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WHY IRELAND EMIGRATED: A POSITIVE THEORY OF FACTOR FLOWS

By KEVIN O'ROURKE

1. Introduction

There are two burning questions in nineteenth century Irish emigration history that have yet to be resolved. The first is: why was it that labour flowed from Ireland to Britain (and elsewhere), while capital failed to flow from Britain (and elsewhere) to Ireland? The second is: did more productive members of society emigrate? This paper does not resolve either issue, but simply points out that the two debates are more closely linked than has hitherto been recognised. If more productive individuals are more prone to emigrate, this may, in fact, explain the absence of substantial capital inflows. Indeed, in the context of the factory system, it could even explain the coexistence of labour and capital outflows from Ireland.

Section 2 reviews the Irish historical literature dealing with this issue, while Section 3 briefly examines the trade theoretic literature regarding the determination of international factor flows. Section 4 outlines a simple two country, two factor, one good model that will be used to formally link the two questions raised above. Section 5 derives the main results of the paper. If certain assumptions about emigrant self-selection are made, then this can be shown to have implications for the direction of factor flows. Section 6 goes one step further, and suggests that high quality workers may indeed have been disproportionately mobile in nineteenth century Ireland. A simple microeconomic argument is given in support of this claim. Section 7 briefly ties in the results of the paper with the rise of the factory system. Section 8 concludes.

2. Two historical debates

What determines whether labour flows from labour abundant regions to capital abundant regions, or whether it is capital that flows to cheap labour? This question inevitably arises when one considers the economic histories of neighbouring rich and poor countries.\(^1\) It is absolutely central, for example, in understanding Irish underdevelopment in the nineteenth century. Under-development and capital scarcity are clearly closely related phenomena;\(^2\) why did British capitalists fail to take advantage of the huge pool of cheap labour

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1 Or of rich and poor regions within the same country.

to be found in Ireland? In the event, massive emigration from Ireland to Britain and elsewhere took place; the population of Ireland fell from 8.2 million in 1841 to 4.5 million in 1901.

This fall in population was largely due to a decline in the agricultural population, and economic historians have accordingly analysed the causes of falling rural employment in some detail. Depopulation in the decade following 1841 was clearly due to the potato famine of the late 1840s; in the longer run, labour appears to have been pulled out of the Irish agricultural sector by higher wages abroad. Moreover, the famine probably played a long run as well as a short run role in reducing rural employment in Ireland. It can be seen as a negative land supply shock, which would of itself tend to reduce employment. It probably speeded up the integration of Irish with world labour markets, which enabled the 'pull' forces mentioned above to come into play. It also reduced the role of the potato in the economy, in the process lessening the links between labour-intensive tillage and land-intensive pasture. The post-famine expansion of pasture thus took on an extreme labour-extensive form.

An important question remains unanswered, however: given that labour left Irish agriculture to work in industry, why did it end up in industry located abroad rather than in Ireland? Until this question is satisfactorily resolved, explanations for long run Irish rural depopulation cannot be regarded as explanations for Irish depopulation per se. Why was it foreign rather than Irish industrial wages which enticed workers to leave agriculture? A negative land supply shock affected the productivity of Irish agriculture but not (presumably) of Irish industry: it may have displaced workers in agriculture, but a priori this does not help us understand why those workers went one step further and emigrated.

Why didn’t capital flow to Ireland? Ireland had, after all, been a member of the United Kingdom since 1800, and capital was free to flow between the two countries, one of them the richest nation on earth. The question has never been satisfactorily resolved. As long ago as 1845, Kane disposed of the argument that a lack of natural resources was to blame. Many contemporaries, such as Sir G. C. Lewis, blamed the lack of British investment in Ireland on the perceived insecurity of property in Ireland: ‘the insecurity of property in Ireland, whether real or supposed, assists in increasing the number of the Irish emigrants to Great Britain, inasmuch as it prevents the English and Scotch capitalist from transmitting materials to be manufactured in Ireland’. Mokyr ends up giving risk of this sort an important role in explaining the lack of British investment.

5 O’Rourke (1991a).
6 O’Rourke (1991a); Crotty (1966).
7 Kane (1845). Mokyr agrees with Kane on this: see Mokyr (1983), pp. 152–58. In theory the existence of non-traded factors of production can of course explain the direction of factor movements; see Section 3. However, since coal, the natural resource most often mentioned by what may termed geographical determinists, was traded, the argument is not directly applicable here.
8 Cited in O’Brien (1921), p. 572.
in Ireland.\(^9\) However, such risk should presumably be reflected in financial markets if it existed (as should political risk, another factor mentioned by some commentators); in the only study of this issue to date (as yet unpublished), O'Grada found that there was no risk premium on Irish property insured by the Sun Fire Insurance Company.\(^{10}\)

The role of external economies of scale has also been raised in the context of nineteenth century Ireland. O'Malley assigns a central role to 'strong tendencies to industrial centralisation in Britain and Ireland'\(^{11}\) in explaining Irish industrial decline in the nineteenth century, while O'Grada says that 'the concentration (of the cotton industry) around Belfast is probably attributable to external economies of scale, though the evidence is elusive'.\(^{12}\) The real problem with the argument as it has been stated to date is precisely that the evidence has been (of necessity, indeed) elusive.\(^{13}\) Despite much interest, therefore, in the issue of what determined the direction of factor flows in nineteenth century Ireland, no consensus whatever has been established as to what the relevant factors were.\(^{14}\)

The issue of whether it was the more energetic and productive members of Irish society who emigrated has also attracted great attention. It was certainly on the minds of contemporary observers. For example, the *Royal Commission on Agricultural Labour* of 1893 contained responses to questions regarding the efficiency of agricultural labour. Assistant Commissioner McCrea (who covered the northern part of the country) concluded that, while opinions on the subject differed, 'the weight of evidence is certainly to the effect that the agricultural labourers are not so efficient or so hard-working as formerly, the best men having emigrated or removed to towns.'\(^{15}\) Mr. O'Brien, reporting from Kanturk in Co. Cork, stated that 'there is a very general opinion and, probably, a perfectly well-founded opinion entertained by the employers of labour in this district that the labourers are now neither as efficient as formerly, nor as those met with elsewhere, owing to the circumstance that the best, youngest, and most competent are those who have emigrated; the old and immature remaining behind.'\(^{16}\) It would be tedious to document the opinions of employers on this

\(^{9}\) Mokyr (1983) p. 194. Mokyr also cites Lewis' remark.

\(^{10}\) O'Grada (1986), p. 18. In any case, risk of this sort could presumably not explain other similar historical cases, such as the migration of labour from rural to urban areas, rather than an opposite migration of capital, *within* nineteenth century Britain. See the many references concerning British internal labour migration given in O'Rourke (1989), Chapter 4. The failure of capital to move to the Southern English countryside is briefly raised in Williamson (1990, p. 210).


\(^{12}\) O'Grada (1986), p. 16.

\(^{13}\) Recent work by Caballero and Lyons (1990) offers the possibility that the presence of external economies of scale could be empirically tested.

\(^{14}\) The issue has been raised in an even broader historical context by Clark (1987). It is of current policy significance as well; Irish industrial policy has consciously based itself for the last 30 years on a program of attracting foreign investment, with the specific goal of reducing the level of emigration.


\(^{16}\) B.P.P. (1893–4), Vol. IV, Part II, p. 35. Lord Eversley was of the same opinion regarding those who migrated from rural England to the cities during the late nineteenth century; see O'Rourke (1989), Section 4.3.
matter in greater detail; suffice to say that opinions similar to those given above were widely and strongly held.\footnote{The source of the information is of course somewhat suspect, given the tendency of farmers everywhere to complain. It should however be said that Mokyr and O'Grada felt able to draw some conclusions from the responses of witnesses to the Poor Inquiry Commission of 1836 regarding the condition of the poor in that year; and indeed, they take that data seriously enough to construct with it a 'subjective index of impoverishment' (Mokyr and O'Grada (1988)).}

It is indisputable that there was strong self-selection operating among potential migrants in nineteenth century Ireland. Emigrants certainly self-selected in terms of age, with young adults being disproportionately represented in post-famine emigration.\footnote{Mokyr (1983), pp. 233–34. Williamson has documented the same phenomenon in the context of rural England (Williamson (1990), Chapter 2).} Various studies have examined the correlation between migration, human capital and skills (see Section 6); with the exception of a study by Mokyr and O'Grada looking at the numeracy of emigrants to America, they tend to find that migration was associated with high levels of skills, education and human capital.

Neither age nor education, however, are really what the labour quality debate was about, as Mokyr and O'Grada themselves point out.\footnote{It was of course of concern to employers that the young were leaving; but in its purest form, the labour quality debate was concerned with whether the 'best' workers within given age and skill categories were emigrating. Thus, the debate was also formally distinct from the related and important debates about the brain drain that have taken place recently (see for example Bhagwati (1979a)), or the extensive empirical survey prepared for the US House of Representatives (Library of Congress (1974)).} The quality of emigrants relative to the population as a whole, within given age and skill categories, would seem impossible to quantify. Self-selection among emigrants in terms of various proxy variables cannot therefore resolve the labour quality dispute in any direction.

In what follows I will construct a simple two-country model where both labour and capital are free to move internationally. I will assume that contemporary observers in Ireland were correct regarding the quality of more mobile labourers, and will show that this assumption generates predictions regarding the direction of factor flows between the two countries. The connection between the two issues discussed above will thus have been established within the context of a formal model. First, however, I will say something about the relevant trade theoretic literature.

3. The trade literature

For the past 20 years, trade theorists have written a great deal about the normative effects of factor flows.\footnote{A good survey of the literature is provided in Bhagwati (1979b).} The positive question of what factor flows will in fact take place under conditions of free factor mobility has not received similar attention. The reason is simple: in many models the answer is indeterminate. In the Ramaswami two-country two-factor one-good model, for example, there is a continuum of possible equilibria. This is because both the
wage and rental rates depend uniquely on capital labour ratios; once one factor price has been equalised between countries, the other is automatically equalised. Thus, there is only one independent equation to determine two unknowns (labour and capital flows).

Introducing a third, internationally immobile factor leads to a determinate outcome.\footnote{See Kuhn and Wooton (1987). This consideration is probably the historically relevant one when the mass migrations of both capital and labour from Europe (including Ireland) to the New World are concerned; but it does not seem to provide a compelling explanation of the emigration from Ireland to Britain during the same period.} Another obvious solution is to appeal to external economies of scale. In this case, if technology is identical across countries, factors could in theory cluster in any country; history will however determine which equilibrium in fact occurs. The external economies of scale argument is an old one, which has become popular recently through the theoretical work of Romer, Lucas and others.\footnote{See for example Romer (1986) or Lucas (1990).} This paper adopts a third route; taking the Ramaswami model as its starting point, it assumes an asymmetry between capital and labour, and examines its consequences. The particular asymmetry it assumes is that there are different qualities of labour, indistinguishable to the employer. This is not the same as assuming different skill levels. It is generally assumed that employers can distinguish between skilled and unskilled workers; here it is assumed that they cannot distinguish between more and less productive workers (call them non-shirkers and shirkers) within a given skill category.

Given this assumption, and others to be outlined below, it is possible to show that under any plausible adjustment mechanism, it must be the case that all non-shirkers move from the labour abundant to the capital abundant country. The direction of capital movement depends on the extent to which the original capital labour ratios in the two countries differ. If the labour abundant country is not too labour abundant relative to the capital abundant country, it will actually experience a net capital outflow.\footnote{If the labour abundant country is relatively very labour abundant, it will experience a net capital inflow, as would be expected. However, all the non-shirkers originally resident in that country will still emigrate.} While returns to capital will be equalised in equilibrium, the equilibrium wage in the labour abundant country will be lower than in the capital abundant country. Moreover, it is possible that wages in the labour abundant country will actually fall as a result of emigration.

4. The model

There are two countries in the model, Ireland (denoted I) and Britain (denoted B). There are two factors, capital (K) and labour (L), and Ireland is relatively labour abundant. Output (Q) is produced according to $Q = F(K, L)$, or (using the labour-intensive form of the production function)

$$Q_i = Lf(k_i) \quad (1)$$
where \( i = I, B \), and the \( k_i \)'s are the effective capital labour ratios actually used in production in the two countries.\(^{24}\)

The three assumptions crucial for the results that follow are now introduced.

**Assumption 1** There are two types of workers in the economy, shirkers and non-shirkers. The marginal product of shirkers is equal to a constant \( a \) of the marginal product of non-shirkers, with \( a < 1.\)^{25} For the sake of simplicity, it is assumed that the labour force is divided equally into these two groups in each country; none of the results are affected if a different ratio is assumed. The reason for assuming that the ratio of shirkers to non-shirkers is the same in both countries is to emphasise that the model does not rely on any asymmetries between countries other than different initial capital labour ratios.

**Assumption 2** Employers in both countries cannot distinguish between the two types of workers, due to excessive monitoring costs.\(^{26}\) The wage is therefore equal to the observed average marginal product of labour; ie.

\[
 w_i = q_i [f(k_i) - k_i f'(k_i)] + (1 - q_i) a [f(k_i) - k_i f'(k_i)]
\]

where \( q_i \) is the proportion of non-shirkers in country \( i \). This proportion is an endogenous variable; it is in general not equal to 0.5 due to the presence of migration (see Assumption 3).\(^{27}\)

**Assumption 3** The costs of emigration depend entirely on whether one is a shirker or a non-shirker. In particular, it is assumed that the costs of emigration are negligibly small for non-shirkers, but prohibitively large for shirkers. This means that all migrants are non-shirkers. The reason for making this assumption should be obvious given the motivation provided in the earlier sections. The aim of the paper is to demonstrate that there is a formal link between the two debates mentioned earlier, namely the 'direction of factor flows debate' and the 'labour quality' debate. An obvious way to accomplish this is to assume that more productive workers were more mobile, and to explore the consequences of this assumption for the direction of international factor flows. The assumption is stated in an extreme form here to make the derivation of results easier. It

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\(^{24}\) The analysis thus assumes constant returns to scale.

\(^{25}\) The value of \( a \) is irrelevant as far as the main result (that all Irish non-shirkers migrate to Britain) is concerned. The precise way in which it affects equilibrium will be dealt with in the following section.

\(^{26}\) Thus the types of issues raised in models of migration under asymmetric information (eg. Katz and Stark (1984)) are ruled out by assumption. These models assume that employers know the skill levels of their own countries' workers, but not of workers who have arrived from other countries. It is interesting to note that Assumption 3 would make precisely the reverse situation more plausible; namely, that employers would be more certain of the productivity of immigrants than of natives. This possibility is however ruled out for reasons given later. Admitting the possibility would make the conclusions of the paper hold a fortiori.

\(^{27}\) The assumption that the labour force in each country is divided equally between shirkers and non-shirkers does however mean that in the initial equilibrium, before the economies are opened up to international factor flows, \( q_i \) will be equal to 0.5 in each country.
should be possible to replace the assumption with a more moderate one (e.g., that shirkers require a higher wage gap if they are to emigrate than do non-shirkers) in such a way that the results of the paper hold in a modified form (i.e., allowing the possibility that some shirkers also emigrate). The point of the paper is, however, a simple one, and the analysis is kept correspondingly simple.

Assumption 3 makes it easy to calculate the proportions \( q_i \) in equation (2) at any point in time. They are simply given by:

\[
q_I = \frac{0.5L - L_x}{(L - L_x)} \tag{3}
\]

\[
q_B = \frac{0.5L^* + L_x}{(L^* + L_x)} \tag{4}
\]

where \( L \) and \( L^* \) are the initial stocks of labour in Ireland and Britain respectively, and \( L_x \) is the stock of Irish labour that has emigrated to Britain. \( K_x \) is similarly defined as the stock of British capital that has been invested in Ireland. Both \( L_x \) and \( K_x \) can in principle be negative.

Equations (3) and (4) imply that wages in Ireland and Britain are given by

\[
w_I = \left[ f(k_I) - k_if'(k_I) \right] \frac{0.5L(1 + a) - L_x}{(L - L_x)} \tag{5}
\]

\[
w_B = \left[ f(k_B) - k_Bf'(k_B) \right] \frac{0.5L^*(1 + a) + L_x}{(L^* + L_x)} \tag{6}
\]

Assumptions 1 and 3 also enable us to define the \( k_i \)'s precisely. Since not all labour is equally productive we need to consider not the number of workers used in production but the effective input of labour in a given country. Assumptions 1 and 3 together imply that

\[
k_I = \frac{(K + K_x)}{[0.5L(1 + a) - L_x]} \tag{7}
\]

\[
k_B = \frac{(K^* - K_x)}{[0.5L^*(1 + a) + L_x]} \tag{8}
\]

\( K \) and \( K^* \) are respectively the Irish and British initial endowments of capital.

It is clear that \( \delta w_I / \delta K_x > 0, \delta w_B / \delta K_x < 0 \) (i.e., that wages rise with the level of the capital stock in both countries). The effect of \( L_x \) on wages is, however, ambiguous. Take for example the effect of \( L_x \) on \( w_B \). There are two effects; increasing labour supply reduces the capital labour ratio \( k_B \), which reduces the expression inside the left hand parentheses in equation (6). The second is a labour quality effect. Increasing \( L_x \) increases the ratio of non-shirkers to shirkers in the British labour force, which in turn tends to raise the wage. This effect is

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28 Such a model would be extremely difficult to solve.

29 The assumption mirrors the assumption made in the signalling literature that the cost of signalling is negatively related to the level of ability (Spence (1973), pp. 358–59). However, it is not assumed here that employers know that non-shirkers are more mobile than shirkers and behave accordingly (i.e., we make Assumption 2 instead). Such an assumption would make the analysis trivial; employers would never invest in Ireland, since by investing in Britain they would be able to only employ the most productive Irish workers. (On the other hand, such an assumption combined with some degree of shirker mobility would give rise to Katz-Stark-type issues such as the possibility of shirkers trying to free-ride by emigrating.)
captured by the expression \([0.5L^*(1 + a) + L_x]/(L^* + L_x)\) which is increasing in \(L_x\). The net effect depends on the size of the relevant parameters.

5. The effects of free factor mobility

The effects of allowing free mobility of capital and labour can best be seen by inspecting Fig. 1 above. The sides of the box represent the world endowments of capital and labour, with the factors located in Ireland being measured from \(O_I\) and those in Britain from \(O_B\). What is of relevance, however, is the endowments of capital and of effective labour, and these are measured from the points \(O_I^e\) and \(O_B^e\). The Irish endowment of capital and effective labour is thus given by the vector \(O_I^eE\), and the British endowment by \(O_B^eE\). \(^{30}\) Capital is measured vertically, and labour horizontally, so Ireland is here shown as being relatively labour abundant.

The return to capital in country \(i\) is denoted by \(r_i\). The locus giving allocations of capital and labour which equalise the return to capital internationally is simply the diagonal \(O_I^eO_B^e\). This is because the return to capital is given by

\[ r_i = f'(k_i) \]  

for \(i = I, B\). Thus equalisation of the return to capital implies equalisation of effective capital labour ratios across countries, or

\[ \frac{(K + K_x)}{[0.5L(1 + a) - L_x]} = \frac{(K^* - K_x)}{[0.5L^*(1 + a) + L_x]} \]  

\(^{30}\) Note that the way I have drawn the diagram implicitly assumes that \(a\) is equal to 0.5. Changing the value of \(a\) changes the total endowment of effective labour in the two countries, and hence the position of the diagonal line in the box.
In the Ramaswami model wages are given by \( w_i = f(k_i) - k_if'(k_i) \); hence any point on the diagonal of the box also equalises wages. This is what leads to the indeterminacy of the Ramaswami model. In this model there is only one point on the diagonal at which wages are equalised. That point is \( A \), drawn vertically above \( E \). Denote the capital labour ratio prevailing in both countries along the diagonal by \( k_w \). At \( A, L_x \) is zero; the wage in both countries is therefore equal to \( [f(k_w) - k_wf'(k_w)](1 + a)^{0.5} \). Point \( A \) therefore represents an equilibrium, since both wages and profits are equalised internationally there. It is however an implausible equilibrium, which would never arise in the real world, and is in any event unstable.

What is the nature of the locus of factor allocations such that wages are the same in the two countries? (Call it the \( WW \) locus.) It must clearly pass through \( A \). To the left of \( A, L_x \) is greater than zero. Define a function \( g(k_i) \) by

\[
g(k_i) = f(k_i) - k_i f'(k_i)
\]

for \( i = I, B \). As is well known, \( g'(k_i) > 0 \). Equations (5) and (6) can be rewritten as

\[
w_I = g(k_I)[0.5L(1 + a) - L_x]/(L - L_x) \tag{12}
\]

\[
w_B = g(k_B)[0.5L^*(1 + a) + L_x]/(L^* + L_x) \tag{13}
\]

If \( L_x > 0 \) (i.e., we are to the left of \( A \)) then

\[
[0.5L(1 + a) - L_x]/(L - L_x) < [0.5L^*(1 + a) + L_x]/(L^* + L_x)
\]

which implies that for \( w_I \) to be equal to \( w_B \), it must be the case that \( g(k_I) > g(k_B) \). This in turn implies that \( k_I > k_B \); in other words, to the left of \( A \), the \( WW \) locus lies above the diagonal of the box. By similar reasoning, the \( WW \) locus lies below the diagonal to the right of \( A \).

Whether the \( WW \) locus slopes up or down depends on whether the net effect of increasing the labour force on the wage is negative or positive. If it is negative, then transferring labour from Ireland to Britain increases wages in Ireland and reduces them in Britain. A compensating flow of capital from Ireland to Britain is then required to keep wages equal. The \( WW \) locus will then be upward sloping. If it is positive, then migration of labour from Ireland to Britain reduces the wage in Ireland and increases it in Britain.\(^{31}\) A transfer of capital from Britain to Ireland is then required to keep wages equal; the \( WW \) locus is downward sloping. Figure 1 has been drawn under the latter assumption; the case where \( WW \) is upward sloping is given in Fig. 2.

As can be seen, there are four regions in the graph in Fig. 1, with regions I and II being of particular interest. The endowment point \( E \) is in region I, where in standard fashion wages are greater in Britain, and the return to capital is greater in Ireland. In region II, by contrast, both wages and profits are greater in Britain than in Ireland. This is possible because even though the effective

\(^{31}\) In this case the positive effect of Irish emigration on the Irish wage (through its effect on the capital labour ratio) is more than offset by the negative effect (due to the lowering of the average quality of labour in Ireland).
capital labour ratio is greater in Ireland than in Britain in region II, there is a sufficiently greater proportion of non-shirkers in Britain than in Ireland. (Recall equation (2)). Regions III and IV are simply the mirror images of regions I and II respectively. The arrows in the graph have been drawn to indicate the dynamics inherent in the model, under the assumption that factors move according to some functions of the form

\[ L_x = h(w_B - w_I) \]  \hspace{1cm} (15)

\[ K_x = g(r_I - r_B) \]  \hspace{1cm} (16)

where \( h(0) = g(0) = 0 \), and \( h', g' > 0 \).

Assumption 3, which insures that only non-shirkers migrate internationally, implies that \( L_x \) is bounded within a certain range, ie. \(-0.5L^* < L_x < 0.5L^*\). This condition is represented by the cross-hatched areas in Figs 1 and 2. The line SS represents the international distribution of labour resulting from the emigration of all of the non-shirkers from Ireland to Britain, while TT represents the situation when all the non-shirkers have moved to Ireland. Given Assumption 3, the economy cannot move to the left of SS, or to the right of TT, and so these regions can be ignored in what follows.

There are two more possible equilibria in the model, represented by the points \( F \) and \( G \) in the diagram. \( F \) is the intersection of the diagonal of the box with the line SS. At \( F \), rates of profit are equalised internationally, so there is no incentive for capital to move between countries. The wage in Ireland is less
than the wage in Britain at $F$; but since all the Irish non-shirkers have gone to Britain, and since by Assumption 3 the costs to shirkers of emigrating outweigh the benefits, there is no incentive for further labour movement either. $F$ is thus an equilibrium. Moreover, $F$ is a stable equilibrium; any deviation rightwards from $F$ (deviation leftwards being impossible) will lead to emigration from Ireland to Britain and some form of capital flow, until the line SS is reached. At that stage the international economy will move along SS until $F$ is reached once again. $G$ is similarly a stable equilibrium, in which all non-shirkers have moved to Ireland.

The equilibrium at $A$ is clearly unstable. Any leftward deviation from $A$ will result in the economy moving leftwards until SS is reached, and any rightward deviation will result in Irish hegemony (i.e. all non-shirkers moving to Ireland).

There are therefore three possible equilibria in the model. It has been shown that the equilibria at $F$ and $G$ are stable, and that that at $A$ is unstable; but in any event it should be obvious that $A$ will never be attained if two economies initially at $E$ are opened up to free mobility of factors. For $A$ to be attained it would have to be the case that $h' = 0$, so that no emigration ever took place regardless of the existence of wage gaps. So long as $h' > 0$, an economy starting at $E$ will move leftwards until it hits SS, at which stage it will then converge to $F$.

The details of adjustment to equilibrium at $F$ are of some interest. At first labour flows out of Ireland, and capital out of Britain. This is the standard dynamic adjustment pattern associated with the Ramaswami model. It is possible, however, that the adjustment path will cross the diagonal of the box before reaching SS. In that case, the adjustment path will involve periods of emigration from Ireland coinciding with net capital outflows from Ireland. This is most suggestive, since it has been claimed in the past (without any evidence being offered to substantiate the claim) that there was indeed a net export of capital from Ireland during the nineteenth century.32

Since the return to capital varies monotonically with the capital labour ratio, the return to capital will fall in Ireland at least initially. If it crosses the diagonal, however, there will be at least some interval during which the return to capital is rising in Ireland. Wages in Ireland can move either up or down during the transition path. Emigration has an ambiguous effect on the wage, as noted earlier, while the capital stock in Ireland (which has a positive effect on the wage) may both rise and fall during the transition.

How likely is it that the transition path will cross into region II, and that capital and labour outflows from Ireland will take place simultaneously? Obviously if the vertical height of $E$ (i.e. the initial Irish endowment of capital) is greater than the vertical height of $F$ (the eventual equilibrium Irish endowment of capital), it is inevitable that Ireland will at some stage experience capital outflows; but the economy may pass into region II even if this is not the case. We can say, ceteris paribus, that the higher the initial Irish endowment of capital, the more likely it is that the economy will end up in region II; and that ceteris

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<tr>
<th>$WW$ slopes down</th>
<th>$K_x &gt; 0$</th>
<th>$K_x &lt; 0$</th>
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<tr>
<td>Effect on wages ambiguous</td>
<td>$w_f$ decreases</td>
<td>$w_g$ increases</td>
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**Table 1**  
Possible effects of factor mobility on wages

*paribus*, the lower is the parameter $a$, the more likely that the economy will enter region II. The latter point can be simply understood by seeing that reducing $a$ shifts the point $O_f'$ to the right, and shifts the point $O_g'$ to the left, hence shifting the diagonal line. In the limit, as $a$ approaches zero, the probability that the economy will pass into region II approaches unity. The less productive are shirkers, the less attractive as a location for investment becomes Ireland, given that emigration has taken place.

The equilibrium at $F$ has several interesting features. Most obviously, at $F$ all Irish non-shirkers have emigrated to Britain. Second, wages in Ireland remain lower than wages in Britain in equilibrium. Third, the Irish capital stock may be either higher or lower than in the pre-factor-flow equilibrium. In Fig. 1, it is higher; it should be obvious, however, that if we had drawn the endowment point at $E'$, the capital stock would be lower in the new equilibrium than initially. Fourth, rates of profit are equalised internationally; profits in Ireland have declined, while profits in Britain have gone up. The net effect on wages in the two countries is, however, ambiguous. There are four possible scenarios, outlined in Table 1 above.

The case where $WW$ slopes up is shown in Fig. 2. The equilibrium will turn out to be $F$ again, but the dynamics could be a little more complicated. This is because it is possible that the path could reach the $WW$ locus. If it were to cross into region III, then one could not be certain that $F$ would be the equilibrium; however, it is impossible that the path would enter region III, since any movement above $WW$ would instantly lead to capital outflows from Ireland bringing the economies back into region II again. Therefore, all of the results outlined above still hold.

It has therefore been shown that when the two economies are opened up to free international factor mobility, all non-shirkers will move from the labour abundant country (Ireland) to the capital abundant country (Britain). Furthermore, in the new equilibrium wages in Ireland will be less than wages in Britain,\(^{33}\) and indeed they may be less than they would have been in the absence of international factor mobility. What is the intuitive reason for these results?

Although Assumption 3 is crucial for making the model easy to solve, another key assumption is Assumption 2. That assumption implies that wages in a

\(^{33}\) Although it is possible that they may have caught up somewhat.
country are not just determined by effective capital labour ratios; they also
depend on the ratio of shirkers to non-shirkers in a country. The higher that
ratio, the lower the wage. This is why in the new equilibrium at $F$ Irish wages
are lower than British wages; effective capital labour ratios are the same in the
two countries, but the ratio of shirkers to non-shirkers is higher in Ireland. This
is also the reason why all the non-shirkers will leave Ireland. They do so because
wages are always higher in Britain than in Ireland. In the Ramaswami model,
such emigration brings capital labour ratios and wage rates into equality
internationally. In this model, the dependence of the wage on the ratio of shirkers
to non-shirkers means that wages in the two countries are never equalised, even
when the Irish effective capital labour ratio exceeds the British ratio (ie. in
region II).

The model is of course highly stylised, and the results are correspondingly
stark. In particular, the conclusion that all Irish non-shirkers emigrate is
excessive. Assumption 3 is responsible for this; if non-shirkers varied in terms
of their emigration costs, some of them might remain at home (just as some
shirkers might emigrate if they varied in their emigration costs). The results of
the paper should thus be seen as giving the intuition for the results of more
general models which would be extremely complicated if not impossible to solve
in practice.

6. Emigrant self-selection in history and theory

The primary aim of this paper is not to argue that the emigrant selectivity
issues raised by the labour quality debate in fact explain Ireland's failure to
industrialise. Rather, it is to make the simple point that if contemporary
observers were correct regarding the average quality of emigrants relative to
the population as a whole, then this can help to explain the asymmetric
adjustment in international factor markets which in fact occurred during the
nineteenth century. The major results of the paper are thus to be found in the
previous section. It is nevertheless interesting to inquire whether it is likely that
contemporary observers were correct, and what theoretical considerations would
lead to the emigrant selectivity which they claimed to be observing.

Theoretically, it is difficult to predict a priori whether more or less productive
individuals should have emigrated. 'On the one hand, insofar as people who
were relatively productive in Ireland in agriculture and other sectors earned
incomes relative to their specific complementarities with respect to other inputs,
there is some theoretical presumption that they would stay. On the other, if
emigration is regarded as a lottery, wherein the "best" leave because the odds
of their improving their lot are better, the outcome is reversed.'

Mokyr and O'Grada point out that the issue of who goes may depend on whether it is
push or pull influences that are at work in bringing about emigration: 'If
emigrants could be clearly categorised by motivation into either "push" or

“pull” types, some of the ambivalence could be removed. A movement of emigrants who are primarily “pulled”, ie. respond to an increase in the demand for labour in the receiving country, would likely be made up of those with a large endowment of energy, ambition, and access to information. “Push” forces, on the other hand, might be expected to force out first the marginal and more vulnerable in any sector or industry.\footnote{35} Irish economic historians are coming around to the view that pull rather than push forces explain post-famine emigration;\footnote{36} this finding clearly strengthens the hypothesis that contemporary observers in Ireland were correct regarding the quality of emigrants.

More direct evidence also exists to support this hypothesis. Nicholas and Shergold (1987) examine Irish migration to Britain between 1817 and 1839. They conclude that ‘the Irish emigrants were not a random sample of the Irish population. Literacy and skills were determinants of the migration decision. The literate and skilled emigrants left behind an older and less-healthy workforce which was less well-endowed with human capital. The flow of superior workers to England is consistent with the failure of the Irish economy to grow and industrialize before the famine.’\footnote{37} In another paper they find that migration within Ireland was a similarly self-selective process.\footnote{38}

Finally, in a recent paper Mokyr specifically addresses the issue of why it was that Ireland did not industrialise despite its abundance of cheap labour. He suggests two possible explanations: first, that Irish workers were inherently less efficient than English workers, and second, that the better workers emigrated, and cites evidence in support of both views.\footnote{39}

A simple microeconomic rationale can also be given for why it is likely that shirkers would be less mobile than non-shirkers. Imagine that these two groups are distinguished not just by their productivity in the workplace, but by their preferences over labour and leisure. In particular, let shirkers have a Cobb-Douglas utility function defined by

\[ U_S = (wL)^x(T - L)^{1-x} \quad (17) \]

\footnote{35} Mokyr and O'Grada (1982), p. 374. Lord Eversley (1907) used the same logic in order to conclude that, since the ‘best’ left the British countryside, pull forces had predominated; see O'Rourke (1989), Chapter 4.

\footnote{36} See the references in Section 2.

\footnote{37} Nicholas and Shergold (1987, p. 175). On the other hand, Mokyr and O'Grada examine the degree of ‘age-heaping’ among emigrants to the United States as reflected in passenger lists recorded between 1803 and 1848; they conclude that emigrants may have been less well-educated than the general population. (Mokyr and O'Grada (1982, pp. 374–9)). However, they also found that artisans were slightly better represented among emigrants than among the population at large (p. 378). In Why Ireland Starved Mokyr examines further evidence relating to emigration to America. He finds that ‘emigration removed more skilled artisans from Ireland than if emigration had been truly “neutral”’ (p. 250); goes on to find further evidence of human capital loss; but concludes that this loss was second order ‘as far as measurable quantitative information is concerned’ (p. 251). (His emphasis.)

\footnote{38} Nicholas and Shergold (1990), p. 42.

\footnote{39} Mokyr (1991). The evidence Mokyr cites in support of the emigration self-selection argument is identical to that cited here.
and non-shirkers have a utility function defined by

\[ U_{NS} = (wL)\beta (T - L)^{1 - \beta}. \]  

(18)

\( L \) is the amount of time spent working in a day. It is here treated as a constant, on the realistic assumption that under the factory system workers had no choice over their working hours. This assumption will be dropped later. \( T \) is the total amount of time available to the worker in a day; \( T - L \) is thus the worker's consumption of leisure. The wage is represented by \( w \). The parameters \( \alpha \) and \( \beta \) represent the preferences of shirkers and non-shirkers respectively over labour and leisure. We assume that \( \alpha < \beta \); i.e. that shirkers value leisure more highly than do non-shirkers.

Let the wages received in Britain and Ireland be denoted by \( w_B \) and \( w_I \) respectively. Furthermore, let there be a cost to moving abroad. It seems reasonable to think of this cost in terms of a reduced value of one's leisure time. Bereft of family, friends and familiar amusements, the enjoyment that one gets out of one's spare time is less when one is abroad than when one is at home.\(^{40}\) Denote this cost by introducing a 'price of leisure' \( p_L \). In equations (17) and (18) above, \( p_L \) was equal to one; the equations implicitly refer to utility in one's own country. When one is abroad, the term in the second set of brackets has to be divided through by \( p_L \), with \( p_L \) being greater than one; i.e. (17) and (18) become

\[ U_S = (wL)^\alpha \left[ \frac{(T - L)}{p_L} \right]^{1 - \alpha} \]  

(17')

\[ U_{NS} = (wL)^\beta \left[ \frac{(T - L)}{p_L} \right]^{1 - \beta} \]  

(18')

Will it be worthwhile to emigrate, given a wage differential? Consider the problem from the point of view of an Irish worker, facing higher wages in Britain, as well as a higher cost of leisure. The conditions that have to be met if it is to be worthwhile for shirkers and non-shirkers respectively to emigrate are as follows:

\[ (w_B L)^\alpha \left[ \frac{(T - L)}{p_L} \right]^{1 - \alpha} > (w_I L)^\alpha (T - L)^{1 - \alpha} \]  

(19)

\[ (w_B L)^\beta \left[ \frac{(T - L)}{p_L} \right]^{1 - \beta} > (w_I L)^\beta (T - L)^{1 - \beta} \]  

(20)

The conditions (19) and (20) simplify to conditions (21) and (22) respectively:

\[ \frac{w_B}{w_I} > \frac{p_L^{1 - \alpha}/\alpha}{(T - L)^{1 - \alpha}} \]  

(21)

\[ \frac{w_B}{w_I} > \frac{p_L^{1 - \beta}/\beta}{(T - L)^{1 - \beta}} \]  

(22)

Since \( \alpha < \beta \), \( p_L^{(1 - \beta)/\beta} < p_L^{(1 - \alpha)/\alpha} \).

Let \( U \) be a subset of regions I and II in Fig. 1 or 2, defined as follows: \( U \) is the one-dimensional transition path between \( E \), the initial endowment, and \( F \), the final equilibrium, that would be followed if only non-shirkers were mobile.

\(^{40}\) This is of course precisely what one hears from emigrants; the choice they have had to make involves a trade-off between more enjoyable leisure activities at home versus higher wages abroad. The fact that so many emigrants return to their native lands for holidays strengthens this contention.
(including the points $E$ and $F$). Let the maximum value of $w_{B}/w_{T}$ attained in $U$ be denoted by $R$, and the minimum value be denoted by $r$.\textsuperscript{41} It is clear that if we choose $\alpha$ and $\beta$ such that

$$p_{L}^{(1-\beta)/\beta} < r < R < p_{L}^{(1-\alpha)/\alpha}$$  \hspace{1cm} (23)

then it will always be worthwhile for non-shirkers to emigrate in $U$. It will however never be worthwhile for a shirker to emigrate in $U$.

If condition (23) holds, then $U$ will in fact be the transition path followed by the economy, and only non-shirkers will emigrate. This is easily seen: the economy starts at $E$, which is a member of $U$. Condition (23) ensures that only non-shirkers emigrate; the economy thus stays within $U$; condition (23) continues to ensure that only non-shirkers emigrate; and so on until $F$ is reached.

We have therefore derived a precise condition under which Assumption 3 holds exactly. If condition (23) does not hold exactly, it will still be the case that non-shirkers are more mobile than shirkers, in the sense that they require a smaller wage gap to move than do the shirkers. If this is the case, a generalised form of the results of Section 5 will presumably hold. The dynamics are however extremely complicated in this case, and even the simple model presented above becomes intractable.

Finally, it is a trivial matter to relax the assumption above that $L$ is fixed. The rationale for doing this might be that although work shifts were typically fixed in duration, workers could choose to work more than one shift, or hold down more than one job. In this case, workers choose $L$ so as to maximise utility. It is easy to verify that shirkers will always pick $L$ equal to $\alpha T$, and that non-shirkers will pick $L$ equal to $\beta T$, regardless of the values of $w$ or $p_{L}$. This implies that shirkers and non-shirkers in Ireland will only find it worthwhile to emigrate to Britain if conditions (24) and (25) respectively hold:

$$(w_{I}\alpha T)^{\beta}[(1-\alpha)T]^{1-\alpha} < (w_{B}\alpha T)^{\beta}[(1-\alpha)T/p_{L}]^{1-\alpha}$$  \hspace{1cm} (24)

$$(w_{I}\beta T)^{\beta}[(1-\beta)T]^{1-\beta} < (w_{B}\beta T)^{\beta}[(1-\beta)T/p_{L}]^{1-\beta}$$  \hspace{1cm} (25)

These conditions simplify to conditions (26) and (27) respectively:

$$(w_{B}/w_{I}) > p_{L}^{(1-\alpha)/\alpha}$$  \hspace{1cm} (26)

$$(w_{B}/w_{I}) > p_{L}^{(1-\beta)/\beta}$$  \hspace{1cm} (27)

Comparing conditions (26) and (27) with conditions (21) and (22), we see that given Cobb-Douglas utility, the same conditions are necessary for workers to want to migrate when they can choose the length of their hours, as when the work length is fixed. Condition (23) thus continues to provide the condition under which Assumption 3 holds exactly.

\textsuperscript{41} $R$ and $r$ exists since $U$ is closed and bounded.
7. Factories and international factor mobility

We saw at the end of Section 5 that Assumption 2 is crucial to the results of the paper. The results of the paper thus depend on the existence of a wage payment system in which monitoring is imperfect and all workers earn the same wage. A move to such a system from a system with perfect monitoring would therefore lead to a movement of labour from labour abundant to capital abundant regions. Under the perfect monitoring regime, the $WW$ locus would coincide with the diagonal of the box, and resources would flow between Ireland and Britain until the diagonal had been reached, at which point the two economies would be in equilibrium. This point would lie somewhere on the diagonal between the point $A$ and the point on the diagonal directly to the left of $E$.\footnote{It is possible that the latter point would lie to the left of $SS$, in which case the perfect monitoring equilibrium might also lie at $F$. In that case the move to imperfect monitoring would involve no further factor flows. This possibility will be ignored in what follows.}

Now imagine that a system involving imperfect monitoring was simultaneously introduced into both countries, supplanting the perfect monitoring system.\footnote{The analysis gets more complicated of course if perfect and imperfect monitoring were to coexist. Imagine therefore that the shock involved was a technical improvement sufficient to make the old system uneconomical at all factor prices, combined with a switch from a perfect to an imperfect monitoring system.} The $WW$ locus would shift to the position shown in Fig. 1 or 2, and a wage gap would develop between Ireland and Britain, due to the greater average productivity of labour in Britain. As long as the perfect monitoring equilibrium was to the right of $SS$, labour would now flow from Ireland to Britain until the point $F$ had been reached. Moreover, such a flow of labour would inevitably be accompanied by a flow of capital from Ireland to Britain as well (since the economy would immediately move into region II).

The important historical point is that such a systemic shift did indeed occur with the replacement of cottage industry by the factory system during the Industrial Revolution. Under the cottage industry system, workers were paid piece rate, an arrangement which obviously involves perfect monitoring. Under the factory system, on the other hand, workers were paid by the hour or the day, with monitoring being imperfect.

The coincidence of massive flows of labour from rural to urban areas with the Industrial Revolution has often been ascribed to the presence of external economies of scale, certainly a plausible hypothesis.\footnote{In his account of the changing industrial fortunes of European regions, for example, Pollard (1981) stresses the role of external economies of scale.} The results of this model suggest another explanation: the rise of the factory system itself gave rise to powerful centralising tendencies within the UK economy.

8. Conclusion

From the analysis above, we can conclude the following: if it was indeed the case that the ‘best’ were the most mobile in society, then this can explain the
failure of regions with low initial relative endowments of capital, such as Ireland, to industrialise. We can also tentatively conclude that if the shocks leading to a decline in agricultural employment in Ireland had taken place in the days of cottage industry, rather than under the factory system, the decline in agricultural employment might have been less likely to imply a decline in the Irish population. What is absolutely clear is that the question of asymmetrical adjustment in international factor markets is an important one, deserving more theoretical, but above all empirical, analysis.

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