<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th>A flow analysis of the link between Irish and British unemployment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Authors(s)</strong></td>
<td>Harrison, Michael J.; Walsh, Patrick P.</td>
</tr>
<tr>
<td><strong>Publication date</strong></td>
<td>1994</td>
</tr>
<tr>
<td><strong>Series</strong></td>
<td>Trinity Economic Paper Series; No. 94/5</td>
</tr>
<tr>
<td><strong>Publisher</strong></td>
<td>Trinity College Dublin. Department of Economics</td>
</tr>
<tr>
<td><strong>Item record/more information</strong></td>
<td><a href="http://hdl.handle.net/10197/1001">http://hdl.handle.net/10197/1001</a></td>
</tr>
</tbody>
</table>
A FLOW ANALYSIS OF THE LINK BETWEEN IRISH AND BRITISH UNEMPLOYMENT

Trinity Economic Paper Series
Technical Paper No. 94/5
JEL Classification J10 & J60

Michael J. Harrison & Patrick P. Walsh,
Department of Economics,
& European Bureau of Economic Research,
Trinity College Dublin,
Dublin 2.

Abstract
This paper is a contribution to the research on Irish unemployment which for the first time models the flows into and out of the Live Register. Using the quarterly flow data constructed by Harrison and Walsh (1994), the analysis proceeds within a small open labour market framework, making use of the concepts of cointegration and error-correction to model the flows and hence the migratory movements between Ireland and Britain. We outline the advantages of using flow data to link unemployment in a small region and a large region within an integrated labour market. We show that demographic changes resulting from natural increases in population and migration are likely to be the key determinants of unemployment turnover in Ireland. We conclude that any explanation of Irish unemployment must account for these special features of the economy, and in particular must indicate why domestic employment movements seem to have had so little effect on the unemployment flows.

Acknowledgements
Research for this paper was funded by the Arts and Social Sciences Benefaction Fund in Trinity College Dublin. Different aspects of the paper were presented to a workshop in the University of Warsaw in January 1994, to the Dublin Economics Workshop in February 1994, to a workshop on European Economic Performance held in Trinity College Dublin in April 1994 and to the Irish Economic Association in May 1994. We thank all who participated in these meetings for their comments. Special thanks are due to Sandra McNally and Eric Strobl for research assistance and to Hartmut Lehmann for making his British flow data available.
I Introduction

Empirical research into unemployment in Ireland has to date concentrated on the use of information on the stocks of unemployed due to the unavailability of other types of data. See, for example, Barry and Bradley (1991), Browne and McGettigan (1993), Honohan (1984, 1992), and Newell and Symons (1990). The present paper is a contribution to this research area which makes use of the data on the flows into and out of the Irish Live Register constructed recently by Harrison and Walsh (1994). The paper adopts a regional labour market perspective on the modelling of these flows, linking the unemployment flows in the small Irish region and the large British region within an integrated labour market by means of error correction models and the concept of cointegration. As will be seen, this approach appears to be well suited to this purpose. In particular there is a clear benefit from using flows rather than stocks.

As suggested by Layard et al. (1991), the stock of unemployment can be viewed as a pool that results from the inflows and outflows of individuals over many periods. In a period of multiple short unemployment spells the stock of unemployment, measured at the end of each quarter, say, may change little. In the case in which the inflow and outflows of individuals over a quarter are the same, the change in the stock of unemployment is zero. Yet, as in Britain in the early 1970s, the turnover of individuals in a quarter could be three times the magnitude of the stock. Research based on the use of stock data cannot account for this turnover activity in any quarter and hence neglects valuable information. A second point to note is that the level of the stock in any given period results from flow activity that can be traced back over many years. The stock is an accumulation of individuals that inflow at some point in history and have failed to outflow since that date. From an empirical point of view the stock level in a given quarter is not just determined by current economic and demographic activity but has a complex historical evolution. This would suggest that
unemployment stocks may be difficult to model using standard statistical techniques. If one wishes to understand the impact of economic and demographic activity on the evolution of the stock of unemployment, it is a simpler task, from a statistical view point, to model the impacts of these factors on the turnover in each and every period. Current turnover activity is directly related to current economic and demographic activity.

The factors that determine unemployment turnover in a small open labour market can be sub-divided into those related to demographic movements and those related to employment turnover. The individuals that flow into the Live Register may come either from employment separations or from new entries to the labour force. Those separated from a job may not flow into the unemployment state. They have the possibility of flowing into other employment either in Ireland or Britain. The latter option implies exit not just from the Irish labour force but from the working-age population. They can also flow out of the labour force but remain in the working age population by going into non-activity in Ireland. New entrants to the labour force can flow straight into the unemployment state. New entrants come from those of working-age that decide to participate in the labour force and also from non-activity, education or home activities. The natural increase in population pushes the growth rate in working-age population and hence the number of potential new entrants onto the labour force. The growing working-age population itself can be offset by migration flows from the non-activity state. If the growth in working-age population is large relative to employment growth and there are job to job flows within the open labour market in the British Isles, there is the possibility that the flow of new entrants to the labour force is a key determinant of the inflow of individuals to the Irish Live Register.

The individuals that outflow from the Irish Live Register can either flow into an employment state in Ireland or into a state of non-participation. Non-participation can represent a migration flow or a return to non-activity in the working-age population in Ireland. If new entrants to the labour force and job to job movements within the British Isles are capable of filling all new job vacancies in Ireland there is the possibility that the outflows from unemployment could be largely migration flows to Britain.

Normally we would expect employment activity to have a major impact on unemployment turnover. Indeed many of the theories developed on the labour market, and many of the studies of Irish unemployment, make this assertion. Ireland is a small open labour market where employment growth is not sufficient to absorb the growth in working-age population and migration flows are at a high level. We must allow for the possibility that demographic changes such as natural increases in the population and migration, could be the major determinants of unemployment turnover in Ireland.

The remainder of the paper investigates this possibility and is organised as follows. In Section II we briefly review recent labour market developments in Ireland in order to indicate the potential importance of demographic factors. In Section III we analyse the flows into and out of the British and Irish Live Registers. In Section IV we present the supporting empirical evidence for the propositions put forward in Section III; and in Section V we compare our findings to those from comparative studies of regional labour market behaviour in Britain and the U.S. Finally, we state our conclusions in Section VI.
II Overview of Irish Labour Market Developments

This overview focuses on some basic labour market developments for males in Ireland. In Table 1 we look at the ability of employment to absorb labour force growth, using figures taken from various Censuses of Population and Labour Force Surveys for nine three year intervals over the period 1971 to 1993.

Table 1
The Growth in the Labour Force decomposed into that absorbed by Employment and Unemployment (Percentages)

<table>
<thead>
<tr>
<th>Year</th>
<th>ΔL/L</th>
<th>ΔE/L</th>
<th>ΔU/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971-1973</td>
<td>0.94</td>
<td>0.64</td>
<td>0.30</td>
</tr>
<tr>
<td>1973-1976</td>
<td>2.60</td>
<td>-1.30</td>
<td>3.90</td>
</tr>
<tr>
<td>1976-1979</td>
<td>4.60</td>
<td>6.50</td>
<td>-1.90</td>
</tr>
<tr>
<td>1979-1981</td>
<td>2.40</td>
<td>-1.70</td>
<td>4.10</td>
</tr>
<tr>
<td>1981-1983</td>
<td>0.60</td>
<td>-3.50</td>
<td>4.10</td>
</tr>
<tr>
<td>1983-1986</td>
<td>-0.30</td>
<td>-3.90</td>
<td>3.60</td>
</tr>
<tr>
<td>1986-1989</td>
<td>-3.20</td>
<td>-1.40</td>
<td>-1.80</td>
</tr>
<tr>
<td>1989-1991</td>
<td>2.00</td>
<td>2.10</td>
<td>-0.10</td>
</tr>
<tr>
<td>1991-1993</td>
<td>0.40</td>
<td>-1.30</td>
<td>1.70</td>
</tr>
</tbody>
</table>

Due to the twin pressures of a rising natural rate of increase and a net inflow of migrants the 1970s was a decade of high working-age population growth. Labour force participation in the 1970s was above 76 per cent. These factors ensured that the labour force grew by 10 per cent during this decade. Over the decade there are two intervals, 1971-1973 and 1976-1979, in which the change in employment as a percentage of the labour force increased. As a result, unemployment grew to 6 per cent of the labour force by 1981. Only in the years of the big public sector expansion, 1976-1979, did the employment growth rate not only exceed labour force growth but also increase its share of the labour force.

In contrast to the 1970s growth in the labour force since the early 1980s has been negative. This was due to changes in three important demographic factors, namely, declining natural rates of population increase, high levels of outward migration and the decline in labour force participation. Along with these changes, employment as a percentage of the labour force declined rapidly during the 1980s due to negative growth rates in employment itself over the period. The unemployment performance, as bad as it was, would surely have been far worse, if it had not been cushioned by the above demographic factors. Since the early 1980s there were two intervals, 1986-89 and 1989-1991, during which the share of employment as a percentage of the labour force increased. In the period 1986-89 employment declined proportional less than unemployment as the labour force contracted. Yet in general, the 1980s was a period of contraction in both the labour force itself and employment as a share of the labour force. Unemployment increased its share of the labour force dramatically to 18 per cent.

In the following sections we address the following question. How important where employment flows relative to demographic factors (such as natural rates of increase and migration flows) in determining the level of turnover in the unemployment pool? Gross outflows from unemployment can be determined by both participation considerations, like migration, and new hirings. Given the poor employment performance, many of the jobs made available could have been filled by new entrants to the labour force and job to job movements in the British Isles. There is a strong possibility that over the two decades many vacancies were not filled by individuals coming from the unemployment state. For this reason we suspect that outward migration flows
could be a central determinant of the gross outflows from the Irish Live Register.

Finally, as the gross inflows to the pool of unemployment may be pushed by the new entrants to the labour force or by job separations, the outcome in the interval 1983 to 1986 could be a result of two scenarios. One would suggest that the 3.9 per cent of the labour force that lost employment migrated and new entrants, which increased the labour force by 3.6 per cent, found themselves in the unemployed state. The other, more closed labour market and static view would be that 3.6 per cent of those separated from employment became unemployed and the remaining 0.3 per cent left the labour force. We make a case below that the former possibility is the more likely relevant in explaining inflows to the Irish Live Register.

III The Data and Analysis of the Flow Approach

The fundamental identity which relates the stock of unemployed males at time \( t+1 \) (\( TU_{t+1} \)) to the stock of unemployed males at time \( t \) (\( TU_t \)) and the total number of newcomers to the Live Register (I) and the total number who left the Live Register (O) during the intervening period is:

\[
TU_{t+1} = TU_t + I_{t+1} - O_{t+1}
\]

where, in an obvious notation, \( t \rightarrow t+1 \) denotes for present purposes a three-month period between time points \( t \) and \( t+1 \). Quarterly series of inflows, \( I_{t+1} \), and derived outflows, \( O_{t+1} \), of males into and out of the Irish Live Register were constructed by Harrison and Walsh (1994). Their approach was similar to that of Lehmann (1993), who constructed the corresponding flows for Britain. The quarterly unemployment inflows, outflows, stock and turnover series, each

smoothed using a five-point moving average, are plotted for Ireland and Britain in Figures 1 and 2 respectively.

The build-up of unemployment is depicted by the accumulating area between the plotted inflows and outflows over time. We can see from Figure 1 that both Irish inflows and outflows were generally increasing during the 1980s and early 1990s. Turnover in the unemployment pool in Ireland, i.e. the sum of inflows and outflows, fluctuated during the 1970s but persistently increased over the 1980s to reach, by the early 1990s, a level almost double that of the early 1970s. Significantly, the annual turnover in the early 1970s was in the region of 220 thousand people, or about four times the stock figure, while by the early 1990s it doubled to about 440 thousand, but then only stood at two and a half times the stock level. This was due to the inflows being greater than the outflows for long periods in the 1980s. This was in stark contrast to Britain where turnover in the unemployment pool in the 1970s was higher than in the 1980s. Annual turnover in Britain during the 1970s was in the region of 6 million, or eight times the stock level, while in the early 1980s it was approximately 5 million, or about two and a half times the stock. As suggested in the introduction, the turnover activity in both Britain and Ireland is large relative to the stock, and therefore to fully explain the evolution of the stock it would appear worthwhile to model the flows in each and every period.

The increased turnover in the Irish unemployment pool in the 1980s is at first sight somewhat puzzling, given that employment growth in Ireland was generally sluggish and sometimes negative. The simultaneous increase in both gross inflows and outflows during this period is also perplexing. However, recalling that demographic factors may be important, the phenomena may be less surprising. The numbers of newcomers to Irish working-age population, even though at a lower level compared to the 1970s, burgeoned during the 1980s. Outward migration flows also increased to very significant levels as
shown in Figure 3 where we see the dominant role of emigration in the net
migration data points. We feel therefore that it may be a combination of these
two important demographic factors that explains the increasing turnover in the
unemployment pool in Ireland over this period.

The importance of the link between Irish and British labour market
developments has been studied by Honohan (1984, 1992) using data on
unemployment stocks. His earlier work showed that during the 1970s, when
product and factor markets in the British Isles were highly integrated, the Irish
unemployment rate had a long-run equilibrium tendency to converge to 5
percentage points above the corresponding UK rate. However his later study for
the 1980s found that the previous relationship did not hold in the same way.
Although the UK rate still appeared to have a strong short- and long-term
influence on the Irish unemployment rate, the Irish rate in the 1980s can no
longer be explained by the trends in the UK rate.

As intimiated above, we feel that it may be a mistake to use stock data to
undertake this type of analysis, especially in the 1980s. The argument is as
follows. Only semi-annual data are available for duration analysis in Ireland. In
Figures 4 and 5, for Ireland and Britain, respectively, we plot the stocks of
unemployment and decompose the total into three different duration categories.
We define the short-term unemployed, \( S_t \), as the number of males unemployed
for a period of under six months; the medium-term unemployed, \( M_t \), as
the number of males unemployed for between six and twelve months; and the long-
term unemployed, \( L_t \), as all males unemployed for over a year. The pools of
short- and medium-term unemployed empty over six month intervals. There are
no recurrent spells in the semi-annual observations of the medium-term stock but
there can be recurrent spells in the semi-annual observations of the short-term
stock due to exit and entry of individuals during the six months. The stock in
the over-a-year category, by definition, has all the "residuals" of those in
previous periods who did not flow out before a year and still remain
unemployed. These residuals can compound over time. The stocks of long-term
unemployed, taken at semi-annual intervals, can have the same individuals
counted for many periods. Both Britain and Ireland have the feature that over
the 1970s the stock of short-term unemployed seems to have determined the
trend in the overall stock level. This suggests that relative to the 1980s we had
a multiplicity of short-term unemployment spells. During the 1980s the residuals
of males that did not flow out under a year grew and compounded in long-term
unemployment. This residual compounding occurred to such an extent that it
swamped the influence of the short-term unemployed and began to push the
trend in the overall stock of unemployment. If we are looking for convergence
properties in relative unemployment rates, these may not be easy to find as the
stocks in each country, especially during the 1980s, reflect a distributed lag of
activity within and between the two regional labour markets. The effect of
current product and labour market activity in Britain on the Irish unemployment
rate may be hard to discern. We therefore look for evidence of convergence
properties in unemployment flows between Britain and Ireland. If one wishes to
understand the impact of economic and demographic activity on the evolution
of the stock of unemployment, from a statistical perspective it is more
appropriate to model the impacts of these factors on the turnover in each period.

Having made the case for the use of flow data, a related point, suggested
by the work of Strobl and Walsh (1994) which estimates the gross outflows of
males from the different duration-specific categories in the Irish Live Register,
is that even though the long-term unemployed became a significant proportion
of the unemployed stock they account for a very small proportion of the
turnover. Using our quarterly flow data, we plot in Figure 6 the smoothed trends
in the outflows for Ireland and Great Britain. These outflows react to current
economic and demographic conditions and in what follows we show that gross outflows for both Ireland and Britain are mainly from durations of under a year.

The semi-annual gross outflow from short-term unemployment over the period \( t \rightarrow t+1 \), \( O_{t \rightarrow t+1}^S \), can come from two groups of individuals: those incumbent at the start of the period and from newcomers who flow into this category over the period. All the newcomers to the Live Register, \( l_{t \rightarrow t+1} \), can potentially flow out over the six month interval \( t \rightarrow t+1 \). All those incumbent under six months at time \( t \), \( S_t \), have the opportunity to outflow during the interval \( t \rightarrow t+1 \). Some of those in \( S_t \) flow out when in the 0-6 month category and others may flow out when they have moved on to the 6 to 12 month category during the interval \( t \rightarrow t+1 \). Compared to newcomers, the incumbents at the beginning of the period can be up to six months longer in short-term unemployment but clearly could also be just one day longer in this category. The semi-annual gross outflow from short-term unemployment over the period \( t \rightarrow t+1 \) is defined using the following formula:

\[
O_{t \rightarrow t+1}^S = (l_{t \rightarrow t+1} - S_t) + (\lambda_t S_t)_{t \rightarrow t+1}
\]

where \((l_{t \rightarrow t+1} - S_t)\) is the true outflow of newcomers from short-term unemployment over the six month interval and \((\lambda_t S_t)_{t \rightarrow t+1}\) is an approximation of the outflow of those who were incumbent in \( S_t \) but outflowed when in the short-term unemployed category in the interval \( t \rightarrow t+1 \). In other words, some proportion \( \lambda_t \) of those incumbent under six months at the beginning of the period, \( S_t \), will flow out from the short-term unemployed category in the interval \( t \rightarrow t+1 \). This fraction \( \lambda_t \) is assumed to be proportional to the hazard rate for newcomers to short-term unemployment over the same six month interval, \( \theta_t = (l_{t \rightarrow t+1} - S_t) / l_{t \rightarrow t+1} \). Yet if there is a lot of outflowing in the early days of short-term unemployment the probability of leaving for newcomers, over a six month interval, could be much larger than for those incumbent for up to six months. To correct for this potential bias in levels, \( \theta_t \) is weighted by the ratio of those who remained incumbent to the newcomers in the previous six month interval, \( S_t / l_{t \rightarrow t+1} \). If economic conditions are dictating that newcomers to the Live Register are remaining for longer durations in short-term unemployment, then a bigger proportion of the newcomers will be accounted for at the end of the six month interval. In these circumstances the level of the hazard rate for newcomers will reflect more accurately the level of the hazard rate for the incumbents. We estimate the percentage of \( S_t \) expected to outflow from the short-term unemployed category, over the six months, as \( \lambda_t = \theta_t (1 - \theta_t) \).

The newcomers to medium-term unemployment, \( M_{t \rightarrow t+1} \), and all those incumbent between six and twelve months at time \( t \), \( M_t \), have a possibility of outflowing from medium term unemployment. We define the outflow from medium-term unemployment, \( O_{t \rightarrow t+1}^M \), over a six month interval, using the following formula:

\[
O_{t \rightarrow t+1}^M = (M_{t \rightarrow t+1} - M_t) + (\lambda'_t M_t)_{t \rightarrow t+1}
\]

where \((M_{t \rightarrow t+1} - M_t) = ((1 - \lambda'_t) S_t - M_t)\) is the estimated outflow of newcomers to medium-term unemployment, over a six month interval. Some proportion \( \lambda'_t \) of those incumbent between six and twelve at time \( t \), \( M_t \), will also flow out of the medium-term category over the six month interval. This hazard is again expected to be proportional to the hazard rate of newcomers to medium-term unemployment during the same six month interval, \( \theta'_t = (M_{t \rightarrow t+1} - M_t) / M_{t \rightarrow t+1} \). To correct for an expected bias in levels we weight \( \theta'_t \) by the ratio of those who remain incumbent to newcomers over a six month interval, \( M_t / M_{t \rightarrow t+1} \).
We estimate the percentage of M, expected to outflow over the next six months
as $\lambda^*_{i} = \theta^{*}_{i}(1 - \theta^{*}_{i})$.

Since the semi-annual gross outflow from long-term unemployment, $O^{L}_{i+1}$, does not empty out over six month intervals, it is defined using the
standard flow-stock relationship with the following equation:

$$O^{L}_{i+1} = I^{L}_{i+1} - \Delta LTU$$

where $I^{L}_{i+1} = (1 - \lambda^*_{i})$, $\Delta LTU = L_{i+1} - L_{i}$. In Figures 7 and 8 we plot
semi-annual decompositions of five-year averages of the percentages of the
overall outflow coming from the different duration categories in Ireland and
Britain, respectively. We see clearly that the activity under a year counts for
well over 80 per cent of the outflows over the entire period in both countries.
A high percentage of the stock may be made up of long-term unemployment in
the 1980s but it has little impact on flow turnover. It is the activity under a year
that is responsible for turnover in both Live Registers.

In the light of the above, and referring again to Figure 6, it would seem
that the quarterly outflows in both countries are substantially driven by activity
in the less than one year duration categories. The essential trends in the series
are remarkably similar up to the late 1980s. This is strongly suggestive, we feel,
of the possibility that the behaviour of the Irish gross outflows is closely related
to developments in the product and labour markets in Great Britain. We feel that
migration flows, particularly to Britain, may account for a sizable proportion of
the outflows from the Irish unemployment pool over the last few decades. In the
absence of the relevant data we make the assumption that the majority of
persons who flowed out of the Irish Live Register almost certainly emigrated.
Some flowed into employment in Ireland and others went into non-participation
but the majority migrated. It is also felt most likely that the majority of the
unemployed that migrated went to Great Britain. As a small regional labour
market, labour and product market adjustments in Great Britain were likely to
have pulled the flows out of the Irish Live Register. To obtain indirect evidence
in support of this view we will model male outflows from the Irish Live
Register as depending on the outflow from the Live Register in Great Britain
and a weighted GDP index designed to reflect the changing migration patterns
away from Great Britain and towards North America and continental Europe.
Great Britain has always been the most significant destination, however, and so
will get the largest weighting. These variables are intended as proxies for the
labour and product market conditions on the mainland. We will estimate the
short- and long-run elasticities of Irish outflows with respect to the above two
variables at their means. We hope to show that economic activity in Britain, via
migration flows, was the prime determinant of the generally increasing gross
outflows of males from the Irish register.

We now turn to the analysis of the inflow. Using the quarterly inflow
data, we examine the link between the inflows of Ireland and Great Britain. The
smoothed inflows are plotted against each other in Figure 9, and display similar
trends except for the period from when Ireland joined the ERM in 1979 to when
the UK joined in 1989. The trends suggest to us that the product market, factor
markets and demographic movements in the small Irish economy were strongly
influenced, via migration, capital and trade flows, by economic conditions in
Great Britain over the 1970s and 1990s but not in the period of the 1980s. We
again set out to estimate the short- and long-run elasticities of the Irish inflow
with respect to the British inflow at the mean in the 1970s, when all markets
were integrated, in the 1980s, when product and capital markets became less
integrated, and in the 1990s, when the capital market again became more
integrated. The relative importance of migration flows, capital and trade flows
cannot be decomposed from the analysis of the 1970s and 1990s. We do outline
evidence that suggests for the 1980s that growth in the number of new entrants to the labour force seems to be the key determinant of the inflow.

IV The Empirical Evidence

The diagrams and accompanying discussion in the previous section are suggestive of the possibility of a number of interesting relationships between the Irish Live Register flows and economic activity in Great Britain in the period from the 1970s to the early 1990s. The purpose of this section is to explore these data sets and suggested possibilities more systematically using some recent techniques of time series econometrics. Specifically, the stationarity/non-stationarity properties of the individual series are examined using several unit root tests, and the possible existence of statistical relationships between the inflow to and the outflow from the Live Register in Ireland and economic activity in Great Britain is investigated by means of error correction models and the concept of cointegration. Such techniques are now well established in applied economics and so will not be described in any detail. It should be stressed, however, that their use here is intended merely as an aid in data description and exploration, rather than as means of testing any particular labour market theory. Yet the analysis is motivated by theories that concern themselves with the dynamics of regional labour market adjustments.

The analysis focuses on the quarterly data series for five variables, namely, the inflow to and the outflow from the Irish Live Register (IRLIN and IRLOUT, respectively), the inflow to and the outflow from the British Live Register (GBIN and GBOUT, respectively), and the weighted GDP index (WGDP) referred to in section III. In all cases the data series are seasonally unadjusted. While the use of unadjusted data may avoid distortion of the dynamics in estimated models, as pointed out by Wallis (1974), the presence of seasonality in the series complicates the testing and estimation procedures used in modelling cointegrated variables. In particular the definition of integration must be modified to include seasonality and the tests for integration must cover the possibility of seasonal unit roots.

Thus we begin by applying the so-called OCSB test proposed by Osborn et al. (1988) to each of our variables of interest. This procedure tests the null hypothesis that a variable, $y_t$, is generated by a stochastic process that is I(1,1) against the alternatives I(1,0) and I(0,1), where I(n,s) denotes that the variable is stationary after first differencing $n$ times and seasonal (i.e. fourth) differencing $s$ times. The test is conducted by estimating the regression equation

$$
(1-L)(1-L^4)y_t = \alpha_0Q_0 + \alpha_2Q_2 + \alpha_4Q_4 + \beta_1(1-L)y_{t-1} + \beta_2(1-L^4)y_{t-4} + \Sigma_{i=1}^p \phi_i(1-L)(1-L^4)y_{t-i} + \epsilon_t
$$

and carrying out separate one-sided $t$-type tests on the non-seasonal unit root ($\beta_1 = 0$) and the seasonal root ($\beta_2 = 0$) and also a joint F test of $\beta_1 = \beta_2 = 0$. The $Q_{n,i}$, $i = 1, ..., 4$, are seasonal dummies used, as suggested by Perron (1988), to allow for the possibility that the test statistics may be influenced by the four starting values of $y_t$; and the value of $p$ is chosen so as to yield an adequate statistical fit as judged by standard diagnostic checks on the estimated residuals. The test results relating to the choice of $p = 2$ are given in Table 2, together with the 5 per cent and 1 per cent critical values obtained from Osborn (1990). The possibility of non-stationary seasonality is rejected by the $\beta_2$ statistic for all series except GBOUT, although in this case the joint F test rejects the null of I(1,1). Indeed the null hypothesis is overwhelmingly rejected for all of the series on the basis of the F test. By contrast, while the $\beta_1$ statistic strongly suggests the existence of a non-seasonal unit root for GBIN, GBOUT and WGDP, the conclusions relating to the Irish flow variables are less clear cut from this test.
A well known drawback of the OCSB test is that it does not permit testing for all possible unit roots in the seasonal process, i.e. the roots corresponding to all of the factors of the seasonal difference operator $1 - L^k$. Consequently a further check on non-stationary seasonality was undertaken using the so-called HEGY test due to Hylleberg et al. (1988) which does allow for these possibilities. Given the decisive rejection of the null of $I(1,1)$ by the previous test, a form of the HEGY test which allows the null of $I(0,1)$ to be tested against the alternatives of $I(1,0)$ and $I(0,0)$ was chosen. The procedure is based on an estimate of the equation

$$ (1-L^k) y_t = \alpha_0 + \alpha_1 Q_{t-1} + \alpha_2 Q_{t-2} + \alpha_3 Q_{t-3} + \delta t $$

$$ + \pi_1 Z_1 y_{t-1} + \pi_2 Z_2 y_{t-1} + \pi_3 Z_3 y_{t-2} + \zeta_t $$

where $Z_t = 1 + L + L^2 + L^3$, $Z_2 = (1 - L - L^2 - L^3)$ and $Z_3 = (1 - L^2)$, and the trend variable $t$, like the seasonal dummies, is included in the light of the arguments of Perron (1988). The existence of non-stationary seasonality, i.e. $y_t \sim I(0,1)$, is not rejected unless $\pi_1$ or $\pi_3$ are statistically non-zero. In similar fashion to the OCSB test, the HEGY test focuses on separate one-sided $t$ tests of the individual unit root possibilities $\pi_k = 0$, $k = 1,...,4$, as well as on a joint F test of $\pi_1 = \pi_3 = 0$. The results of this procedure, again for the case $p = 2$, are presented in Table 3 along with the 5 per cent and 1 per cent critical values. The F statistics signal a strong rejection of complex unit roots in the case of all variables; and together with the $t$ statistics associated with $\pi_1$, the hypothesis of non-stationary seasonality is firmly rejected for GBIN, GBOUT and WGDP. While the test on $\pi_2$ is not significant for IRLIN and IRLOUT at the 5 per cent level, the statistics are close to the critical value for that probability level. Recalling the general lack of power of unit root tests, the balance of the evidence would clearly appear to suggest that seasonal unit roots are unlikely to be a feature of our data series. A similar conclusion has been reached by Osborn et al. (1988) and Muscatelli and Hurn (1992) on the basis of similar tests on UK macroeconomic data series. By contrast, the statistics for $\pi_1$ provide firm evidence of a unit root at the non-seasonal frequency in the case of all variables tested.

As a final check, the variables were subjected to standard augmented Dickey-Fuller (ADF) tests, where the null hypothesis of a non-seasonal unit root, $I(1, 0)$, is assessed against the alternative of $I(0, 0)$ by means of a t-type statistic. The results are given in Table 4 for variants of the test with one up to four lags, and with and without a deterministic time trend. In accordance with the earlier tests, the conclusion that emerges from Table 4 is that of strong evidence for the existence of a non-seasonal unit root in each of the five data series investigated.

In the light of these preliminary findings, exploration of the possible links between the flows into and out of the Irish Live Register and the corresponding flows into and out of the British Live Register proceeded by means of modelling along the lines of the Engle-Granger (1987) two-step procedure. Thus, for both the inflow relationship and the outflow relationship, the earlier unit root tests were first supplemented by tests for cointegration using ordinary least squares (OLS) residuals from suitably specified static models in the levels of the variables for the period 1967-1 to 1993-4. Both the cointegrating regression Durbin-Watson (CRDW) and the Dickey-Fuller (DF) tests were employed, the former perhaps being preferred because, as Bhargava (1986) has shown, it is less likely to be influenced by the inclusion of a constant and/or a trend in the static models. However, due to the possibility that more than one cointegrating vector may exist when a relationship contains more than two integrated variables, the Johansen (1988, 1989) procedure was also employed in the case of the outflow equation. Secondly, given that there were clear indications that Irish inflows and
British inflows and also Irish outflows and British outflows and WGDP are cointegrated, error-correction models were constructed for both relationships, which incorporate descriptions of the long-run tendencies between the respective variables, as well as of their short-run dynamic behaviour. All computations were done using the MIROFIT 3.0 econometric package of Pesaran and Pesaran (1991).

The static outflow equation relates the level of IRLOUT to the levels of Gbout and WGDP. However, to obtain a satisfactory cointegrating regression, and mindful of recent discussions of the legitimacy of including trend and other proxy variables in a cointegrating equation, it was deemed necessary also to include a dummy variable to capture the significant negative seasonal effect on the outflow in the fourth quarter of the year, and a further dummy to model a structural change in the flow data. Given the very small size of the Irish Labour market compared to that of Great Britain, there seems little doubt that Gbout and WGDP are at least weakly exogenous variables in the sense of Engle et al. (1983), and therefore that the outflow equation constitutes a valid conditional model. The same fact also suggests that an error-correction term should only enter the equation for the IRLOUT variable of interest, and that the Johansen method should confirm a single cointegrating vector and produce maximum likelihood results in accord with those obtained from the static regression. The OLS results for this equation, together with the CRDW and DF statistics and the Johansen results are given in Table 5. The CRDW and DF values from the static regression both firmly suggest rejection of the null hypothesis of no cointegration. The Johansen results confirm the existence of a single cointegrating vector and, moreover, produce an estimate for this vector which conforms very closely to that suggested by the static regression. This is entirely consistent with our expectations based on exogeneity considerations; it would also seem to suggest that our static estimate of the cointegrating vector is not subject to undue bias.

The construction of an error-correction model (ECM) for IRLOUT was explored, starting with a general model incorporating several lags of the differenced variables as well as the usual error-correction term, and employing a progressive simplification strategy to obtain a reasonably parsimonious representation. The results for the preferred variant of the ECM are presented in Table 6. On the basis of the range of standard tests reported, we regard this result as a very satisfactory description of changes in the Irish outflow series and their relationship with the outflow and GDP changes over the period. As can be seen, the adjustments in the quarterly outflow from the IRLOUT series are significantly positively correlated with contemporaneous changes in the British outflows and the general economic climate as reflected by the change in WGDP. However, the coefficients of the error-correction term and the lagged change in Irish outflow are even more significant statistically, indicating, respectively, the importance of the convergence tendency resulting from departures from the long-run equilibrium relationship in the previous quarter, and the inertia in the dynamic outflow adjustment activity which extends back to the corresponding quarter of the previous year. This point is reinforced by Table 7 in which we report the short-run elasticities, using the absolute mean changes for the 1970s, 1980s and 1990s, of ΔIRLOUT with respect to ΔIRLOUT(-4), ΔGBOUT, ΔWGDP and the error correction term. Table 7 also reports the corresponding long-run elasticities of IRLOUT with respect to Gbout and WGDP evaluated at the means of the variables using our static estimates of the cointegrating coefficients which the Johansen results, it will be recalled, suggest are not subject to undue bias. The combined long-run elasticity of Irish outflows with respect to the variables Gbout and WGDP is considerably greater than unity in each of the three decades, and especially in the 1980s.
The results constitute important direct evidence of the impact that British economic activity has had on the overall outflow of males from the Live Register in Ireland. Indeed, we would suggest that economic activity in Britain, via migration flows, seems to be the prime determinant of the gross outflow of males from the Irish register, and that this finding helps us to understand both the long-run tendencies and short-run movements in this outflow during the period studied.

The static inflow equation relates the level of IRLIN to that of GBIN. Like GOUTH and WGDP the explanatory variable GBIN is assumed to be at least weakly exogenous for the parameters in the inflow equation as Ireland is a small region of activity within the British Isles. However, in view of the apparent complexity of the link between the variables, and especially of the possible shift in the relationship during the period 1979-1 to 1989-4, as suggested by Figure 9, it was also necessary in this case, as in the outflow equation, to include further proxy variables to produce a regression with stationary residuals. Specifically, variables were included to allow for the possibility of a shift both in the intercept and the coefficient on GBIN in the 1979 to 1989 period (D1 and GBIN*D1, respectively). Seasonal dummies were also employed to capture observed negative effects on IRLIN in the second and third quarters of a year; and finally, as suggested by Figure 9, and the preliminary unit root tests, it was necessary to incorporate a deterministic time trend. The results for the static inflow equation are given in Table 8. In this case, because only two economic variables are involved and hence only one cointegrating vector is possible, the Johansen procedure was not employed. Once again, the CRDW and DF tests emphatically indicate cointegration. The shifts modelled for the 1979 to 1989 period also appear to be very important, though as the test statistics associated with them are not valid and they have not been included in the table. The estimates and test statistics for the preferred ECM for the Irish inflows are reported in Table 9. As with the results for the outflow equation the results in Tables 8 and 9 appear to constitute a highly satisfactory description of the relationship between the Irish and British inflows to their respective Live Registers during the sample period. The variable ΔIRLIN is significantly positively associated with contemporaneous changes in the British inflows, and the coefficients of the error-correction term and the lagged change in Irish inflow are even more significant statistically, indicating once again the importance of the equilibrating tendency resulting from departures from the long-run relationship in the previous quarter, and the inertia in the dynamic inflow adjustment activity which, as in the outflow case, extends back to the corresponding quarter of the previous year. Table 10 presents the elasticities for the 1970s, 1980s and 1990s of ΔIRLIN with respect to ΔIRLIN(-4), ΔGBIN and the error correction term, again using the means of the absolute changes in these decades; it also gives the long-run elasticities of IRLIN with respect to GBIN, evaluated for the same decades using variable means. Overall, the results suggest to us that due to migration, capital and trade flows between the two countries, inflows in Ireland in the 1970s were determined by demographic and market adjustments in response to product and factor market adjustments in Britain. This seems to have happened to a lesser extent in the early 1990s, but not it appears during the 1980s when capital and product markets became somewhat less integrated.

Although the link between the inflows seemed to break down in the 1980s, migration flows were at their strongest, as indicated in Figure 3 and as confirmed by our outflow analysis. With negative growth in employment in both Ireland and Britain for prolonged periods during the 1980s, one might expect employment separations to have pushed a common trend in the inflow into the British and Irish Live Registers. Yet if migration flows came from the employment state in Ireland, there is the possibility that separations may not
have had much impact on the inflows into unemployment. During this decade the "baby boom" effect was still strong, even though it was offset by the migration of potential new entrants to the labour force. To see the relationship the growth in the working-age population had with the inflows into and out of unemployment in the 1980s, we write down the following identity relating the stock of working-age population at time \( t+1 \) (\( \text{WAP}_{t+1} \)) to the stock at time \( t \) (\( \text{WAP}_t \)) plus the total number of newcomers to working-age population (I) minus and the total number who leave working-age population (O):

\[
\text{WAP}_{t+1} = \text{WAP}_t + \text{I}_{t+1} - \text{O}_{t+1}
\]

where \( t \rightarrow t+1 \) denotes one year between time points \( t \) and \( t+1 \). Increased inflow into working-age population is due to the natural increase in population and inward migration. The outflow can be due to retirements, deaths and outward migration. Referring back to equation (1), we see that the change in the stock of unemployment can be driven by many factors in addition to that of working-age population. Theoretically, the inflow depends not only on the working-age population, but on changes in participation and increased separation flows from the employment state. The outflows from unemployment may be due to non-participation considerations, which include migration, and to flows to employment engagements. We have already seen that migration flows seem to be the prime determinant of the gross outflows from unemployment. This would also seem to be the key determinant of outflows from the working-age population. If the growth in new entrants to the labour force is the main driving force of the inflows into the unemployment pool in the 1980s, this would imply that the trend in the change in working-age population and the change in unemployment should be approximately the same. It is clear from Figure 10 that over the 1980s the change in unemployment had the same trend as the change in working-age population. This has the implication that the inflows to unemployment were very significantly pushed by the growth in working-age population. This is in marked contrast to the experience in the 1970s, when the inflows appeared to be driven more by market and demographic adjustments in Ireland stimulated by developments in Britain. From the early 1990s, developments in Britain seem to have re-established their influence on the inflows via market and demographic adjustments in Ireland, and the working-age population bulge seems to have lost its dominance.

V. Comparative Regional Labour Market Behaviour

In the preceding sections we have suggested the existence of strong links between labour market activity in Britain and unemployment flows in Ireland. One obvious question to ask is did the varying degree of product and factor market integration induce any convergence in relative employment and wages? The overall male employment capacity of the public and private sectors has remained fairly static, never deviating too much from 0.78 million over the last few decades. This employment situation occurred along side large demographic changes. In the face of external shocks, fiscal expansion in the late 1970s and contraction in the 1980s, accession to the EEC and the more recent entry to the ERM, the employment capacity of Ireland's small open economy has been surprisingly constant. However, despite the stability in overall numbers, there have been changes in the composition and structure of employment. In particular, although the industrial sector has had a fairly constant 30 per cent share in Ireland's employment capacity, within the manufacturing sector there has been a move away from employment in food and traditional manufacturing to high-technology manufacturing. This was brought about largely by the export tax relief and grant incentives given by the Irish government to foreign-owned
firms, and the exposure of the traditional sector to unprotected foreign competition. The agricultural sector has seen a more dramatic decline in employment over the 20-year period, from 30 per cent to 14 per cent of total employment. This has resulted essentially from a move to capital intensive farming practices dictated by the price support system within the European Common Agricultural Policy. Finally, employment in services, particularly market services, has increased from 40 to 56 per cent. Half of this total is in the public sector and most of the rest is in the non-traded sector.

The constancy of Irish employment capacity in the face of increased exposure to external shocks has been due mainly to the fact that a large proportion of total employment falls under either the umbrella of government intervention or is naturally sheltered from foreign competition in the non-traded sector. This helps the economy to maintain its current employment capacity, but it does not help the market in its capacity to create jobs. The market is also heavily constrained by the fiscal contraction created by Ireland’s debt burden, high public sector pay agreements, and the non-competitiveness of many sectors of the economy which produce expensive transport and communications infrastructure for use as inputs in the small indigenous private sector. Structural change and deficiencies have not permitted the private sector to develop a capacity to absorb Ireland’s growing participating working-age population. This explains the lack of convergence on relative employment activity; but with such large migration flows, was there convergence in relative wages?

Walsh (1994) shows that the wage series for Irish and British manual workers in industrial employment over the period 1950 to 1992 are cointegrated provided an adjustment is made for differences in purchasing power in the two countries. In the short run there is a lagged response of Irish wages to deviations from the equilibrium relationship with British wages but real earnings in the long run tend to rise one for one with those in Britain. Curtis and FitzGerald (1994) also look at the factors bringing convergence of labour costs in the industrial sector of the economy. Having said this, weekly earnings of Irish agricultural labourers remained at less than 50 per cent of average earnings in industry over the entire post-war period. The Irish labour force has remained a dualistic one, with a very large sector in which earnings were low relative to those of the small group of skilled industrial workers. The persistence of very low wages in Ireland despite unparalleled emigration over six generations, and the co-existence of the relatively small, skilled industrial sector that has enjoyed relatively high wages must highlight the fact that labour market integration and mobility does not equalise the return to labour within and between different labour markets. In general, rigid real wages and employment levels in the Irish labour market have allowed demographics, in particular working-age population bulges and migration flows, to be the key source of variation in unemployment.

This is not unlike the experience in the U.S. as outlined by Blanchard and Katz (1992). When a typical US state has been affected by an adverse shock to employment, a simple labour market model of regional evolutions would predict that wages would decline and unemployment rise relative to other states. This in turn should induce dynamic regional labour market adjustments that, in the long run, push convergence of employment and unemployment levels to the national average. These adjustments, in response to lower relative wages and unemployment levels, include the creation and inward migration of jobs and an outward emigration of workers. Over the post-war period, some US states have consistently grown faster than the national average, while some have grown more slowly. Employment growth rates over the post-war period have been surprisingly stable. Regional shocks to employment have largely permanent effects. In response to an adverse shock, employment eventually reverts to growing at the same underlying rate, but at a lower level. In contrast to employment, relative unemployment rates exhibit no trend and do not exhibit
high persistence. Transitory regional shocks did lead to transitory fluctuations in relative unemployment and wages. Lower relative wages should have induced net immigration of firms and emigration of workers. Higher relative unemployment should induce a net outward migration of labour. The evidence is suggestive of a weak effect of wages on job and labour migration movements, while relative unemployment levels have a strong effect on worker migration flows. The weak effect of wage differentials on migration rates is also found by Barro and Sala-i-Martin (1991). The dominant adjustment mechanism to regional labour demand shocks is labour mobility rather than job creation or job migration. Labour mobility in turn appears to be primarily a response to changes in unemployment rather than consumption wages. In the long run it is quantities and not prices that make the adjustment. This is not too dissimilar to the Irish experience viv á viv Great Britain.

What is surprising is that the experience of labour market evolutions in Britain is quite different. Gregg and Wadsworth (1994) and Evans and McCormick (1994) examine this issue in some detail. The persistence of the relative regional unemployment rates and relative regional employment growth and contraction, until recently, is quite striking. Evans and McCormick (1994) describe the nature of both regional wage flexibility and migratory patterns by making a distinction between manual and non-manual workers. The focus of the Gregg and Wadsworth (1994) paper is on the decline in relative regional unemployment rates following the 1990 recession.

Both relative and absolute regional unemployment differentials narrowed in the 1990s. Up to 1990 the persistence of unemployment differentials across regions over time assumed the status of a stylised fact. The early 1990s is an exceptional period in regional labour market performance. Gregg and Wadsworth show that much of the convergence across the standard regions in the 1990s is accounted for by differential responses of labour force participation.

As a result, unemployment in prosperous regions has risen because labour supply has grown and employment has changed little. Unemployment in depressed regions has risen less as employment falls have been partially offset by labour force withdrawal.

Non-manual workers seem to form a small subgroup that operate in an integrated British labour market. Real earnings for non-manual workers in Ireland, in the long run, also tended to rise one for one with those in Britain. This suggests that the labour market for non-manual workers seems to be highly integrated within the British Isles. Variations in regional unemployment in Britain are largely arising in manual labour. Yet net migration from depressed regions largely consists of non-manual workers. As a result the pattern of net migration in the 1970s and 1980s represents a rather small percentage of the British working-age population. Migration in Britain is highly counter-cyclical. Between 60 and 70 per cent of all moves are undertaken by employed non-manual workers. The non-manual labour market is flexible and geographically integrated while the manual market seems spatially rigid. Ireland’s regional labour market experience was the exact opposite in this respect in that manual workers were spatially flexible. One reason proposed for the lack of manual worker mobility within Britain is that housing subsidies and council house tenancy is non-transferable across regions. Neither fluctuations in relative regional wages nor migration plays a significant role in eliminating manual unemployment in regions experiencing persistent negative employment demand shocks. Instead, reductions over time in regional rates of labour force participation appear to have played a central accommodating role in Britain.

The lack of convergence in regional unemployment within Britain is in sharp contrast to the strong convergence of unemployment in Ireland to that in Britain. This is mainly due to the high mobility of Irish manual workers in relation to the large labour market in Britain and the lack of similar inter-
regional flows within Britain. The Irish experience is very similar to that in the US in that it is a quantity rather than a price adjustment which, in the form of migration flows, pushes the convergence in relative unemployment levels.

VI CONCLUSION

In the absence of detailed migration data, this paper has devised a methodology for quantifying the impact of migration flows on unemployment turnover in a small open labour market. For the case of Ireland and Great Britain, the approach produces results which suggest that quantity adjustments have pushed convergence in Irish unemployment levels to those in Britain, and not price adjustments. In addition the results suggest that unemployment flows over the whole sample period have been predominantly pushed and pulled by working-age population growth and migration flows, rather than by changes in employment. It seems that the rigid real wages and employment levels in the Irish labour market have allowed demographic factors, pushed and pulled by the strong links with the British labour market, to be the key source of variation in Irish unemployment turnover.

These findings lead us to ask two questions that constitute an agenda for further research. First, why has the level of employment in Ireland been so stable for so many years and so low relative to the size of the working-age population? In Section V we suggested that the answer may relate to certain structural deficiencies, most of which are outside the labour market. Secondly, what are the implications of the results of this study for the conventional labour market policies being used in Ireland? The answer to this may require an evaluation of Irish manpower policy in a wider context.

Data Appendix

GBSTOCK: Is a consistent series of male unemployment (excluding school leavers) in Great Britain. This uses the 1988 definition of unemployment and is quarterly data taken at the end of March, June, September and December of each year.

GBIN: Constructed by Lehmann (1993), 1967-1 to 1979-4, from the quarterly age-by-duration analysis of the live register. 1980-1 to 1993-4 was constructed from various issues of the Employment Gazette. The data was adjusted to ensure consistency with the 1988 definition.

IRLSTOCK: The total number of unemployed males, $T_{u,n}$, is available in a consistent quarterly series based on the definition of the Live Register introduced in January 1980. The precise time points used for this series are the end of March, June, September and December.

IRLIN: A consistent quarterly inflow series for males for the period 1967-1 to 1993-4 was constructed by Harrison and Walsh (1994). For the period 1967-1 to 1982-4, they made use of the Central Statistics Office’s unemployment age-by-duration analysis for males. For the final period, 1983-1 to 1993-4, the inflows of unemployed males have in fact been published by the Central Statistics Office on a monthly basis.

WGD: Quarterly weighted GDP series which included GDP from Great Britain, Germany and the U.S. Great Britain had at least 80 per cent of the weighting.
### Table 2: Results of OCSB Test of Non-Stationary Seasonality

<table>
<thead>
<tr>
<th></th>
<th>$\beta_1 = 0$</th>
<th>$\beta_2 = 0$</th>
<th>$\beta_1 &amp; \beta_2 = 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRLOUT</td>
<td>-3.29</td>
<td>-5.27</td>
<td>27.32</td>
</tr>
<tr>
<td>GBOUT</td>
<td>-2.04</td>
<td>-3.23</td>
<td>9.21</td>
</tr>
<tr>
<td>WGDGP</td>
<td>1.82</td>
<td>-8.33</td>
<td>44.89</td>
</tr>
<tr>
<td>IRLIN</td>
<td>-3.19</td>
<td>-4.92</td>
<td>24.10</td>
</tr>
<tr>
<td>GBIN</td>
<td>-0.96</td>
<td>-5.72</td>
<td>29.35</td>
</tr>
<tr>
<td>1% C V</td>
<td>-2.82</td>
<td>-4.35</td>
<td>4.80</td>
</tr>
<tr>
<td>5% C V</td>
<td>-2.11</td>
<td>-3.75</td>
<td>3.79</td>
</tr>
</tbody>
</table>

### Table 3: Results of HEGY Test of Non-Stationary Seasonality

<table>
<thead>
<tr>
<th></th>
<th>$\pi_2 = 0$</th>
<th>$\pi_1 = 0$</th>
<th>$\pi_1 &amp; \pi_2 = 0$</th>
<th>$\delta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRLOUT</td>
<td>-1.96</td>
<td>-2.66</td>
<td>-1.45</td>
<td>12.41</td>
</tr>
<tr>
<td>GBOUT</td>
<td>-0.63</td>
<td>-3.91</td>
<td>-1.72</td>
<td>10.27</td>
</tr>
<tr>
<td>WGDGP</td>
<td>-2.29</td>
<td>-4.09</td>
<td>-4.94</td>
<td>21.06</td>
</tr>
<tr>
<td>IRLIN</td>
<td>-2.73</td>
<td>-2.56</td>
<td>-1.91</td>
<td>9.03</td>
</tr>
<tr>
<td>GBIN</td>
<td>-2.86</td>
<td>-3.86</td>
<td>-2.77</td>
<td>10.63</td>
</tr>
<tr>
<td>1% CV</td>
<td>-4.15</td>
<td>-3.57</td>
<td>-2.71</td>
<td>-4.05</td>
</tr>
<tr>
<td>5% CV</td>
<td>-3.52</td>
<td>-2.92</td>
<td>-2.28</td>
<td>-3.44</td>
</tr>
</tbody>
</table>

### Table 4: Results of ADF Tests for Non-Seasonal Unit Roots

<table>
<thead>
<tr>
<th></th>
<th>ADF(1)</th>
<th>ADF(2)</th>
<th>ADF(3)</th>
<th>ADF(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) Without Trend</td>
<td>5% CV = -2.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRLOUT</td>
<td>-2.29</td>
<td>-1.45</td>
<td>-0.03</td>
<td>-0.74</td>
</tr>
<tr>
<td>GBOUT</td>
<td>-3.56</td>
<td>-2.29</td>
<td>-1.19</td>
<td>-2.01</td>
</tr>
<tr>
<td>WGDGP</td>
<td>-0.12</td>
<td>0.20</td>
<td>1.00</td>
<td>0.66</td>
</tr>
<tr>
<td>IRLIN</td>
<td>-1.94</td>
<td>-1.28</td>
<td>-0.23</td>
<td>-1.06</td>
</tr>
<tr>
<td>GBIN</td>
<td>-2.83</td>
<td>-2.51</td>
<td>-2.00</td>
<td>-3.13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ADF(1)</th>
<th>ADF(2)</th>
<th>ADF(3)</th>
<th>ADF(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) With Trend</td>
<td>5% CV = -3.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRLOUT</td>
<td>-4.02</td>
<td>-2.86</td>
<td>-1.58</td>
<td>-2.13</td>
</tr>
<tr>
<td>GBOUT</td>
<td>-3.80</td>
<td>-2.18</td>
<td>-0.49</td>
<td>-1.70</td>
</tr>
<tr>
<td>WGDGP</td>
<td>-1.65</td>
<td>-1.76</td>
<td>-2.51</td>
<td>-2.37</td>
</tr>
<tr>
<td>IRLIN</td>
<td>-3.91</td>
<td>-3.03</td>
<td>-2.32</td>
<td>-2.56</td>
</tr>
<tr>
<td>GBIN</td>
<td>-3.00</td>
<td>-2.53</td>
<td>-1.87</td>
<td>-3.41</td>
</tr>
</tbody>
</table>
Table 5:
(i) Results of Static (Co-integrating) Regression for IRLOUT

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-52.78</td>
</tr>
<tr>
<td>GBOUT</td>
<td>0.02</td>
</tr>
<tr>
<td>WGDNP</td>
<td>0.90</td>
</tr>
<tr>
<td>Seasonal 4</td>
<td>-7.21</td>
</tr>
<tr>
<td>Dummy</td>
<td>-10.93</td>
</tr>
</tbody>
</table>

\[ R^2 = 0.81 \quad CRDW = 1.44 \quad DF \text{ (for residuals)} = 6.86 \]

(ii) Results of Johansen ML Procedure (non-trended case).
(Where r denotes the number of cointegrating vectors)

Maximal Eigenvalue Test

<table>
<thead>
<tr>
<th>Null</th>
<th>Alternative</th>
<th>Test Statistic</th>
<th>5% CV</th>
<th>10% CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>r = 0</td>
<td>r = 1</td>
<td>20.33</td>
<td>22.00</td>
<td>19.77</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>r = 2</td>
<td>12.68</td>
<td>15.67</td>
<td>13.75</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>r = 3</td>
<td>0.60</td>
<td>9.24</td>
<td>7.53</td>
</tr>
</tbody>
</table>

Trace Test

<table>
<thead>
<tr>
<th>Null</th>
<th>Alternative</th>
<th>Test Statistic</th>
<th>5% CV</th>
<th>10% CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>r = 0</td>
<td>r ≥ 1</td>
<td>33.61</td>
<td>34.91</td>
<td>32.00</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>r ≥ 2</td>
<td>13.29</td>
<td>19.96</td>
<td>17.85</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>r = 3</td>
<td>0.60</td>
<td>9.24</td>
<td>7.53</td>
</tr>
</tbody>
</table>

Normalised Estimated Co-integrating Coefficients

Variables: Constant | GBOUT | WGDNP

Coefficients: -54.11 | 0.02  | 0.93

Table 6: OLS Results of ECM for IRLOUT

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔIRLOUT(-4)</td>
<td>0.47</td>
<td>6.25</td>
</tr>
<tr>
<td>ΔGBOUT</td>
<td>0.02</td>
<td>2.80</td>
</tr>
<tr>
<td>ΔWGDNP</td>
<td>1.37</td>
<td>2.71</td>
</tr>
<tr>
<td>Seasonal 4</td>
<td>-4.34</td>
<td>-3.83</td>
</tr>
<tr>
<td>ECM</td>
<td>-0.62</td>
<td>-5.87</td>
</tr>
</tbody>
</table>

\[ R^2 = 0.69 \quad \hat{R}^2 = 0.67 \quad F_{4,99} = 44.38 \quad DW = 2.12 \]

LM Tests for
(i) Fourth-Order Autocorrelation: \( \chi^2_4 = 6.03 \)
(ii) Functional Form: \( \chi^4_1 = 1.82 \)
(iii) Normality: \( \chi^2_2 = 4.05 \)
(iv) Heteroscedasticity: \( \chi^4_1 = 0.11 \)
### Table 7: Elasticities, IRLOUT

**Short-Run Elasticities at Mean Changes**

<table>
<thead>
<tr>
<th>Variables</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔIRLOUT(-4)</td>
<td>0.53</td>
<td>0.45</td>
<td>0.52</td>
</tr>
<tr>
<td>ΔGBOUT</td>
<td>0.30</td>
<td>0.17</td>
<td>0.15</td>
</tr>
<tr>
<td>ΔWGDP</td>
<td>0.29</td>
<td>0.16</td>
<td>0.11</td>
</tr>
<tr>
<td>ECM</td>
<td>-0.55</td>
<td>-0.29</td>
<td>-0.45</td>
</tr>
</tbody>
</table>

**Long-Run Elasticities at Mean of Variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
</tr>
</thead>
<tbody>
<tr>
<td>GBOUT</td>
<td>0.44</td>
<td>0.36</td>
<td>0.25</td>
</tr>
<tr>
<td>WGDP</td>
<td>2.35</td>
<td>2.61</td>
<td>2.03</td>
</tr>
</tbody>
</table>

### Table 8: Results of Static (Co-integrating) Regression for IRLIN

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>CRDW = 1.78</th>
<th>DF (for residuals) = -8.70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-5.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GBIN</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GBIN*D1</td>
<td>-0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trend</td>
<td>0.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>18.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seasonal 2</td>
<td>-4.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seasonal 3</td>
<td>-2.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| R²          | 0.82        |             |                             |

### Table 9: OLS Results of ECM for IRLIN

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>t - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.15</td>
<td>2.38</td>
</tr>
<tr>
<td>ΔIRLINC(-4)</td>
<td>0.29</td>
<td>3.90</td>
</tr>
<tr>
<td>ΔGBIN</td>
<td>0.03</td>
<td>2.96</td>
</tr>
<tr>
<td>ΔGBIN*D1</td>
<td>-0.01</td>
<td>-0.48</td>
</tr>
<tr>
<td>Seasonal 2</td>
<td>-4.39</td>
<td>-4.11</td>
</tr>
<tr>
<td>ECM</td>
<td>-0.70</td>
<td>-7.35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>R²</th>
<th>0.67</th>
<th>0.66</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>0.66</td>
<td>0.66</td>
</tr>
<tr>
<td>R²</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>F&lt;sub&gt;5.00&lt;/sub&gt;</td>
<td>33.45</td>
<td></td>
</tr>
<tr>
<td>F&lt;sub&gt;5.00&lt;/sub&gt;</td>
<td>2.23</td>
<td></td>
</tr>
</tbody>
</table>

**LM Tests for**

(i) Fourth-Order Autocorrelation: \( \chi^2_{1} = 7.04 \)
(ii) Functional Form: \( \chi^2_{1} = 0.44 \)
(iii) Normality: \( \chi^2_{1} = 1.68 \)
(iv) Heteroscedasticity: \( \chi^2_{1} = 0.76 \)
Figure 1: Irish Male Total Unemployment Stock, Inflows, Outflows, & Turnover

Table 10: Elasticities, IRL

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM</td>
<td>0.01</td>
<td>0.02</td>
<td>0.03</td>
<td>0.04</td>
<td>0.05</td>
<td>0.06</td>
<td>0.07</td>
<td>0.08</td>
<td>0.09</td>
</tr>
<tr>
<td>AVPHN</td>
<td>0.12</td>
<td>0.13</td>
<td>0.14</td>
<td>0.15</td>
<td>0.16</td>
<td>0.17</td>
<td>0.18</td>
<td>0.19</td>
<td>0.20</td>
</tr>
<tr>
<td>ARPLN</td>
<td>0.21</td>
<td>0.22</td>
<td>0.23</td>
<td>0.24</td>
<td>0.25</td>
<td>0.26</td>
<td>0.27</td>
<td>0.28</td>
<td>0.29</td>
</tr>
<tr>
<td>VARIPL</td>
<td>0.30</td>
<td>0.31</td>
<td>0.32</td>
<td>0.33</td>
<td>0.34</td>
<td>0.35</td>
<td>0.36</td>
<td>0.37</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Long-run Elasticities at Mean of Variables

Short-run Elasticities at Mean Changes
Figure 2 - British Male Total Unemployment Stock, Inflows, Outflows, & Turnover

Figure 3 - Trend in Irish Male Net Migration
Figure 6 - Trend in Irish & British Male Unemployment Outflows

Figure 7 - Irish Male % of Outflow from Duration Specific Categories
Figure 8 - British Male % of Outflow from Duration Specific Categories

Figure 9 - Trend in Irish & British Male Unemployment Inflows
REFERENCES


TRINITY ECONOMIC PAPERS

Trinity Economic Papers provide a forum for the rapid dissemination of research results at the pre-publication stage (Technical Papers) and for policy-oriented research (Policy Papers) conducted at the Department of Economics, Trinity College, Dublin. This series was instituted in 1994. The Department of Economics, Trinity College, Dublin gratefully acknowledges the financial support of Bank of Ireland Group Treasury.

Technical Papers Series

94/1 Lobato, I.N. and Walsh, P.P. Cartel Stability and the Joint Executive Committee (1880-1886), June.

94/2 Brülhart, M. Marginal Intra-Industry Trade: Measurement and Relevance for the Pattern of Industrial Specialisation, June.

94/3 Burke, A.E. Economic Integration and New Firm Formation: Evidence from the United Kingdom and Ireland, November.

94/4 O'Toole, F. and Strobl, E. Compulsory Voting and Government Spending, November.

94/5 Harrison, M.J. and Walsh, P.P. A Flow Analysis of the Link Between Irish and British Unemployment, November.

Policy Papers Series

94/1 Matthews, A. Impact of the GATT Uruguay Round Agreement for the Irish Economy, June.


94/3 Davis, M. Unsustainable Parities: The ERM in Turmoil, October.

Sponsored by Bank of Ireland Group Treasury