The size of the labour-force nevertheless expands, and the welfare of EU citizens deteriorates.

For $(dw_i/dl_i) + \beta - 2\gamma(L-L^*)$ positive, though not too large, the opposite effect occurs.[14] In this case, bringing in workers from outside the EU moves us closer to the socially efficient equilibrium, expands the welfare of EU workers, and draws yet more of them to the SOE.

Hence my argument earlier that these ambiguities, far from weakening the model, actually make it more interesting.

Concluding Comments

This paper has presented a new perspective on the modelling of regional economies. The key ingredients include infrastructure and mobility of both capital and labour. In terms of infrastructure, the emphasis is on the fixed cost component, which allows both the tax-base effect and congestion to be taken into account. As for capital mobility, the distinction is between constant-returns and increasing-returns technologies. For peripheral economies, access to the IRS technology is arguably through FDI. Not all economies will be successful in this regard of course. The paper also explores a new way of treating labour mobility. The love-of-variety approach introduced here allows one retain the representative-agent assumption, which is useful for welfare analysis, while avoiding the restriction of requiring migrant welfare levels to be the same no matter in which location they end up.

[13] I am of course ignoring motivatory factors such as solidarity, recognition of the benefits of cultural diversity etc., in order to focus narrowly on the economic issues influencing welfare.

[14] "Not too large" refers to the requirement that X-Z must remain negative. I have yet to complete the proof that this will hold true for all feasible values of X.

Taking Ireland as a prime example of a regional economy, because of the strong degree of mobility of both capital and labour exhibited over a long period of time, the model was used to revisit a number of practical issues of analytical interest. In each case, the model can be argued to have thrown up a number of new dimensions to the issues explored.

A remaining weak point of the model is that no cognisance is taken of the fact that there may be several points of "critical mass" associated with different stages of infrastructural development. This raises the possibility that immigration beyond the point identified as "optimal" in the present paper may facilitate moving to the next stage of infrastructural development.

References

Andersson, F., and R. Forslid (2000) “What we cannot learn from the Irish experience: a fundamental asymmetry of asymmetric shocks”, unpublished ms., Lund University.

Barry, F. (1996) “Peripherality in Economic Geography and Endogenous Growth Theory: Evidence from Ireland’s Adjustment to Free Trade”, *World Economy*.

Barry, F., J. Bradley and A. Hannan (2001) “The Single Market, The Structural Funds and Ireland's Recent Economic Growth, *Journal of Common Market Studies*, forthcoming.

Barry, F., and J. Fitz Gerald (2001) "Fiscal Policy, the Irish Boom and the Constraints of Monetary Union”, paper delivered to the Swedish Committee on Stabilisation Policy in EMU; Stockholm, May 3, 2001.

Barry, F., H. Görg and E. Strobl (2001) "Foreign Direct Investment, Agglomerations and Demonstration Effects: An Empirical Investigation", UCD Working Paper, available at: http://www.ucd.ie/~economic/workingpapers/2001.htm

Borjas, G. (1995) "The Economic Benefits from Immigration", *Journal of Economic Perspectives*, 9, 3-22.

Borjas, G. (1996) *Labor Economics*, New York: McGraw-Hill.

Dascher, K. (2000) "Trade, FDI and Congestion: The Small and Very Open Economy", Working Paper, UCD Centre for Economic Research and CEPR. Available at: http://www.ucd.ie/~economic/workingpapers/2000.htm

Faini, R. (1996) "Increasing Returns, Migrations and Convergence", *Journal of Development Economics*, 49, 121-136.

Gao (1999) “Economic Geography and Vertical Multinational Production”, *Journal of International Economics*.

Haaland, J., and I. Wooton (2000) “International Competition for Multinational Investment”, *Scandinavian Journal of Economics*.

Harris, R. (1995) Trade and Communication Costs, *Canadian journal of Economics*.

Harris, R. (2001) A Communication-Based Model of Global production Fragmentation, in S. Arndt and H. Kierzkowski, eds., *Fragmentation: New Production Patterns in the World Economy*, Oxford: OUP.

Kelley, A. C. (1988) “Economic Consequences of Population Change in the Third World”, *Journal of Economic Literature*, 26, 1685-1728.

Krugman and Venables (1990) “Integration and the Competitiveness of Peripheral Industry”, in Bliss and de Macedo, eds., *Unity with Diversity in the European Economy*, Cambridge.

Krugman and Venables (1995) “Globalization and the Inequality of Nations”, *Quarterly Journal of Economics*.

Midelfart-Knarvik et al. (2000) “The Location of European Industry”, Economic Papers No. 142, European Commission.

O Grada, C. (1994) *Ireland: A New Economic History, 1780-1939*, Oxford: OUP.

O Grada and Walsh (1994) The Economic Effects of Emigration: Ireland, in B. Asch, ed., *Emigration and its Effects on the Sending Country*, Santa Monica: Rand.

O'Rourke, K. (1991) “Did the Great Irish Famine Matter?”, Journal of Economic History, 51 (1), 1-22.

O'Rourke, K. (1995) "Emigration and Living Standards in Ireland since the Famine". *Journal of Population Economics*, 8, 407-421.

Oswald, A. (1985) “The Economic Theory of Trade Unions”, *Scandinavian Journal of Economics*.

Whelan, K. (1999) "Economic Geography and the Long-Run Effects of the Great Famine", *Economic and Social Review*, 30 (1), 1-20.