The Economic and Social Research Institute

# Convergence in Living Standards in Ireland: The Role of the New Economy?

by

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October 2000

ESRI Working Paper No. 134


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## 1. Introduction

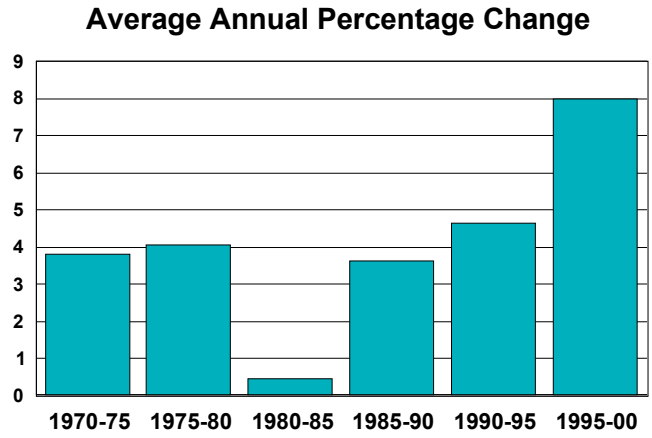
The Irish economy has undergone a process of rapid convergence to the European average standard of living over the course of the 1990s. This follows a long period of almost thirty years when the standard of living, measured as GDP per head, showed relatively little change. This paper examines the reasons behind the failure to converge up to 1990 and the very rapid convergence thereafter. In particular, it considers the extent to which "new economy" considerations account for this unusual performance.

Section 1 of this paper sets out the historical record on convergence. It decomposes the change in GDP per head into the effects of demographic changes and changes in output per person employed. Section 2 describes a small model of the economy with skilled and unskilled labour. This model is used in Section 3 to examine the roles of a range of different factors in driving convergence and in accounting for the relatively rapid increase in output per person employed. Finally, in Section 4 some conclusions are drawn on the likely growth in the capacity output of the economy in the medium term.

## 2. Convergence and Productivity

In the late 1970s the then Irish government pursued a “dash for growth” policy which involved a huge fiscal injection. Even at the time economists warned that this was unsustainable[1] and, in the early 1980s, when the storm of world recession hit, it almost wrecked the Irish economy. As shown in Figure 1, the result was a period of almost 10 years of fiscal retrenchment in the 1980s as successive governments tried to put the economy together again. The process was extremely painful, involving both major increases in taxation and a massive cutback in state expenditure.

Figure 1: Growth in GNP

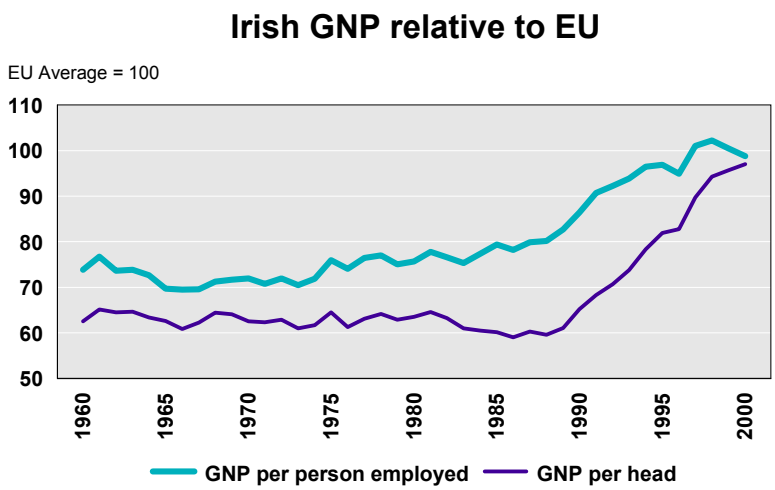



Source: Duffy, Fitz Gerald, Kearney and Smyth, 1999.

[1] P. Geary, 1978, "How Fianna Fail’s economic policies cannot get this country moving again", Macgill, April.

Figure 1 shows the growth rate for GNP for each of the five-year periods from 1960 to 2000. With the exception of the first half of the 1980s, when the fiscal retrenchment and the external recession knocked economy way off course, between 1960 and 1990 there was relatively little deviation from an apparent trend growth of 4% a year. For the 1990s the growth rate picked up, so that the economy is currently growing at a rate well above its past trend.

Figure 2: Relative Standard of Living




Source: Duffy, Fitz Gerald, Kearney, and Smyth, 1999

The result of the relatively rapid period of growth is that Ireland, which in 1990 had a GDP per head of around 74 per cent of the EU average, already exceeds the EU average (114.7 per cent). A more appropriate measure is GNP per head (which excludes profit repatriations by foreign multinationals). On this measure Ireland can also be seen to have narrowed the gap in living standards, with output per head compared to the EU as a whole rising from 65 per cent in 1990 to 97 per cent this year (Figure 2).

The pattern of development discussed above suggests a marked change in gear around 1990; between 1960 and 1990 there was little change in Ireland's position within the EU, measured in terms of GNP per head. While this may appear to be an exceptional rate of convergence in living standards, measured as GNP per head, the situation looks rather different when considered in terms of output per person employed – national productivity broadly defined. On this measure the Irish economy has been converging towards EU standards of productivity fairly steadily since the 1970s. While we are presently seeing some acceleration in the rate of convergence, this is not out of character with the past 30 years. In this paper we consider the factors underlying the convergence and the apparent acceleration in activity in the 1990s.

The explanation for the contrast between the two measures, GNP per head and GNP per person employed, lies in the movement in the economic dependency ratio – the ratio of the population not in paid employment to those who are at work. As discussed earlier, while Ireland still has an economic dependency ratio well above the EU level in the 1980s, it will actually fall below the EU average some time in the next few

years. This contrast, and its related effects on living standards represented by the movement in GNP per head, reflects the window of opportunity which is available to Ireland over the next 20 years. The declining dependency ratio, at a time when the ratio is rising elsewhere in the EU, will make possible a rapid rise in living standards in Ireland.

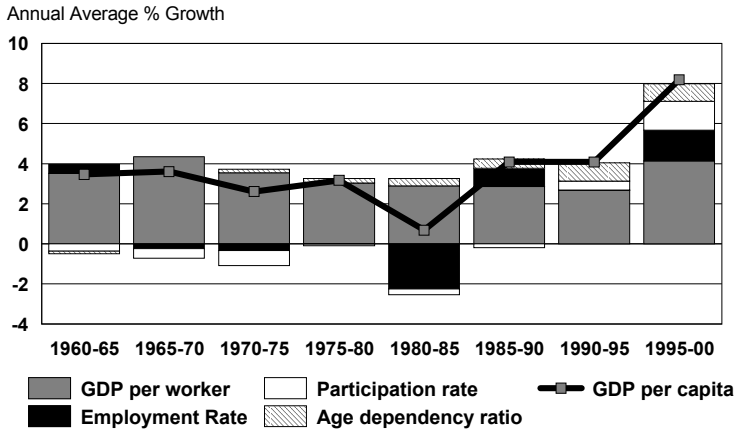
To understand more fully the productive capacity of the economy it is useful to decompose GDP per capita into a number of individual components, namely productivity, employment, participation and dependency, as follows:

$$\underbrace{\frac{GDP}{N}}_{\text{GNP per capita}} = \underbrace{\frac{GDP}{LTOT}}_{\text{Productivity}} \cdot \underbrace{\frac{LTOT}{LF}}_{\text{Employment Rate}} \cdot \underbrace{\frac{LF}{N1564}}_{\text{Participation Rate}} \cdot \underbrace{\frac{N1564}{N}}_{\text{Dependency Ratio (inverse)}}$$

where *LTOT* is total employment, *LF* is the labour force, *N1564* is the population of working age (15-64) and *N* is the total population. The first term on the right hand side of the equation measures productivity (output per employee), the second term measures employment as a proportion of the labour force (equal to one minus the unemployment rate), the third term measures the participation rate and the fourth term is the inverse of the dependency rate.

Figure 3 plots the growth in each of the components of GDP per capita in five-year intervals from 1960. It is clear from the chart that productivity growth has been strong throughout the past 30 years. The proximate cause of the fall in GDP per capita in 1980-85 was a large increase in unemployment (a fall in the employment rate). In recent years increases in participation and employment have made a positive contribution to overall growth in GDP per capita.

Figure 3: Decomposition of GDP per capita Growth




This decomposition helps distinguish the relative importance of different factors underlying overall growth performance. By way of example let us compare the period 1965-70 with the period 1990-95. Between 1965 and 1970 productivity growth averaged 4.3 per cent per annum, a rate which has not been equalled since. However, because participation rates fell and the unemployment rate rose during this period the

overall growth in GDP per capita was slower at 3.6 per cent per annum. By contrast in the period 1990-1995 productivity growth was lower at 2.7 per cent per annum but because participation rates grew and dependency rates fell GNP per capita grew at a faster rate of 4.1 per cent. Productivity growth alone is not sufficient to foster growth.

The chart indicates that since 1990 each of the factors, productivity, employment, participation and dependency have made net positive contributions to growth. The recent growth experience has been driven by the coincidence of several favourable underlying factors. Strong productivity growth reflects the strength of the supply-side of the economy driven *inter alia* by the growth in the stock of human capital and improvements in the physical infrastructure of the economy. This has in turn increased employment. The rise in participation rates, driven by increased participation of women in the workforce, is strongly linked to the increase in investment in education as well as cultural change and improved employment prospects. At the same time underlying demographic trends (and especially with declining unemployment) have reduced the dependency ratio.

In understanding the past record of growth in the Irish economy it is useful to examine the contributions of labour and capital to that growth and to consider how total factor productivity (TFP) has moved over time. Table 1 shows the data for the five-year periods from 1960 to the present.

First we distinguish between TFP calculated using GNP and using GDP. The difference between these two aggregates is primarily profit repatriations by foreign multinationals operating in high technology sectors, such as computers and pharmaceuticals. These repatriations represent part of the large contribution to the economy from the growth of business in "new economy" sectors and, in a sense, it represents part of the contribution of this factor to the Irish convergence process.

Table 1: Contributions to Growth and Total Factor Productivity

| | 1960-65 | 1965-70 | 1970-75 | 1975-80 | 1980-85 | 1985-90 | 1990-95 | 1995-00 |
|---|---|---|---|---|---|---|---|---|
| Labour | 0.19 | -0.11 | 0.34 | 0.89 | -0.87 | 0.59 | 1.12 | 2.65 |
| Capital | 0.46 | 1.46 | 1.54 | 1.91 | 1.23 | 0.72 | 0.83 | 2.33 |
| TFP – GDP | 3.13 | 2.78 | 2.26 | 1.79 | 1.13 | 2.58 | 2.70 | 4.30 |
| TFP – GNP | 3.20 | 2.70 | 2.03 | 1.26 | -0.03 | 1.97 | 2.51 | 3.10 |
| Education | | | | | 0.96 | 0.59 | 0.54 | 0.43 |
| Adjusted for education: | | | | | | | | |
| TFP – GDP | | | | | 0.17 | 1.99 | 2.15 | 3.87 |
| TFP – GNP | | | | | -0.99 | 1.38 | 1.97 | 2.66 |

Over the last forty years the contribution to growth from capital accumulation has varied between a minimum of 0.5 percentage points in the early 1960s to a high of 2.3 percentage points in the late 1990s. The contribution of labour has been much less stable, with falling employment in the early 1980s, as the economy adjusted to a range of shocks.

Total factor productivity, calculated on a GDP basis, fell below 2 per cent in the 1980s. This reflects the serious economic difficulties that were sustained over most of the decade. Faced with the downturn firms shed labour, but many of them were probably still overstaffed with consequential effects on profitability. Since 1990 the rate of growth in TFP has picked up and in the second half of the decade it hit 4.3 per cent a year – the highest growth rate ever.

To what extent does this rapid growth in TFP in the second half of the 1990s represent new economy effects, as in the United States. The strong growth in the US economy has been an important factor in the successful performance of the Irish economy. Strong growth in foreign direct investment into Ireland has played an important role in increasing the economy's supply potential. In a sense this does represent an effect from new technology - moving the productive capacity of the manufacturing sector into sectors where new products are expanding demand rapidly. However, the more important effects where new technology helps expand the productive potential of the economy as it increases the rate of productivity remains unproven. The way the national accounting data are collected makes difficult or even rules out the measurement of such effects in much of the services sector.

Table 2: Percentage Contribution of Factors to growth (1960-92)

| | Capital | Labour Quality | Raw Labour | TFP |
|---|---|---|---|---|
| Austria | 21.01 | 8.93 | 3.67 | 66.39 |
| Germany | 36.36 | 17.48 | 8.74 | 37.42 |
| Ireland | 35.08 | 18.88 | 7.00 | 39.04 |

Source: Durkan, Fitzgerald and Harmon, 1999 and Koman and Marin, 1997.

An important additional factor contributing to the growth in output since 1980s is the extensive investment in human capital. Durkan, Fitzgerald and Harmon, 1999, have produced an index measuring the growth in human capital. When allowance is made for this by adjusting labour input it is seen to explain up to 0.5 percentage points of the growth in TFP in the 1990s. They also compare their estimate for Ireland of the contribution of the different factors of production to growth with the estimate of Koman and Marin, 1997 for Austria and Germany (Table 2).

The data in Table 2 indicate that the contribution of investment in human capital over the period 1960-92 was slightly higher in Ireland than in Germany. However, the investment began much later in Ireland than in Germany[2]. As a result, the effects are still continuing to add to growth in the 1990s in Ireland (Table 1) whereas the effects in much of the rest of the EU have begun to tail off.

Using this methodology, when allowance is made for the investment in human capital and for foreign direct investment (through using GNP), the growth in TFP in the period 1995-2000 is still seen to be high at over 2.5 per cent. This is over half a percentage point up on the first half of the 1990s. However, the magnitude of the difference only explains a small proportion of the very rapid growth in the Irish economy over that period. The bulk of the explanation is seen to lie in the rapid increase in factor inputs, especially in the input of labour. The fact that the supply of labour is rising much more rapidly in Ireland than elsewhere in the EU is due to a range of demographic factors (Fitz Gerald, 2000).

## *3. The Model*

In order to explore the mechanisms through which investment in human capital and FDI impact on the economy we have developed a small structural model of the labour

[2] Free second level education was only introduced into Ireland in 1967.

market, separately distinguishing skilled and unskilled labour. This model allows us to examine the mechanisms through which a range of different factors have contributed to the current growth. The results somewhat modify somewhat the conclusions drawn in the previous Section.

The model we describe her is concerned with the medium-term behaviour of the labour market. So far little attention has been given to the short-run dynamics of individual equations and this must be taken into account in interpreting the results.

## 3.1 Output determination

The equation for output is based on the model of the traded goods sector developed in Bradley and Fitz Gerald (1988). This is a small open economy model, where multinational enterprises select a location for production on the basis of world demand and Ireland's relative cost competitiveness. Because the Irish economy is largely traded, we use this specification to model GDP. The equation is as follows:

$$\log(GDP)_t = c_{31} + c_{32}\log\left(\frac{W}{W_{GER} * e_{GER}}\right)_t + c_{33}\log\left(\frac{W}{W_{UK} * e_{UK}}\right)_t + c_{34}\log(GDP_{USA})_t + c_{35}\log(GDP_{USA\_90})_t + c_{36}\log(GDP)_{t-1}$$

In the equation, world demand is proxied by US GDP ($GDP_{USA}$), given the dominance of US multinationals in the Irish traded sector. As can be seen from Figure 1 below, the growth in Irish GDP accelerated in the 1990s fuelling the convergence of Irish GDP with the EU average. This acceleration has been the subject of much debate but is undoubtedly fuelled by an increase in US FDI into Europe and an increase in Ireland's *share* of US FDI in that period (see for example Barry and Bradley, 1997, Barry *et al*. (1999)and Ruane and Gorg, 1997). To capture this FDI effect the equation also includes an additional term that is constant till 1990 and grows at the same rate as US GDP in the 1990s. This term captures the change in elasticity after 1990 because of the enhanced role of FDI.[3]

Competitiveness is measured using two terms, Irish average wage costs ($W$) relative to the UK ($W_{UK}$*$e_{UK}$) and Germany ($W_{GER}$*$e_{GER}$). These are chosen as representative of Ireland's main trading partners. For a given level of world demand, an improvement in competitiveness will increase Ireland's market share and result in growth faster than the world economy.

The underlying data in the equation are shown in Figure 4. The acceleration in Irish GDP in the 1990s is confirmed by the increase in the annual growth rate. The two competitiveness terms indicate that the Irish economy has been wage-competitive in the 1990s. Irish wages relative to the UK, having increased steadily in the 1970s,

[3] An alternative specification along the lines of Barrell and te Velde, 2000, might be better at identifying the FDI effect.

stabilised since that time, and Irish wages relative to Germany declined in the 1990s to levels last seen in the 1970s.

Table 3: Output determination equation, estimation results

| Coefficient | estimate | std. error | t-stat | prob>\|t\| | Diagnostics | |
|---|---|---|---|---|---|---|
| $c_{31}$ | 2.442 | 0.784 | 3.12 | 0.00 | 1970-1998 | |
| $c_{32}$ | -0.081 | 0.032 | -2.53 | 0.02 | $R^2$ | 1.00 |
| $c_{33}$ | -0.088 | 0.061 | -1.43 | 0.17 | Std. Error | 0.02 |
| $c_{34}$ | 0.438 | 0.090 | 4.84 | 0.00 | D.W. | 1.50 |
| $c_{35}$ | 0.302 | 0.069 | 4.41 | 0.00 | | |
| $c_{36}$ | 0.712 | 0.064 | 11.13 | 0.00 | | |

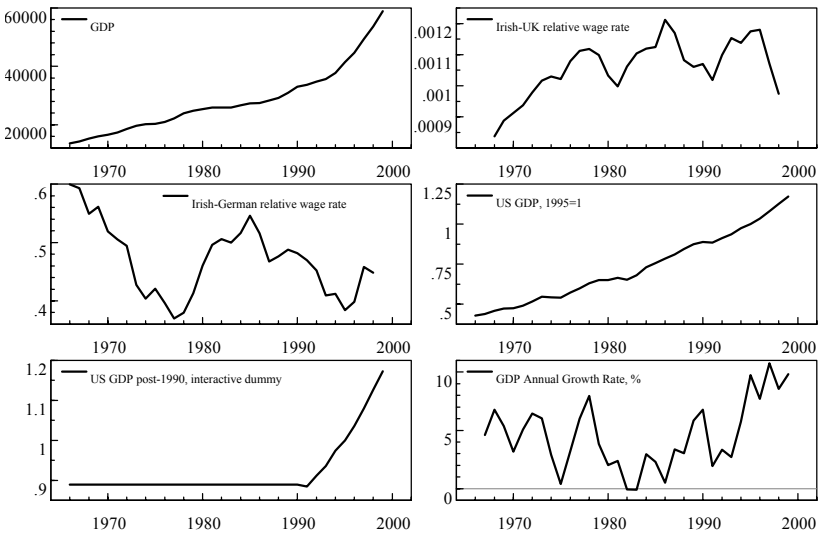
The estimation results are shown in Table 3. The equation fit is good and the implied long-run relationship is:

$$\log(GDP) = 8.49 - 0.28\log\left(\frac{W}{W_{GER} * e_{GER}}\right) - 0.30\log\left(\frac{W}{W_{UK} * e_{UK}}\right) + 1.52\log(GDP_{USA}) + 1.05\log(GDP_{USA\_90})$$

There are strong and significant long-run competitiveness elasticities *vis-à-vis* the UK and Germany, both approximately equal to –0.3. The elasticity on US GDP is high, at 1.5, indicating the degree of dependence of the Irish economy on the US multinational sector. The post-1990 FDI-effect, at 1, is also significant.

The convergence of Irish GDP in the 1990s is captured in the underlying parameters of this equation. With an improvement in competitiveness in the 1990s and a structural change in the composition of Irish GDP through the FDI-effect, the parameters imply that for a one percentage point increase in US GDP, Irish GDP will grow by 2.5 per cent.

Figure 4: Output equation variables




## 3.2 Labour supply

The Irish labour market operates rather differently depending on the educational qualifications of workers. Those with high levels of education are typically more

mobile and will emigrate (immigrate) in periods of low (high) labour demand, so that participation rates and unemployment rates among these workers are relatively stable. Those with lower levels of education have more volatile participation rates, so that in periods of low labour demand they either withdraw from the workforce or are unemployed. This means that the unemployment rates for low-skilled workers are much higher than for high-skilled workers. At the margin we assume that the skilled labour market clears quite rapidly through migration.

Because of these important distinctions, we model the participation decision for high-skilled and low-skilled workers separately. High-skilled is defined as workers who have completed second-level education to at least Leaving Certificate level. The labour force participation decision is modelled for each group of worker as follows:

**Low-skilled labour supply**:

$$\left(\frac{N_L}{POP_L}\right)_t = c_{21} + 0.525\log\left(\frac{W_L}{P_C}\right)_t + c_{23}UR_{t-3} + c_{24}T_t$$

The low-skilled participation decision is modelled as a function of the real low-skilled consumption wage, a trend term and a lagged unemployment rate. In the equation the coefficient on the real wage is imposed at 0.525 based on detailed microsimulation analysis of the participation decision by in Barrett et al. (2000). The lag on the unemployment rate was determined by experimentation, the third lag provided the best fit. This equation determines low-skilled labour supply $N_L$.

The low-skilled population of working age is determined by the following identity:

$$POP_{L,t} = POP_{L,t-1} + \Delta POP_{L,t}$$

**High-skilled labour supply**:

$$\left(\frac{N_H}{POP_H}\right)_t = c_{11} + 0.525\log\left(\frac{W_H}{P_C}\right)_t + c_{13}T_t$$

The high-skilled participation decision is modelled as a function of the real high-skilled consumption wage and a trend term. The coefficient on the real wage is imposed at 0.525 based on detailed microsimulation analysis of the participation decision by in Barrett et al. (2000). It represents the weighted average of a higher rate for females and a lower rate for males. However, as female participation rates rise it can be anticipated that the labour supply elasticity may fall - there are fewer women outside the labour force to be attracted into it. In addition, there is evidence in Barrett *et al.* (2000) that this elasticity is probably falling with rising income.

The unemployment rate is not included in this participation equation because high-skilled workers are mobile and will migrate if labour demand is low *(*Fahey, Fitz Gerald and Maitre, 1998*)*. This equation determines the high-skilled wage $W_H$.

This latter point is captured in the identity determining the high-skilled population aged 20-64. The coefficient of 0.75 on migration is imposed since approximately 75% of migrants are in the age group 20-64 and it is assumed they are all high-skilled.

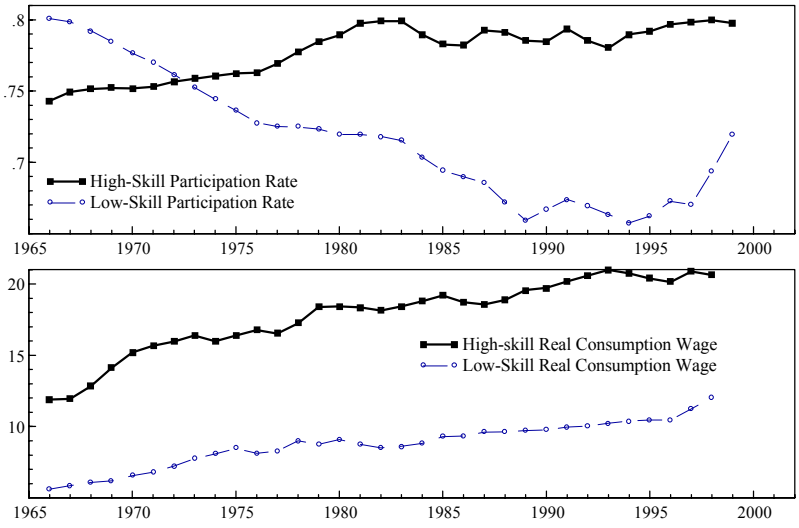
$$POP_{H,t} = POP_{H,t-1} + \Delta POP_{H,t} + 0.75M_t$$

Figure 5 shows the underlying variables in the participation equations. Participation rates are much higher among the high-skilled. The low-skill participation rate fell continuously between 1965 and 1989, this pattern changed in the 1990s and in the late 1990s it has begun to increase sharply again, reflecting the tightening of the labour market.

Table 4: Labour force participation equations, estimation results

| Coefficient | *estimate* | *std. error* | *t-stat* | *prob>\|t\|* | *Diagnostics* | |
|---|---|---|---|---|---|---|
| Labour force participation: High-skilled | | | | | 1980-1998 | |
| $c_{11}$ | 7.735 | 2.623 | 2.95 | 0.01 | $R^2$ | 0.80 |
| $c_{13}$ | -0.004 | 0.001 | -3.24 | 0.01 | Std. Error | 0.01 |
| | | | | | D.W. | 1.31 |
| | | | | | Rho(1) | 0.55 |
| Labour force participation: Low-skilled | | | | | 1980-1998 | |
| $c_{21}$ | 18.000 | 1.666 | 10.80 | 0.00 | $R^2$ | 0.96 |
| $c_{23}$ | -0.004 | 0.001 | -2.80 | 0.01 | Std. Error | 0.01 |
| $c_{24}$ | -0.009 | 0.001 | -11.00 | 0.00 | D.W. | 1.34 |

Figure 5: Participation equation variables




The estimation results for the participation equations are shown in Table 4. There is significant autocorrelation in the high-skill participation equation, this is adjusted for with an estimated autocorrelation coefficient of 0.55. Both equations suggest that, in the absence of increases in real wages, participation rates would be falling slowly over time. The coefficient on the unemployment rate in the low-skill equation indicates that an increase in the unemployment rate of one percentage point would reduce low-skill participation by 0.4.

## 3.3 Migration

Migration is modelled as a function of the expected real after tax earnings in Ireland relative to the UK. While in the 1960s and 1970s most emigrants were unskilled, since 1980 most migration both into and out of the country has been skilled (Fahey, Fitz Gerald and Maitre, 1998 and Barrett and Trace, 1999). As a result, all migration is assumed to be high-skilled, and it is through this mechanism that the high-skilled labour market is cleared. The lags in the migration equation determine the speed with which this segment of the market clears. (As we shall see below, the high-skilled unemployment rate is assumed constant as a simplification in the model.)

$$M_t = c_{61} + c_{63} * \left( \frac{W * (1 - RGTYP)}{P_C} \right)_t \Bigg/ \left( \frac{W_{UK} * (1 - RGTYP_{UK})}{P_{C\_UK}} \right)_t + c_{64} M_{t-1} + c_{65} D_{1990}$$

The coefficient estimates are shown in Table 5. The implied long-run relationship is:

$$M = -291 + 192{,}724 * \left( \frac{W * (1 - RGTYP)}{P_C} \right) \Bigg/ \left( \frac{W_{UK} * (1 - RGTYP_{UK})}{P_{C\_UK}} \right) + 47 D_{1990}$$

These parameter values are difficult to interpret due to scaling problems. The following example illustrates their magnitude. If we take the average value of the relative wage term during the 1990s (1990-1998) then the implied migration would be of the order of 80,000 net immigration, which represents a substantial addition to the labour force.

Figure 6: Migration equation variables

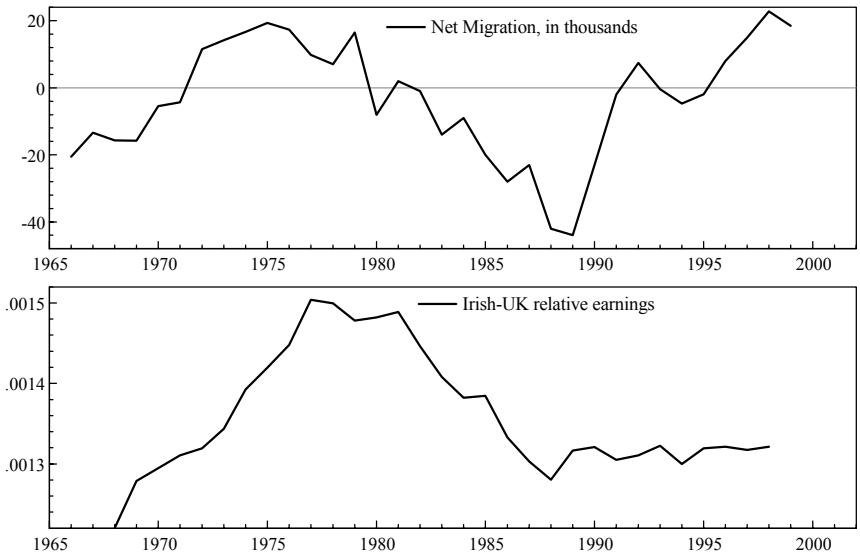



Table 5: Migration equation, estimation results

| Coefficient | estimate | std. error | t-stat | prob>\|t\| | Diagnostics | |
|---|---|---|---|---|---|---|
| $c_{61}$ | -147.650 | 63.880 | -2.31 | 0.04 | 1980-1998 | |
| $c_{63}$ | 97,778.518 | 45394.095 | 2.15 | 0.05 | $R^2$ | 0.82 |
| $c_{64}$ | 0.493 | 0.142 | 3.47 | 0.00 | Std. Error | 8.24 |
| $c_{65}$ | 23.891 | 5.351 | 4.46 | 0.00 | D.W. | 1.86 |

## 3.4 Labour demand

The demand for labour is modelled as a function of output, the real consumption wage and a time trend. This equation assumes that all firms are profit-maximisers. The estimation results suggest an insignificant real wage effect (Table 6) with a strong negative time trend (Harrod-neutral technical progress) reflecting the decline in the labour-output ratio over time as shown in Figure 7.

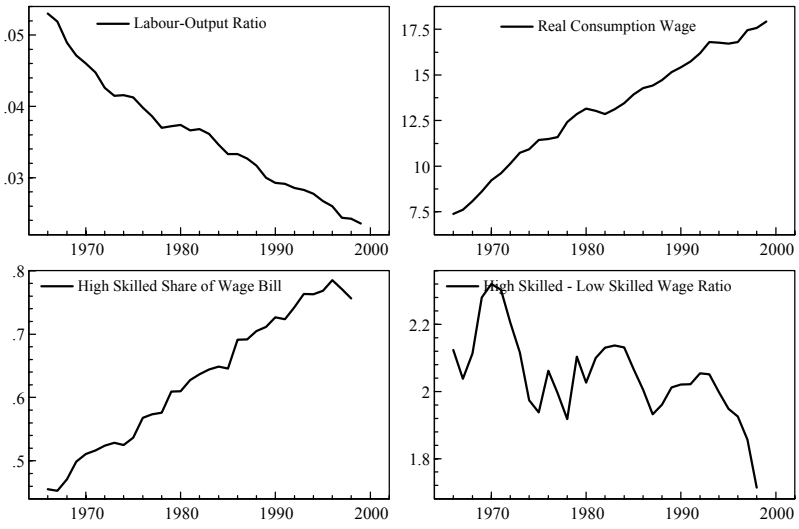
$$\left(\frac{LNA}{GDP}\right)_t = c_{41} + c_{42}\log\left(\frac{W}{P_C}\right)_t + c_{43}T_t$$

Table 6: Labour demand equation, estimation results

| coefficient | Estimate | std. error | t-stat | prob>\|t\| | Diagnostics | |
|---|---|---|---|---|---|---|
| $c_{41}$ | 1.148 | 0.227 | 5.06 | 0.00 | 1970-1998 | |
| $c_{42}$ | -0.008 | 0.006 | -1.26 | 0.22 | $R^2$ | 0.99 |
| $c_{43}$ | -0.001 | 0.000 | -4.51 | 0.00 | Std. Error | 0.00 |
| | | | | | D.W. | 1.50 |
| | | | | | Rho (1) | 0.48 |

In addition to the decline in the labour-intensity of output, there has been a steady shift towards the employment of more high skilled labour over the period (see Figure 7). Relative factor prices can account for some of this, since the ratio of high to low skilled wages has fallen over time. However during the period 1975-1993 relative factor prices were relatively steady and the skilled labour share continued to rise. This is mainly due to structural change within the manufacturing sector towards more high tech, skill intensive industries (Kearney, 1997), as captured by the positive time trend in the factor demand equation.

Figure 7: Labour demand equation variables




A second equation models high-skilled and low-skilled labour inputs to estimate substitution effects within the total labour bundle. A translog equation is used to model high-skilled employment as follows:

$$S_H = \left( \frac{W_H . LNA_H}{YWNA} \right)_t = c_{51} + c_{52} \log \left( \frac{W_H}{W_L} \right)_t + c_{53} T_t$$

where $YWNA = W_H * LNA_H + W_L * LNA_L$

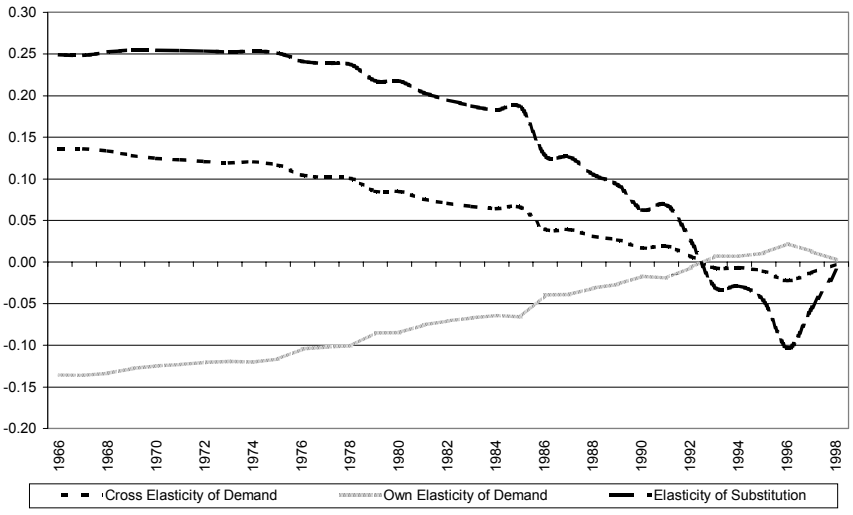
The estimation results shown in Table 7 imply that over time high skilled labour has become less substitutable for low skilled labour as its share in the total labour bundle has risen. Figure 8 plots the implied elasticities of substitution and demand. By the end of the 1990s there is effectively a zero elasticity of substitution between the two types of labour. Technical progress is biased towards skilled labour in production.

Table 7: Labour substitution effects, estimation results

| coefficient | estimate | std. error | t-stat | prob>\|t\| | Diagnostics | |
|---|---|---|---|---|---|---|
| $c_{51}$ | -22.177 | 0.606 | -36.58 | 0.00 | 1970-1998 | |
| $c_{52}$ | 0.186 | 0.041 | 4.52 | 0.00 | $R^2$ | 0.99 |
| $c_{53}$ | 0.011 | 0.000 | 38.65 | 0.00 | Std. Error | 0.01 |
| | | | | | D.W. | 1.06 |

Figure 8: Estimated Elasticity of Substitution and Demand,

High-Skilled vs Low-Skilled Labour




Finally the identity $LNA = LNA_H + LNA_L$ is used to determine low-skilled employment $LNA_L$.

## 3.4 Equilibrium in the labour market: unemployment and wage determination

**Equilibrium in the low-skilled labour market:**

Equilibrium in the low-skilled labour market occurs through the wage bargaining process. Estimation of a low-skilled wage bargaining equation proved extremely difficult. This is because, between 1980 and the late 1990s, the low-skilled wage rate is probably driven by the rate of social welfare setting a wage floor above a level that

would clear the market. It is only in the last few years that rising unskilled wage rates have risen significantly, reducing the effective replacement rate. This meant the persistence of structural unemployment throughout most of the 1980s and the 1990s.

We show the results of the "best fit" equation here, estimated over the period up to the early 1980s. However, in simulation for the period from 1980 till the late 1990s, the unskilled wage rate is assumed to be driven by changes in the real rate of unemployment payments. The equation specifies the real consumption low-skilled wage as a function of the UK unemployment rate, the real value of unemployment benefits and labour productivity.

$$\log(\frac{W_L}{P_C})_t = c_{71} + c_{72}UR\_UK_t + c_{73}\log\left(\frac{UB}{P_C}\right)_t + c_{74}\log\left(\frac{GDP}{L}\right)_t + c_{75}\log(\frac{W_L}{P_C})_{t-1}$$

The results are shown in Table 8. There is no significant productivity effect and the strongest relationship is with the reservation wage (unemployment benefit).

Table 8: Low-skilled wage determination effects, estimation results

| coefficient | estimate | std. Error | t-stat | prob>\|t\| | Diagnostics | |
|---|---|---|---|---|---|---|
| $c_{71}$ | -1.798 | 0.366 | -4.92 | 0.00 | 1966-1981 | |
| $c_{72}$ | -0.009 | 0.004 | -2.05 | 0.07 | $R^2$ | 0.99 |
| $c_{73}$ | 0.767 | 0.194 | 3.95 | 0.00 | Std. Error | 0.02 |
| $c_{74}$ | 0.046 | 0.164 | 0.28 | 0.78 | D.W. | 2.09 |
| $c_{75}$ | 0.140 | 0.154 | 0.91 | 0.39 | Rho (1) | -0.18 |

Given the low-skilled wage, the average wage is derived as follows:

$$W = \frac{W_H LNA_H + W_L . LNA_L}{LNA}$$

**Equilibrium in the high-skilled labour market:**

In the model equilibrium in the high-skilled labour market occurs through the migration mechanism and changes in participation. Labour supply will adjust to match labour demand and there is no structural high-skilled unemployment. The unemployment rate is treated as a fixed frictional rate as follows:

$$\frac{N_H}{L_H} = \beta$$

While this is an oversimplification, it is a realistic representation of the medium-term behaviour of the economy. This equation determines the level of total high-skilled employment $L_H$. Given an exogenous level of total agricultural employment $LA$, then this can be used to determine $LA_H$ , $LA_L$ and $L_L$ as follows:

$$L_H = LNA_H + LA_H \,,\; L_L = LNA_L + LA_L \,,\; L = L_H + L_L$$

$$N = N_H + N_L \,,\; U = N - L \,.$$

The aggregate unemployment rate and the skilled unemployment rate are defined as,

$$UR = \frac{U}{N} * 100,\ UR_H = \frac{N_H - L_H}{N_H} * 100$$

## *4. The Factors Driving Growth*

In this Section we expand the analysis in Section 2 using the model set out in Section 3. We consider the relative contributions of the different factors contributing to the rapid convergence in Irish living standards to the EU average. The use of a structural model of the economy provides greater insights into what has happening than is possible with the simple accounting identity estimating TFP.

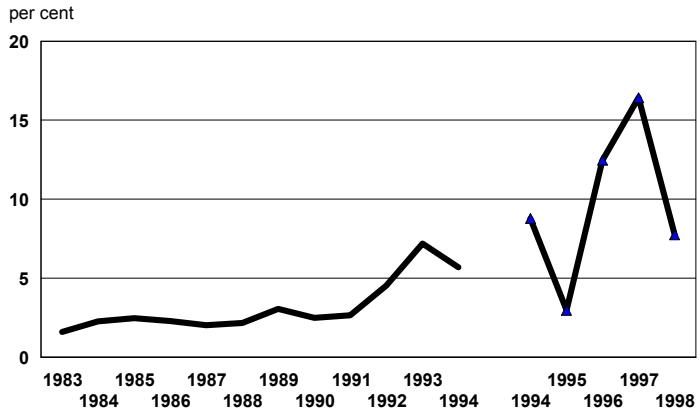
In each case we perturb the model with respect to a single variable to see what impact it has on the economy. However, the interaction effects between the different factors are likely to be substantial.

The first factor we consider is the impact of a shift in the demand curve for Irish output reflected in the big increase in foreign direct investment. We then consider a number of supply side factors – investment in human capital and migration.

### 4.1 Effects of Foreign Direct Investment

A very important factor in explaining the rapid convergence in living standards in the 1990s to the EU average has been foreign direct investment. The success of the strategy of attracting foreign investment is illustrated in Figure 9. In particular in the 1990s, Ireland's share of all US foreign direct investment into the EU averaged well over 5 per cent, with even higher levels achieved in the most recent years. With the increasing concentration of these firms in high technology sectors, the new investment has significantly tightened the market for skilled labour.

Figure 9: Ireland's Share of US FDI into the EU




Source: US Survey of Current Business. Data 1983-1994 are Capital Expenditure by Foreign Affiliates of US Companies; Data post 1994 are Direct Investment Abroad

The rising demand for skilled labour occurred throughout the industrialised economies (Nickell and Bell, 1995) over the 1980s and the 1990s. However, the shift in demand in Ireland has been accentuated by the impact of foreign direct investment on the economy. The bulk of the foreign direct investment has, until recently, gone to

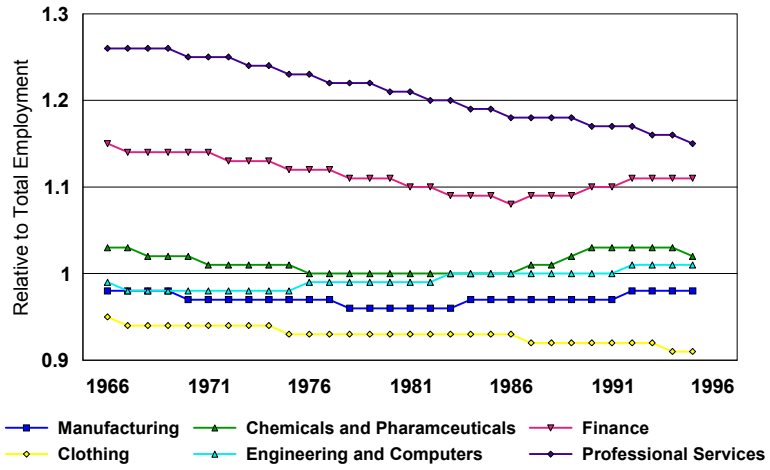
the manufacturing sector. By 1997 almost 50 per cent of all employment in manufacturing was in foreign owned firms and a quarter of all employment was in US owned firms (Table 9). The bulk of this employment in foreign owned firms was in the high-technology sector, broadly defined.

Table 9: Share of total manufacturing employment by sector and by ownership

| | Irish Owned | Foreign Owned | | Total |
|---|---|---|---|---|
| | | | of which: US Owned | |
| Other | 40.1 | 17.3 | 7.1 | 57.4 |
| High Tech. | 12.1 | 30.5 | 18.2 | 42.6 |
| Total | 52.2 | 47.8 | 25.2 | 100.0 |

In the 1960s the two sectors of the economy that employed the bulk of the skilled labour force were market and non-market services, in particular financial and professional services. They still are the major employers of skilled labour, but the gap in levels of human capital employed between these sectors and the rest of the economy has narrowed considerably (Figure 10), with a general upgrading of the skill levels in high-technology manufacturing (engineering, including computers, and chemicals). The high technology manufacturing sector, driven by the inflow of foreign firms, now has an above average level of human capital in its labour force. The most rapid increase in the demand for skilled labour in the 1990s has occurred in the high technology manufacturing and in financial services, both of which are affected by the inflow of new firms from abroad.

Figure 10: Sectoral Human Capital




It is difficult to capture directly the impact of FDI on the Irish economy, partly because of the consistency with which the policy has been followed over forty years – there is little variance in the tax rate. The work of Barrell and te Velde, 1999, offers a way forward using pooled data from Ireland and the UK. However, here we have proxied the effect with a dummy allowing the elasticity of Irish GDP with respect to US GDP to change in the 1990s.

Figure 11: Effects on GDP of Reduced FDI post-1990

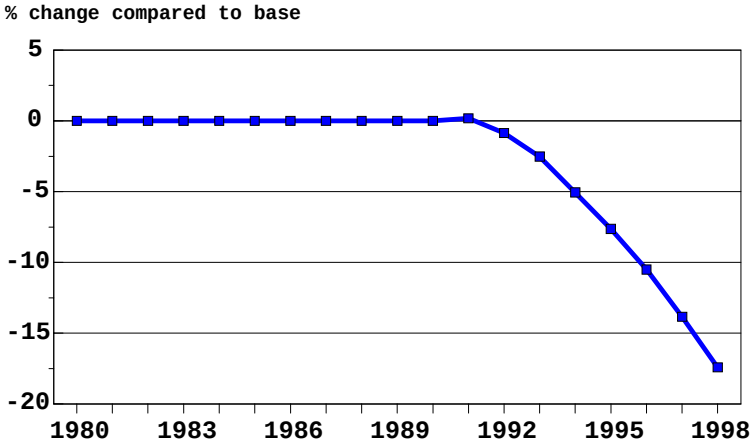
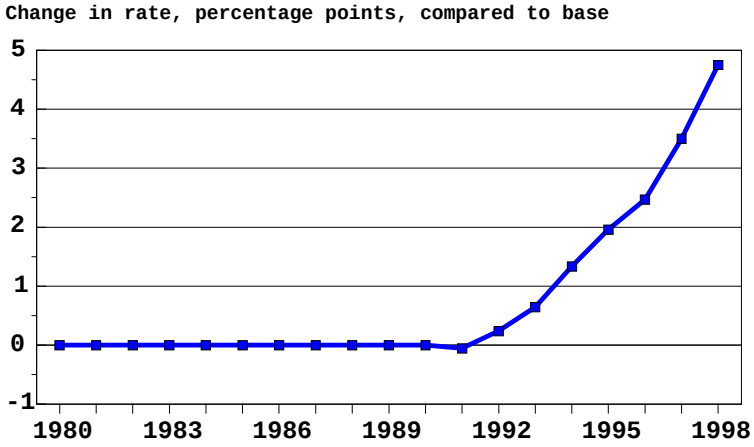



Figure 12: Effects on Unemployment Rate of Reduced FDI post-1990




In this simulation we hold that elasticity unchanged, shifting inwards the demand curve for Irish output and Irish labour. As shown in Figure 11, this simulation shows a reduction by 1998 of over 17 per cent of GDP relative to the benchmark – a reduction in the growth rate of around two percentage points a year. While the identification of this effect as "the effect of FDI" is crude, probably overestimating the effect, it does indicate the potential importance of this channel. As a result of such a shock the reduction in employment would have been between 12 and 15 per cent by 1998.

The reduction in output and employment would have resulted in substantial emigration (reduced immigration) over the period. This response would have occurred as a result in the fall in skilled wage rates. However, with unskilled wage rates fixed by the replacement rate and with no unskilled migration, unskilled unemployment would have been almost five percentage points higher by the end of the period than it actually was (Figure 12).

This simulation indicates the importance to the Irish economy of the growth of new high technology sectors. The introduction of such activity has come about through the rise in FDI. However, it should be understood that the rather simple specification of

the model in Section 3, omitting many important factors driving demand for Irish output, biases upwards the measured impact of FDI.

### 4.2 Effects of Reduced Investment in Human Capital

In this simulation the relative educational attainment of the population was held fixed at its 1980 level and immigration was also held fixed. This would have seen a very big reduction over time in the supply of skilled labour matched by a very much bigger increase in the supply of unskilled labour. The impact of such a reduction in the supply of skilled labour would have been a dramatic rise in skilled wage rates to a level over 50 per cent above their actual 1998 level. With unskilled wage rates fixed by the replacement rate average wage rates would have risen by 40 per cent. Such a rise in domestic labour costs would, in turn have had a very big effect on the competitiveness of the economy. As shown in Figure 13, by 1998 the level of GDP would have been 17 per cent below its benchmark level – a reduction in the growth rate over the period of just under one per cent a year.

Figure 13: Effect on GDP of Reduced Investment in Human capital

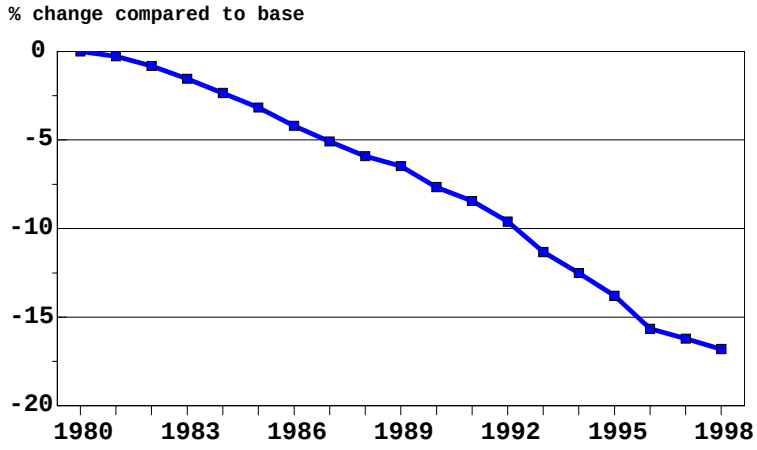
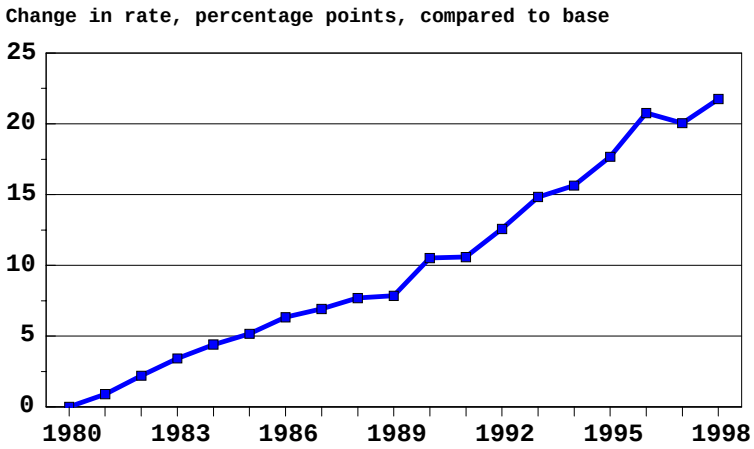



Figure 14: Effect on Unemployment Rate of Reduced Investment in Human Capital




Clearly this would not have been sustainable. As shown in Figure 14, the unemployment rate would have been over 20 per cent above the benchmark by the end of the period. With unemployment already high over most of the 1980s and 1990s

such a level of unemployment (unskilled) would have put impossible pressure on the public finances – pressure which is not modelled her. Instead the replacement ratio would have had to fall and with it unskilled wage rates to make the economy more competitive. This would have involved a further increase in wage dispersion between skilled and unskilled labour.

The results of this simulation suggest a markedly larger contribution from investment in human capital than was the case with the analysis in Section 2. This simulation indicates a contribution of around one percentage point a year to the growth rate compared to the earlier estimate of just over 0.5 percentage points a year over the same period. This would leave a somewhat smaller TFP to be possibly explained by "new economy" factors.

In considering the contribution to growth from investment in human capital, account should also be taken of the extent to which the demand curve for goods produced using skilled labour has shifted outwards. This is reflected in a general rise in demand for skilled labour world-wide (Nickell and Bell, 1995). Ireland has gained its share of this demand partly through the entry of new foreign firms investing in the country. Without this shift in the demand curve, the big increase in supply of skilled labour would have resulted in a fall in the skilled wage rate. Instead, all the micro-economic evidence indicates that the return has actually increased (Barrett, Callan and Nolan, 1999). What this means is that the interaction of FDI (and new economy effects) is significantly enhanced by the simultaneous impact of increased investment in human capital.

### 4.3 Effects of Migration

In recent years net immigration of skilled labour has played an important role in expanding the supply of skilled labour. The model specification implies that ultimately the supply of skilled labour is infinitely elastic.

Within this model the effect of immigration of skilled labour is to reduce upward pressure on the skilled wage rate. In turn, this reduces the cost of producing in Ireland and increases output. Because Irish skilled and unskilled labour are effectively complements, the increase in competitiveness due to falling skilled wage rates is to increase the demand for unskilled labour. Thus the effect of skilled migration is to reduce the pressures for growing inequality in wage rates through reducing skilled wage rates and tightening the market for unskilled labour.

Over the four years 1996 to 1999 net immigration averaged 16,000 a year. As Barrett and Trace, 1998, have shown, the bulk of these people, whether they were returning emigrants or foreigners, had a high level of education. As a result, they significantly increased the supply of skilled labour over that period. The effect of this increase in the supply of skilled labour was to reduce labour market pressures.

Table 10: Effects of Net Migration in the Four Years Ended 1999

| | | |
|---|---|---|
| Skilled Labour Supply | % | 3.2 |
| Skilled Wage Rates | % | -4.7 |
| GNP | % | 1.5 |
| Total Employment | % | 3.2 |
| Unemployment rate | percentage points | -0.7 |

The labour market model, described above, suggests that after four years, the impact of the immigration was to increase the supply of skilled labour by 3.2 per cent and reduce skilled wage rates by 4.7 percentage points (Table 10). (The model assumes that due to high levels of unskilled unemployment unskilled wage rates are unaffected by demand.)[4] As a result, the model would suggest that the impact of net immigration of skilled labour was to narrow the gap between skilled and unskilled wage rates by around 4.5 percentage points compared to the situation with no net migration.

This relaxation in the skilled labour supply constraint, and the resulting reduction in skilled wage rates, made Ireland more competitive on world markets. The model would suggest that this raised the level of GNP in the short run by 1.5 percentage points. The long run impact would be substantially greater, due to the slow adjustment of productive capacity to changing economic circumstances. Ultimately the model would suggest that the impact of the improved competitiveness would be to raise the level of GNP by around 4 percentage points.

With rapid adjustment of both skilled and unskilled employment (they are complements) to the changed circumstances, the unemployment rate is estimated to have fallen by around 0.7 percentage points, all of which is concentrated among those members of the labour force with limited education.

Of course this analysis is only partial in nature as it does not take account of the wider impact of higher growth in putting increased pressure on existing infrastructure, in particular on housing. The model also incorporates some simplifying assumptions that are probably inappropriate under current circumstances. While the model assumption that unskilled wage rates are unaffected by labour market pressures was reasonably appropriate in the 1980s and early 1990s, it is clearly unrealistic under current circumstances. To the extent that the tightening of the unskilled labour market impacts on unskilled wag rates, the narrowing in wage dispersion arising from immigration will be even greater than shown in Table 10.

This simulation offers an interesting contrast with the findings of Borjas, Freeman and Katz, 1997, for the United States. Their research indicated that immigration of unskilled labour has adversely affected the position of unskilled inhabitants. The results of the model for Ireland suggest that the immigration of skilled labour has improved the position of unskilled labour in Ireland.

## *5. Conclusions*

The analysis in Section 2 of this paper shows that the rate of increase in TFP in Ireland, however defined, has been higher over the late 1990s than in earlier periods. It is also markedly higher than in much of the rest of the European Union. It is clear that some of the acceleration in productivity growth in Ireland is attributable to "new economy" effects. However, in calculating the growth in TFP allowance must also be made for the impact of rising human capital on measured output per head.

[4] However, recent evidence suggests that this may no longer be the case and that the tightening of the unskilled labour market is exerting upward pressure on wage rates.

The subsequent analysis in Sections 3 and 4 shows that rising investment in human capital has contributed about one per cent a year to the increase in productivity. However, it also highlights the effects of a change in gear in the 1990s, a change that is reflected in a higher inflow of foreign direct investment. The growth that has taken place in the economy over the 1990s has been particularly marked in the high technology sectors of manufacturing and in financial and business services. However, there has also been rapid growth in other service sectors such as retailing, which were not affected to the same extent by the "new economy".

The growth in output in high technology manufacturing sectors has undoubtedly made an important contribution to the growth in output in Ireland. Even when profit repatriations are allowed for, this remains true. If US national accounting conventions were used for Ireland, deflating the value of output in sectors, such as computing, by a hedonic price index, it is likely that the measured growth in output would be significantly higher.[5] Under such circumstances the value of GDP and GNP would remain unchanged while the increase in the volume of measured output would rise. However, as most of the output of these sectors is exported, welfare, as reflected in gross national disposable income, would be unchanged. That is because the higher increase in the volume of output would have to be offset against the loss in the terms of trade, reflecting the rapidly falling price of computers.

For example, ten personal computers in 1990 might have bought a BMW. Today thirty much more powerful machines would be needed to buy the same car. Even if output had trebled, using the BMW measure of living standards, in this example there would be no rise in welfare.

As part of the rapid structural change in the economy, there is a substantial shakeout of employment in those parts of the tradable sector that are dependent on unskilled labour. The economy-wide rise in wage rates is effecting a transfer of labour market resources from the more traditional parts of the manufacturing sector (such as clothing and textiles) to the services sector. This is part of a natural process of change that is masked by the already low levels of unemployment – the job losses do not appear as increase in unemployment. While the effect of this change is to increase output per head in the economy, it is difficult to measure separately.

The most important way that "new economy" could be expected to have an effect on productivity is through increasing output in existing sectors through the use of new technology. However, once again, because of measurement conventions the national accounts will not reflect such a change. Increased productivity as a result of new technology in areas such as the civil service, the financial sector, and even economic research institutes, can only be measured indirectly.

The conclusion of this paper is that, while the "new economy" has had a beneficial effect on productivity in Ireland, it is a relatively small part of the story of Irish economic convergence. Other factors, such as investment in human capital, the policy

[5] However, allowance must also be made for the need to deflate imports of computer parts by a similar index.

on FDI and the country's unusual demographic structure have played a bigger role in changing the economy over the last two decades.

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