68

Changing Participation Rates in the Euro area: The Case of the Celtic Tiger

By Yvonne McCarthy[1] and Kieran McQuinn[2]
Central Bank and Financial Services Authority of Ireland

Abstract

The relatively modest nature of economic growth in the Euro area over the past 10 years has led to increased attention being devoted to ways of facilitating greater supply in European labour markets. An increase in participation rates has been identified as one possible means of achieving this goal. However, progress on this and other policy initiatives has, by general consensus, been limited. In this paper, we examine the evolution of participation rates in the Euro area, focussing, in particular, on one of the more dynamic Euro area labour markets — that of Ireland's. The Irish economy has experienced profound change over the past 16 years with increasing participation, particularly among females, being one of the key engines of growth behind the emergence of the so called ''Celtic Tiger''. We compare and contrast developments in Irish participation rates with those of certain other Euro area countries. Based on recent trends, we also examine a number of likely future scenarios for Irish participation rates and labour force developments.

[1] E-mail: yvonne.mccarthy@centralbank.ie.

[2] E-mail: kmcquinn@centralbank.ie. We would like to thank Karl Whelan, Maurice McGuire and Tom O'Connell for their comments on an earlier draft of the paper. The views expressed in this paper are our own, and do not necessarily reflect the views of the Central Bank and Financial Services Authority of Ireland or the ESCB.

1. Introduction

Over the past 10 years, a growing body of academics and policy makers have focussed on the relatively modest nature of Euro area economic performance. For much of the post-War period, the rate of economic growth in Europe was similar to that observed in the United States. However, since the mid-1990s the US economy has grown substantially faster than that of Western Europe with US GDP growing at an average rate of 3.3 percent per year compared with 2.0 percent in the Euro area. Contributions from Blanchard (2004), Alessina et al. (2005) Dew-Becker and Gordon (2006) and Prescott (2004), amongst others, have addressed the relatively poor economic performance of Europe focussing, in particular, on labour market issues, while the Lisbon Agenda set of policy proposals, discussed in high-profile publications such as the 2003 *Sapir Report*, has attempted to identify specific targets for the Euro area economy as a means of stimulating long run growth.

The objective of facilitating a greater provision of labour within the Euro area is increasingly apparent at an institutional level. While the primary goal of the European Central Bank (ECB) is one of price stability, the ECB's constitution also calls for it to promote economic growth, provided this does not compromise price stability. In this context, the ECB has become a key participant in public debates about the need for structural reforms to boost the potential capacity for growth in the Euro area.[3] In that regard, the Lisbon Agenda outlined in 2000 articulates a variety of proposals aimed at increasing potential output growth. One of the many measures identified as facilitating such growth is increased participation rates. However, by general consensus[4] there has been limited progress on these measures in the interim period.

This paper has two objectives. Firstly, we aim to highlight the importance of participation rates in driving output growth in the Euro area over the past 20 years. We conduct a growth accounting exercise where the contribution of labour market developments to potential output for the 13 Euro area countries over the period 1983-2006 is analysed. This extends a similar type exercise for the Euro area and the USA in McQuinn and Whelan (2006). The labour market component of growth, which is measured in total hours, is broken down into the contribution of population growth, participation rates, unemployment rates and the average workweek length, so that the contribution of each to economic growth can easily be calculated, and the role of participation rates highlighted.

Secondly, following on from the Lisbon Agenda aim to increase participation rates, we narrow our focus to the case of one of the more dynamic Euro area economies of recent years, and examine the likely future development of participation rates in Ireland. We analyse the relative contributions of demographic forces and individual population cohort behaviours in driving aggregate Irish participation rate developments and examine the implications of our results for future participation rates.[5] To benchmark the Irish case, we also consider past labour force participation rate developments for two other countries in the Euro area; the Netherlands (the country with the highest participation rate in the Euro area) and Italy (the country with the lowest). Conducting such a comparison provides an indication as to whether Ireland is an outlier in enjoying a strong growth contribution from changing participation rates or whether the Irish economy is merely ''catching up with'' or ''converging'' to long-run Euro area trends. As a final exercise, we employ CSO population projections and examine the implications for future Irish labour force participation rates of likely changes in population structure over the next 25 years.

Ireland provides an interesting case study for an analysis of participation rate developments because of the strong performance of the Irish economy in recent years and the contribution

[3] For example, see Jean-Claude Trichet: Testimony before the Committee on Economic and Monetary Affairs of the European Parliament, 23rd May 2005. Available online at: www.bis.org/review/r050530b.pdf.

[4] See, for example, a speech given by President of the European Commission José Maunel Barroso to the European Parliament, Strasbourg, 9th March 2005.

[5] This issue is attracting increasing attention in an international context with studies such as Aaronson et al. (2006) examining the recent pattern of declining labour force participation in the United States.

of the notable transformation of its labour market, and more particularly, participation rates. Ireland in the 1980s was characterised by high emigration, chronic unemployment and very high debt to GDP ratios, while the Irish economy of the present millennium is synonymous with some of the fastest growth rates and highest income levels in the western world. This transformation occurred over a relatively short period of time. In 1987, for example, Irish output per worker was 77 percent of that in the Euro area, by 2000 it was 100 percent and by the end of 2006, it had risen to almost 110 percent of the Euro area level.

While many areas of Irish economic life have indeed been transformed, underpinning much of the Irish success story has been the performance of the labour market. At the end of 2006, over 2 million people were at work in the Irish economy. In 1990, that figure was just over 1 million. Unemployment, which throughout the 1980s had averaged 14 percent, has, for much of the new millennium, been at the full employment rate of approximately 4.5 percent. Increased participation rates, particularly amongst females, have been a major part of this success story.

The structure of the rest of the paper is as follows; in the next section we present a decomposition of the growth rates of the 13 Euro area countries over the period 1983 to 2006, paying attention, in particular, to the role of the labour component of growth. We then focus on Irish participation rates, examining the role played by actual changes in the participation rate of different population cohorts and the role of underlying demographic forces. Additionally, we examine the future implications for the Irish participation rate given likely changes in demographic trends over the next 25 years. A final section offers some concluding comments.

2. Decomposing Euro area Growth

In analysing cross-country growth patterns, we employ a growth accounting exercise. Our starting point is the standard assumption that output in each country is produced according to a Cobb-Douglas production function:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$$

$$K_t = (1-\delta)\, K_{t-1} + I_{t-1} \qquad (1)$$

where Y_t is real GDP, K_t is capital input, L_t is labour input (defined as hours worked), I_t is investment and A_t is total factor productivity (TFP). Output growth can then be written in the following manner:

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t}{A_t} + \alpha \frac{\dot{K}_t}{K_t} + (1-\alpha)\frac{\dot{L}_t}{L_t} \qquad (2)$$

With data on output growth, capital growth, and labour growth in hand, an estimate of TFP growth is then obtained.

The growth of the labour component L_t can be broken down into the following components:

$$\frac{\dot{L}_t}{L_t} = \frac{\dot{Pop}_t}{Pop_t} \times \frac{(1-\dot{Prate})}{(1-Prate)} \times \frac{(1-\dot{Urate})}{(1-Urate)} \times \frac{\dot{H}_t}{H_t} \qquad (3)$$

where *Pop* is total population, *Prate* is the participation rate, *Urate* is the unemployment rate in an economy and *H* is the average week worked per employee. In this instance, participation rates are defined as the ratio of the labour force to the total population.

We compile a cross-country sample of 13 member countries of the Euro area.[6] Also included for comparative purposes is the 13-country aggregate for the Euro area. The data are annual. Income and investment data are available for all countries (with the exception of Slovenia) at least from 1980 onwards, while labour force data are available for most countries from 1983 onwards. The exact coverage of the sample along with all data sources is described in detail in the Appendix to the paper.

Our empirical calculations use the standard value of α=1/3 for all cases.[7] No official

[6] These are Belgium, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland and Slovenia. Malta and Cyprus recently became members of the Euro area but are not included here because of data limitations.

[7] An alternative is to use the labour share of income to calibrate the parameter $1-\alpha$. However, for the Euro area, this value has averaged about two thirds, in line with our assumptions. In addition, we should note that our calculations can be considered accurate for any neoclassical production function, provided our estimate of the elasticity with respect to labour input is well captured by our two thirds assumption.

Table 1: Decomposition of Annual Cross-Country Growth Rates

Country	(Δy-Δl)	Δy	Δa	Δk	Δl	Labour Components: Pop	Prate	Urate	H
					1983-1992				
Austria	N/A	2.61	N/A	0.78	N/A	N/A	N/A	N/A	–0.24
Belgium	1.76	2.51	1.04	0.97	0.50	0.28	0.06	0.41	–0.24
Germany	2.61	3.27	2.00	0.83	0.44	0.17	0.46	0.19	–0.38
Spain	N/A	3.28	N/A	1.31	N/A	N/A	N/A	N/A	–0.35
Finland	N/A	1.38	N/A	0.85	N/A	N/A	N/A	N/A	–0.29
France	2.31	2.40	1.66	0.69	0.06	0.55	–0.14	–0.19	–0.17
Greece	1.18	1.60	1.21	0.11	0.28	0.60	–0.18	0.01	–0.15
Ireland	**3.01**	**3.02**	**2.46**	**0.55**	**0.00**	**0.54**	**–0.26**	**–0.02**	**–0.26**
Italy	2.94	2.63	2.21	0.63	–0.21	0.21	–0.05	–0.07	–0.30
Luxembourg	5.09	6.10	4.15	1.28	0.67	0.62	0.26	0.09	–0.30
Netherlands	0.74	3.07	1.00	0.52	1.55	0.58	1.04	0.51	–0.58
Portugal	N/A	3.76	N/A	0.94	N/A	N/A	N/A	N/A	–0.39
Slovenia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Euro area	2.21	2.74	1.72	0.67	0.35	0.35	0.23	0.09	–0.31
					1993-2002				
Austria	N/A	2.30	N/A	0.87	N/A	N/A	N/A	N/A	–0.58
Belgium	1.58	2.56	0.93	0.97	0.66	0.11	0.38	0.09	0.07
Germany	2.49	1.74	1.42	0.82	–0.50	–0.02	0.10	–0.07	–0.52
Spain	0.49	3.73	0.32	1.25	2.16	0.54	0.71	0.99	–0.08
Finland	N/A	3.88	N/A	0.22	N/A	N/A	N/A	N/A	–0.12
France	2.31	2.33	1.68	0.64	0.02	0.29	0.18	0.22	–0.67
Greece	2.10	3.30	1.96	0.54	0.80	0.40	0.66	–0.10	–0.16
Ireland	**4.30**	**8.08**	**3.96**	**1.60**	**2.52**	**1.42**	**0.82**	**0.96**	**–0.67**
Italy	1.28	1.83	0.95	0.52	0.37	0.02	0.35	0.08	–0.09
Luxembourg	5.06	6.09	3.60	1.80	0.69	0.69	0.34	–0.02	–0.31
Netherlands	1.35	3.09	1.05	0.88	1.16	0.35	0.89	0.29	–0.37
Portugal	2.77	3.68	1.58	1.49	0.61	0.36	0.48	0.06	–0.28
Slovenia	N/A	4.15	N/A	1.62	N/A	N/A	N/A	N/A	0.51
Euro area	1.79	2.31	1.24	0.72	0.35	0.20	0.33	0.18	–0.37

Table 2: Decomposition of Annual Cross-Country Growth Rates

Country	(Δy-Δl)	Δy	Δa	Δk	Δl	Labour Components: Pop	Prate	Urate	H
					2000-2006				
Austria	1.48	1.74	0.85	0.72	0.17	0.32	0.15	–0.10	–0.20
Belgium	1.48	1.73	0.65	0.92	0.17	0.35	0.11	–0.21	–0.08
Germany	0.98	0.95	0.43	0.54	–0.02	–0.10	0.62	–0.28	–0.27
Spain	–0.36	3.31	–0.73	1.59	2.44	1.11	0.92	0.66	–0.25
Finland	2.73	2.97	2.14	0.66	0.16	0.11	0.01	0.27	–0.23
France	1.21	1.67	0.53	0.83	0.31	0.51	0.13	0.10	–0.43
Greece	2.92	4.30	2.08	1.30	0.92	0.12	0.52	0.32	–0.04
Ireland	**2.65**	**5.19**	**1.33**	**2.16**	**1.70**	**1.49**	**0.61**	**0.00**	**–0.39**
Italy	–0.39	0.88	–0.64	0.68	0.85	0.02	0.56	0.53	–0.27
Luxembourg	3.72	4.03	2.00	1.82	0.21	0.74	0.43	–0.27	–0.69
Netherlands	1.07	1.50	0.39	0.82	0.29	0.26	0.33	–0.13	–0.17
Portugal	0.45	0.88	–0.63	1.23	0.29	0.34	0.43	–0.43	–0.04
Slovenia	3.05	3.90	1.44	1.89	0.56	0.10	0.64	0.13	–0.30
Euro area	0.66	1.62	0.20	0.78	0.64	0.30	0.49	0.10	–0.25
					2003-2006				
Austria	1.94	2.52	1.48	0.65	0.39	0.35	0.17	–0.18	0.05
Belgium	1.26	2.36	0.76	0.86	0.74	0.46	0.55	–0.15	–0.12
Germany	0.43	1.55	0.39	0.41	0.75	–0.04	0.91	–0.10	–0.02
Spain	–0.40	3.52	–0.70	1.61	2.61	1.14	1.11	0.68	–0.31
Finland	3.32	3.95	2.85	0.68	0.42	0.12	0.01	0.37	–0.08
France	1.62	2.04	0.95	0.81	0.28	0.59	–0.13	–0.21	0.03
Greece	3.10	4.14	1.99	1.46	0.69	0.10	0.64	0.15	–0.20
Ireland	**1.58**	**5.14**	**0.65**	**2.12**	**2.37**	**1.57**	**1.00**	**0.03**	**–0.23**
Italy	–0.22	1.05	–0.43	0.63	0.85	0.01	0.50	0.57	–0.23
Luxembourg	4.77	5.20	3.20	1.71	0.29	0.53	0.73	–0.24	–0.73
Netherlands	1.59	2.22	1.15	0.65	0.42	0.09	0.19	–0.06	0.19
Portugal	0.58	1.10	–0.13	0.88	0.35	0.27	0.28	–0.29	0.09
Slovenia	3.00	4.66	1.72	1.83	1.11	0.03	1.45	0.14	–0.51
Euro area	0.65	2.07	0.40	0.72	0.95	0.33	0.56	0.11	–0.05

Note: *Pop* refers to population, *Prate* is participation, *Urate* is employment and *H* is average hours worked per employee.

estimates of the capital stock exist for Euro area countries, so our estimates are based on an initial assumption that capital in 1980 was at the steady-state value implied by the Solow growth model (discussed in greater detail in the Appendix) and subsequently calculated on the assumption that capital depreciates at 6 percent per year. Our results, however, are not particularly sensitive to either this initial assumption or the assumed depreciation rate.

In Tables 1 and 2 we present the results of the decomposition of equations (2) and (3). We also include calculations of output per worker ($\Delta y - \Delta l$). The results are illustrated for four different time periods (i) 1983 — 1992, (ii) 1993 — 2002, (iii) 2000 — 2006 and (iv) 2003 — 2006. A general result to emerge across the different time periods is the relatively poor performance of Euro area labour markets. Apart from the Netherlands initially, Spain and Ireland, the contribution to growth of European labour markets has been quite modest.

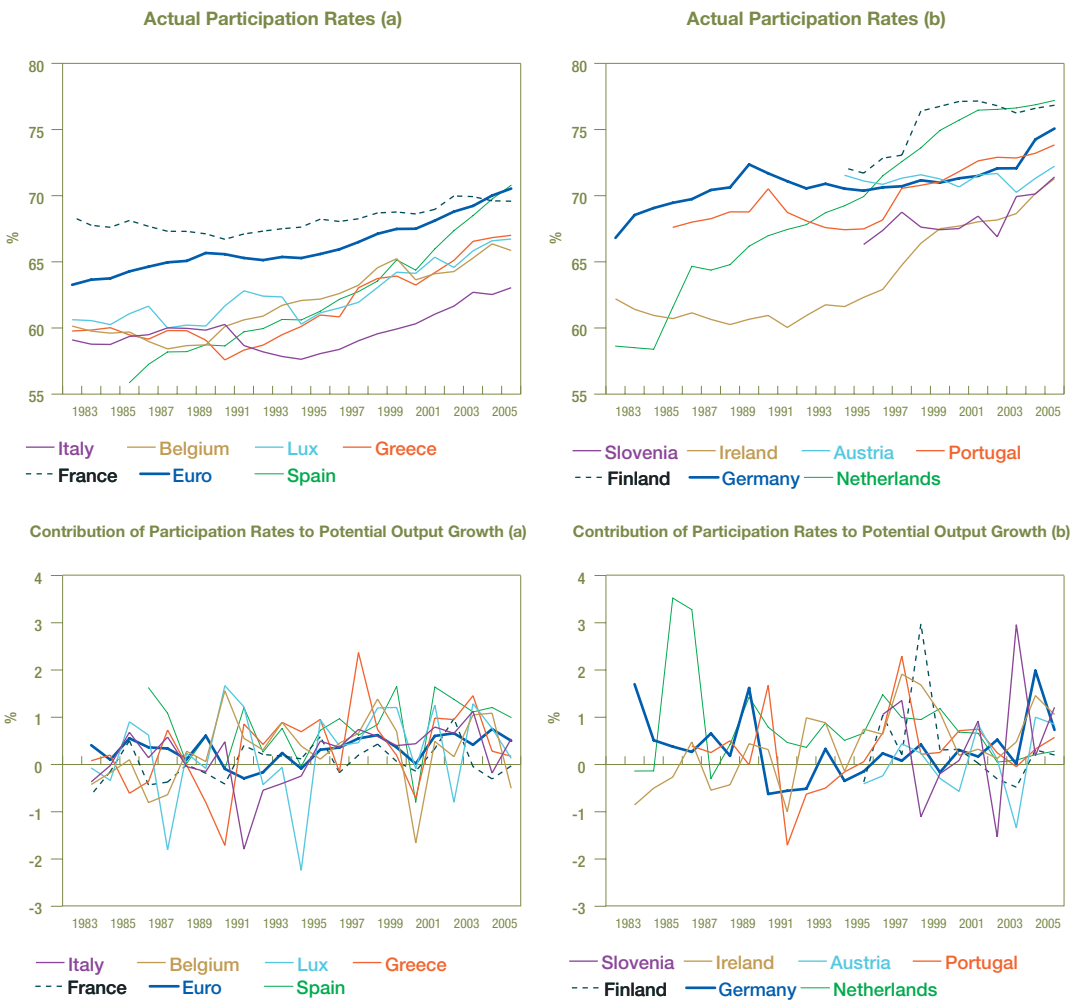
For the initial time period, Spain, Germany, Portugal and Luxembourg register the strongest output growth. For Germany and Luxembourg most of this growth would appear to have originated in the strong performance of total factor productivity (TFP) over this period. For many of the Euro area countries between 1983 and 1992 the difference between output growth and the increase in output per worker is quite small. In general the relatively poor performance of the Euro area labour market during the period can be attributed both to increases in unemployment, decreases in some countries participation rates and declines in the average workweek.

In the second sub-period, the Irish ''Celtic tiger'' clearly emerges, with the Irish economy registering a strong annual average rate of growth of over 8 percent between 1993 and 2002. While TFP growth accounted for almost 4 percent of this increase, it can be seen that the Irish labour market accounted for over 2.5 percentage points of this growth. Inspection of the labour elements reveals growth across three of the four sub-components with population increases, increased participation rates and lower unemployment playing a strong role. Only the Spanish economy came near to enjoying a similar type contribution from the labour market, where Germany, for example, over the same period actually saw a negative contribution to growth from this source.

In the more recent sub-periods, it is Spain and the smaller nations of the Euro area — Ireland, Slovenia, Greece and Luxembourg — that are the most dynamic performers. For the post 2000 period, Irish growth averaged over 5 percent per annum, with Greece, Luxembourg and Slovenia growing at about 4 percent per annum. This compares with a Euro area average of just over 1.6 percent. Again Spain and Ireland enjoy substantial contributions from their labour markets with increases in participation rates continuing to play a key role. The growing importance of demographic factors, particularly in the case of Ireland, is also apparent, with the increase in population also contributing significantly to economic performance. Growth rates in Greece and Luxembourg, on the other hand, appear to owe more to improvements in TFP over the period. The contribution of improved Irish, Slovenian and Spanish participation rates post 2003 appears to be very much the exception in the Euro area. Indeed, one of the largest labour markets — that of France actually experiences negative growth from participation rates over the same period.

To concentrate more on the role played by participation rates, in the top two graphs of Figure 1 we plot the actual participation rates for the countries in our sample. Owing to the number of countries, we break the sample into countries (a) and (b). The latter grouping includes those countries that had the highest rate of participation at the end of the sample period. On average most countries experienced a relatively modest increase in participation rates. However, some countries have clearly experienced particularly strong increases. Over the period 1996 to 2006, Spain, Ireland, the Netherlands and Greece averaged annual increases in their participation rates of at least 1 percent. Spain and Ireland's performance is notable with annual growth rates of 1.4 percent. The Dutch performance is also worthy of comment as it registers the

Figure 1: Particiation Rates for Euro Area Countries



largest increase in total over the period 1983-2006 of 32 percent. From an Irish and Spanish perspective, it is also worth noting that, despite the very strong increases in participation rates over the entire period, by 2006, the actual rate of participation in the Irish and Spanish labour markets was still below the highest rates in the Euro area, i.e. those of the Netherlands, Germany and Finland.

In the bottom two graphs of Figure 1, the contribution of participation rates to output growth is plotted, with the y-axis depicting the percentage points of economic growth accounted for by participation rates. Towards the end of the 1990s, for example, it can be seen that the increases in Irish, Greek and Portuguese participation rates were contributing up to 2 percentage points of economic growth for certain years.

As a general issue, the relatively poor performance of the labour markets in the larger Euro area countries is of some concern. It could be argued, for instance, that the static nature of labour markets in countries such as Germany, France and Italy has had knock-on repercussions for TFP growth over the past 10 years. The recent poor TFP performance within the Euro area has been illustrated in contributions by Musso et al. (2005) and McQuinn and Whelan (2006) with the latter study also examining the longer-term growth implications for the Euro area of this productivity slowdown.

2.1 Measurement Issues

As is the case with any growth accounting decomposition, these calculations must come with some important caveats. Both left- and right-hand-sides of the growth accounting

equation are subject to significant measurement error, and our measures of real GDP, labour input, and capital input could potentially be considered imperfect. This is because our approach has been to compare Euro area countries' economic performances over a relatively long period using comparable statistical measures, and this necessitates using measures that may be slightly less sophisticated than those available for one of the countries or over shorter time periods. Overall, however, we think our main finding of the relative performance of different labour markets over the sample period is impervious to any such measurement issues.

Recently there have been some suggestions that the relatively poor contribution of labour markets to economic growth in the Euro area may be explained by changes in the composition of labour. For example, perhaps Europe's poor growth performance could be due to the fact that it has been adding lower quality workers over time. A study by Schwerdt and Turunen (2006) suggests, however, that the pattern of labour quality growth in the Euro area over the period 1983-2004 was relatively steady, implying that this explanation does not seem to work in practice.[8]

3. The Irish Labour Market

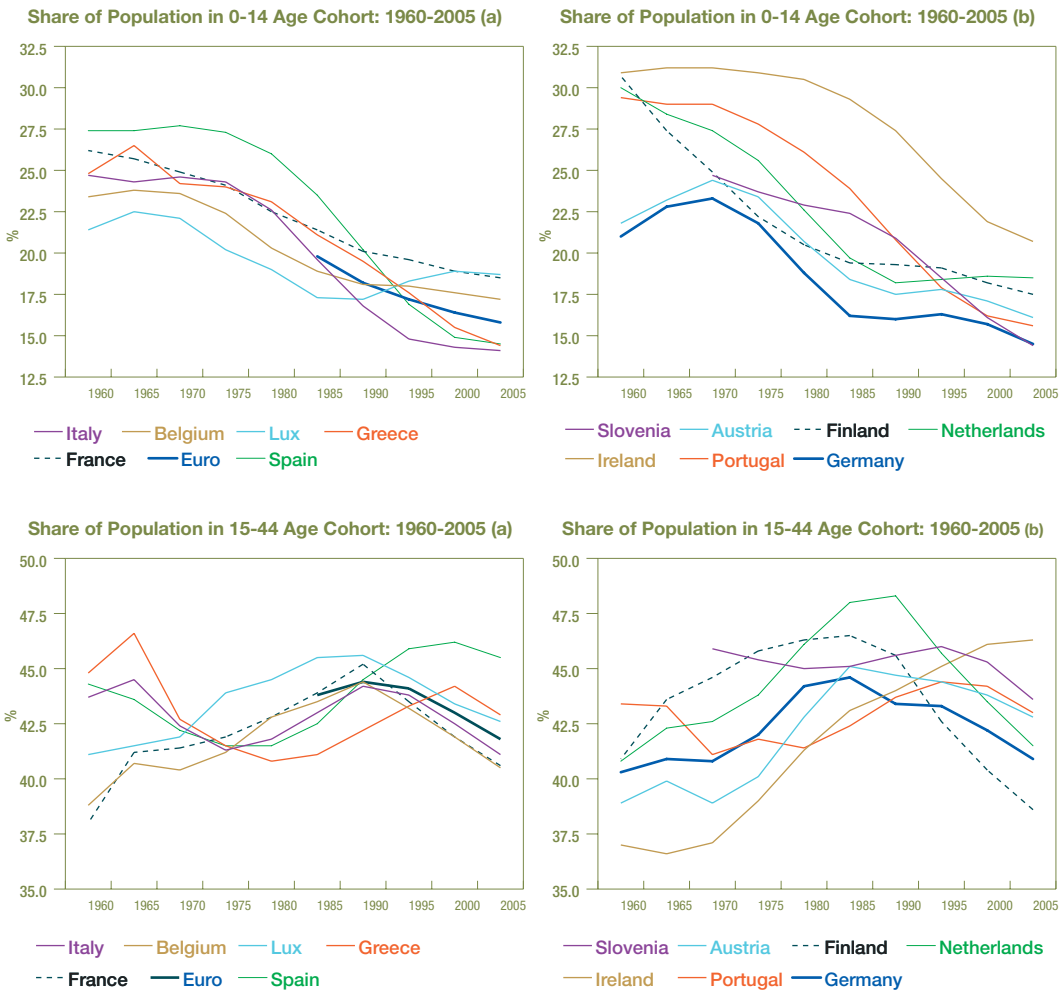
The recent rapid transformation in the Irish labour market is of considerable interest and several studies have sought to examine the rationale for the significant turnaround in its performance. In one of the more celebrated contributions, Honohan and Walsh (2002) present a panoramic overview of Irish economic progress, questioning whether Ireland's recent growth was due to some spectacular sustained increase in productivity or whether the story is a more conventional case of an increase in the proportion of the population at work. They conclude that the Irish story is mainly a ''delayed structural transformation as the proportion of the population at work outside agriculture and their productivity at last spurted towards the levels long achieved in other industrialized countries, and the productivity of the labour force remaining in agriculture rose''. The conclusion drawn from Honohan and Walsh (2002) is that, while the groundwork for Irish convergence to western European living standards had been in place since the early 1960s, subsequent macroeconomic policy failures had prevented the process from occurring until well into the 1990s. Studies more particular to the labour market such as Walsh (1999, 2000) examine the cyclical and structural influences on Irish unemployment, while Walsh (2004) examines the transformation of the Irish labour market over the period 1980 to 2003. More recently, Bergin and Kearney (2007) address the role played by human capital accumulation in the Irish labour market throughout the 1990s.

One of the more commonly hypothesised components of the Irish growth story has been the stimulus provided by the changing demographic structure of the population — see Fahey, Fitzgerald and Maitre (1998) for example for a discussion of this. The relatively high nature of the Irish birth rate throughout the 1960s, 1970s and even into the early 1980s, by western standards, resulted in a large provision of labour in the Irish economy from the mid 1980s onwards. To understand the relative contribution of the changing population structure, in Figure 2 we plot the evolution of key age cohorts for five-year intervals over the period 1960 to 2005 for all Euro area countries. Using the same classification as Figure 1, countries are broken into groups (a) and (b). In the top two graphs of Figure 2, the share of the 0 to 14 age bracket in the total population for all countries is plotted. It is evident that, within Europe, Ireland, Portugal and Spain have had the youngest population over most of the period. In Ireland's case, the percentage of the population in this youngest cohort has consistently been the largest of the countries examined.

The implications of this trend can be seen in the bottom two graphs of Figure 2, where the percentage of the total population in the key 15 to 44 age bracket is presented. The trend for Ireland and Spain is in contrast to the other countries plotted. Throughout the sample

[8] Estimates of labour quality growth in Schwerdt and Turunen (2006) are constructed by weighting hours worked for different types of workers by labour costs for each type of worker, where labour costs are derived from predicted wages from cross-country regressions of individuals' wages on their human capital characteristics.

Figure 2: Euro Area Population Dynamics



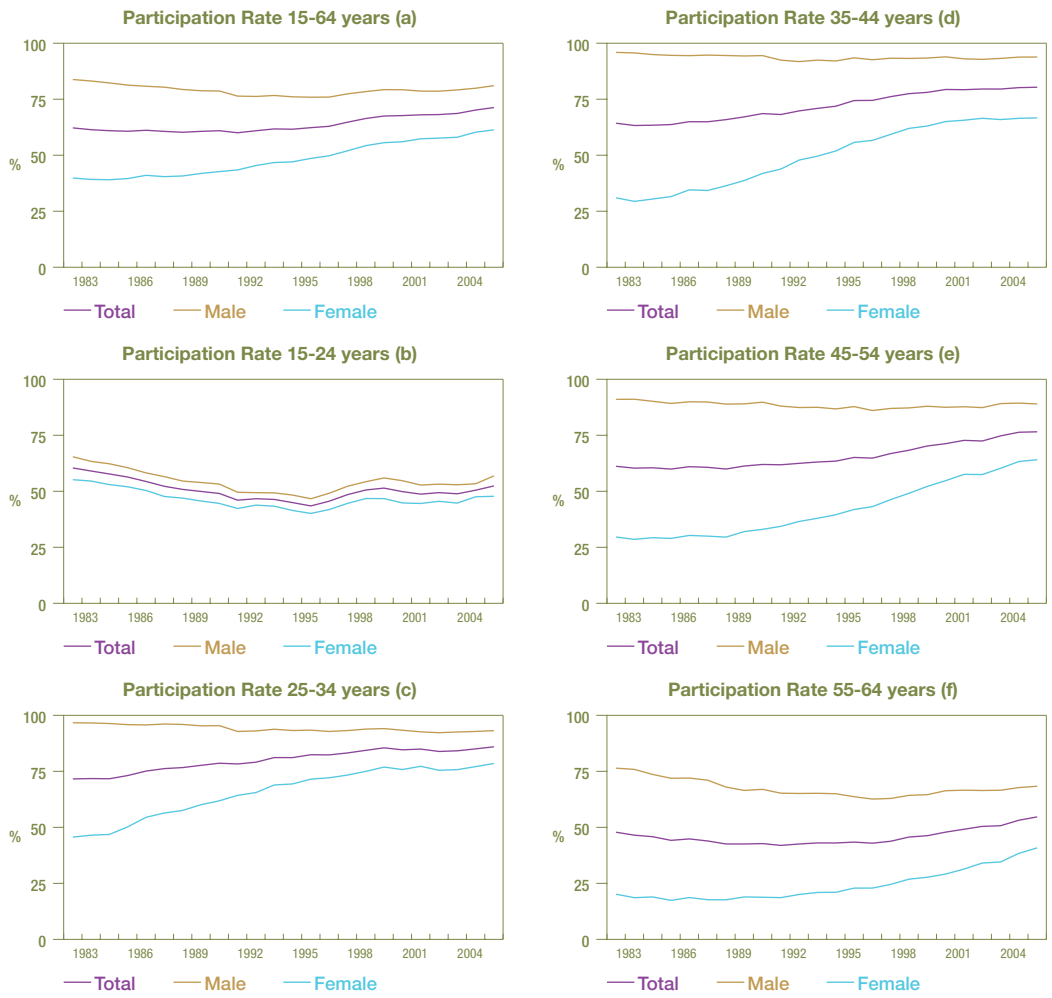
period, an increasing proportion of the Irish and Spanish populations has been entering this age cohort, while, for most of the other countries, it is clear that this cohort's proportion of the population has been in decline since the early to mid 1990s. Such population dynamics have important implications for labour supply, particularly since participation decisions differ across age cohorts, with older cohorts tending to participate less than their younger counterparts.

In order to gain an understanding of how these population changes affected the aggregate Irish participation rate, we follow Fallick and Pingle (2007) and decompose changes in Irish participation rates over the last 20 years (shown in Figure 3) into two main factors: the influence of changes in the share of the population in a particular age cohort and the influence of changes in the labour supply behaviour of certain age cohorts, using the following identity:

$$R_t - \overline{R} = \sum_j \left[(\overline{R}_j - \overline{R}) \times S_{j,t} + (R_{j,t} - \overline{R}_j) \times \overline{S}_j + (R_{j,t} - \overline{R}_j) \times (S_{j,t} \times \overline{S}_j) \right] \quad (4)$$

where R denotes a participation rate, S is the population share, the subscript j denotes demographic groups, t is a time subscript and overbars denote the sample mean. Therefore, R_t is the aggregate participation rate in a particular year, $R_{j,t}$ is the participation rate of the demographic group j in that year, and $\overline{R}$ and $\overline{R}_j$ are, respectively, the mean of the aggregate participation rate and the group j participation rate mean over the sample period.

Figure 3: Labour Force Participation Rate by Age Cohort



This identity shows that the deviation of the aggregate participation rate from its sample mean in any year can be decomposed into the contributions of (1) the difference between each cohort's average participation rate and the average aggregate rate, weighted by the cohort's population share, (2) the difference between each cohort's participation rate and its own mean, weighted by the cohort's average population share and (3) an interaction term, which is negligible. Changes in the first term show the contribution to the aggregate participation rate of changes in the cohort's population share over time while changes in the second term show the contribution of changes in the cohort's participation rate to the aggregate rate over time.

Figures 4 and 5 illustrate this decomposition for the 5 age cohorts. Focussing initially on female participation rates in Figure 4, it is clear that the population share has in general played a positive role in driving female participation rates over the period. However, this factor's contribution has been relatively stable over time. On the other hand, the labour force participation rate of individual cohorts has registered notable changes throughout the sample period, thereby having an important effect on the changing aggregate participation rate observed earlier. This is particularly the case for the prime working age group. In Figure 6, which shows the contributions to the labour force participation rate for men, we see that changes in the labour force participation rate of the 15-24 year olds were a key factor driving developments in the male participation rates.

In the Irish case, it is particularly interesting to address whether the increases in the different participation rates have been due to ''push'' factors such as greater access to education, changes in tax/social policy or whether the substantial increases have been motivated by ''pull'' factors such as the increased demand for labour generated by the Celtic tiger. A number of points have emerged in the literature on the changing fortunes of the Irish labour market that are worth mentioning.

Firstly, participation decisions tend to be closely linked to the economic cycle, so that in a period of high growth, the associated labour market opportunities encourage workers to participate, (Darby et al, 1998). While this was a factor in the Irish participation rate story, participation rates had been trending upwards since the mid 1980s, before the onset of the Celtic Tiger boom, suggesting that other factors were also important. In particular, several changes were made at an institutional level in order to encourage participation: disincentives to entering employment were reduced, the administration of the social welfare system was made rigorous and active labour market policies aimed at enticing certain categories of discouraged workers back into the labour force were also implemented. For example, community employment schemes were put in place to target the long-term unemployed (Walsh, 2004). In the case of females, falling fertility rates, increasing education levels and rising wage rates contributed to higher participation rates (Fahey et al, 2000). In addition, changes in legislation and social provisions (for example, the movement to individualisation of tax credits), as well as changes in the nature of labour demand were all important factors driving changes in labour market behaviour. Technological progress and

Figure 4: Contributions to Female Labour Force Participation Rate

Figure 5: Contributions to Male Labour Force Participation Rate

the marketisation of domestic goods and services also played a role, as innovation in home appliances reduced the time spent in traditional home duties, while marketisation meant that goods and services typically produced in the home, could instead be purchased from outside. Increased immigration is also likely to have played a role in increasing participation rates. Since 1996, net migration figures have been positive in Ireland and research shows that immigrants who have arrived in Ireland in recent years tend to have higher participation rates than natives (Barrett, Bergin and Duffy, 2006).

To further tease out the results, Table 3 assesses the total impact of the changes highlighted in Figures 4 and 5 on the aggregate participation rate over time. In column 1 in the upper part of the Table, we show the actual labour force participation rate (LFPR) recorded in 1985, 1990, 1995, 2000 and 2007. Column 4 shows the percentage change in this series over time. In column 2 we generate an aggregate participation rate that holds constant the cohort participation rates at their 1985 levels, while allowing population shares to evolve as per the historical data. The change in this series, shown in column 5, isolates the influence of population shares in driving participation rate increases.[9] In column 3 we hold female participation rates constant at their 1985 level, so that the percentage change in this series isolates the effect of changing male participation rates and both male and female population shares to the aggregate participation rate. We subtract this percentage change from the numbers in column 5 (contribution of both male and female population shares) and present the results in column 6, thus showing the contribution of

[9] The choice of base year can, of course, affect the quantitative results of the decomposition, though the qualitative results are unchanged.

Table 3: Contributions of Population Shares and Changes in Individual Male and Female Cohort Participation Rates to the Aggregate Participation Rate in Ireland (%)

Year	(1) Actual LFPR	(2) LFPR (1985 levels)	(3) Female 1985 levels	
1985	60.9	60.9	60.9	
1990	60.7	61.0	59.1	
1995	61.6	61.0	57.3	
2000	67.5	61.0	58.8	
2007	72.2	61.3	59.6	
	(4) Actual Change	(5) Contrib. Of Pop Shares	(6) Contrib. of Male LFPR	(7) Contrib. of Female LFPR
1985-1990	–0.5	0.1	–3.1	2.6
1990-1995	1.6	0.0	–3.0	4.6
1995-2000	9.6	0.1	2.5	7.0
2000-2007	7.0	0.4	1.0	5.6

changing male participation rates only to the aggregate participation rate over time. In column 7, we show the contribution of changing female participation rates to the aggregate participation rate by subtracting columns 5 and 6 from column 4. In other words, we subtract the contribution of changing population shares and changing male participation rates from the total change in the aggregate participation rate.

Focussing on column 5 we can see that changing population shares had little impact on changes in the aggregate participation rate over time, a result already shown in Figures 4 and 5. For example, between 2000 and 2007, of the 7 percentage point increase in the aggregate participation rate, changing population shares accounted for only 0.4 percentage points of this. Column 6 shows that changes in the male participation rate accounted for 1.0 percentage point of the increase in the participation rate between 2000 and 2007, while in column 7 we can see that the majority of the increase over the period was the result of a rise in female participation rates.

Table 4: Contributions of Population Shares and Changes in Individual Male and Female Cohort Participation Rates to the Aggregate Participation Rate in the Euro area (%)

Year	(1) Actual LFPR	(2) LFPR (1985 levels)	(3) Female 1985 levels	
1985	63.7	63.7	63.7	
1990	65.7	64.2	63.6	
1995	65.3	64.7	62.6	
2000	67.5	64.9	63.0	
2007	70.8	64.8	63.5	
	(4) Actual Change	(5) Contrib. Of Pop Shares	(6) Contrib. of Male LFPR	(7) Contrib. of Female LFPR
1985-1990	3.0	0.7	–1.0	3.2
1990-1995	–0.6	0.7	–2.4	1.1
1995-2000	3.4	0.3	0.4	2.7
2000-2007	5.0	–0.2	0.9	4.2

Table 5: Contributions of Population Shares and Changes in Individual Male and Female Cohort Participation Rates to the Aggregate Participation Rate in Italy (%)

Year	(1) Actual LFPR	(2) LFPR (1985 levels)	(3) Female 1985 levels	
1985	58.8	58.8	58.8	
1990	59.8	58.9	58.1	
1995	57.6	59.5	56.6	
2000	59.9	60.2	57.0	
2007	62.5	60.3	57.2	
	(4) Actual Change	(5) Contrib. Of Pop Shares	(6) Contrib. of Male LFPR	(7) Contrib. of Female LFPR
1985-1990	1.8	0.3	–1.3	2.9
1990-1995	–3.7	1.1	–3.8	–1.0
1995-2000	4.0	1.2	–0.4	3.2
2000-2007	4.4	0.1	0.3	3.9

Table 6: Contributions of Population Shares and Changes in Individual Male and Female Cohort Participation Rates to the Aggregate Participation Rate in the Netherlands (%)

Year	(1) Actual LFPR	(2) LFPR (1985 levels)	(3) Female 1985 levels
1985	58.4	58.4	58.4
1990	66.2	59.1	60.7
1995	69.2	59.5	60.7
2000	74.9	59.4	62.4
2007	78.5	57.6	61.9

	(4) Actual Change	(5) Contrib. Of Pop Shares	(6) Contrib. of Male LFPR	(7) Contrib. of Female LFPR
1985-1990	13.3	1.2	2.7	9.4
1990-1995	4.6	0.7	–0.7	4.6
1995-2000	8.2	–0.3	3.1	5.4
2000-2007	4.8	–3.0	2.2	5.6

To place the Irish participation rate story in a European context, Tables 4, 5 and 6 replicate the exercise of Table 3 for the Euro area, Italy and the Netherlands. Italy and the Netherlands are chosen as the former has the lowest participation rates in the Euro area, while Dutch participation rates, as can be seen from Figure 1, are the highest. Along with estimates for the Euro area as an aggregate, this provides a context for the Irish experience. As is evident from the tables, in the most recent time period 2000 to 2007, Irish participation rates grew at a faster rate than in Italy, the Netherlands or the Euro area. This was also the case between 1995 and 2000. Participation rates grew by 4.8 percent between 2000 and 2007 in the Netherlands, by 4.4 percent in Italy and by 5 percent in the Euro area. In both the Netherlands and the Euro area, it is interesting to note that the contribution of changing population shares between 2000 and 2007 was actually negative, so that all of the increase in the aggregate participation rate came from changes in the participation behaviour of different cohorts of the population. In particular, as in Ireland, the majority of the increase in the aggregate participation rate during the period 2000 to 2007, was the result of an increase in the participation rate of females. In fact, with the exception of Italy between 1990 and 1995, female participation rate changes accounted for the largest portion of change in the aggregate participation rate in all of the time periods examined. Overall the strong contribution of female participation rates is similar to that which prevailed in the United States between 1965 and 1990, when a large portion of the increases in the aggregate labour force participation rate was accounted for by increased participation among females, particularly the younger and prime-aged cohorts (Fallick and Pingle, 2007).[10]

3.1 Implications for the Future

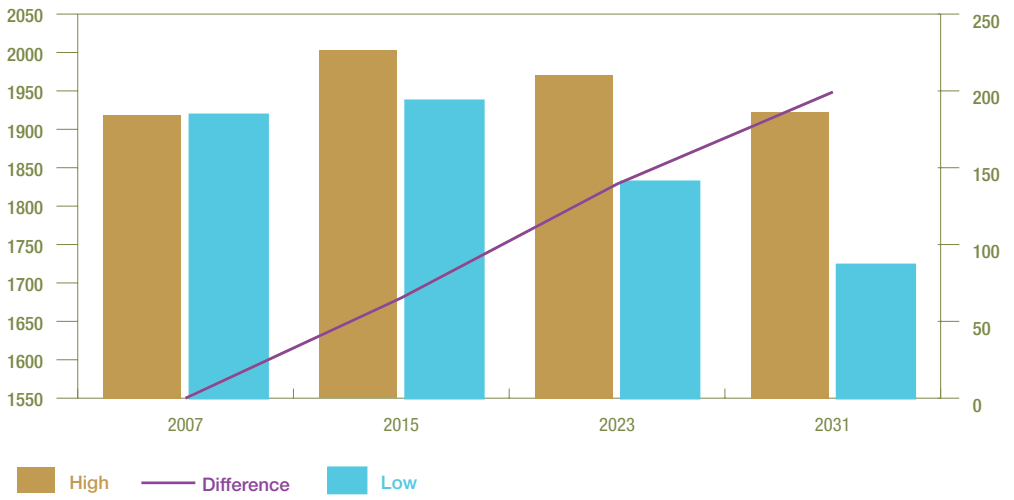
What of the future? In this section we analyse the implications of likely future population trends for the aggregate Irish participation rate. The CSO has produced six different population projections by sex, year and age out to 2031 for Ireland, each of which are based on different assumptions of fertility, mortality and migration (see Appendix for details on assumptions). Here we examine the implications for future participation rates and labour supply of two of these scenarios; a High and Low migration scenario with medium fertility rates.[11]

Figure 2 demonstrated, on a historical basis, the relatively young profile of the Irish demographic structure in a European context. Figure 6 shows the total population levels for the 25 to 54 age group for the High and Low migration scenarios for different years in the forecast horizon. The difference between the two scenarios is also plotted in the Figure and can be read off the axis on the right hand side. The key implication of this graph is that, over time, Ireland's changing demographic structure will result in a fall in potential labour supply i.e. the proportion of the population in the prime working age group, 25 to 54, is expected to decrease . Consequently, changes in population shares are likely to have

[10] Female participation rates for prime-aged women continued to make a positive contribution to the aggregate participation rate in the United States after 1990, but the increases were smaller than in the 1965 to 1990 period, and were in turn offset by declines in the participation rate of young prime-aged men.

[11] Medium fertility in these scenarios implies a constant total fertility rate of 1.85 from 2011 onwards.

Figure 6: Actual Population Levels for 25-44 Age Group (000s)



an important impact on future labour supply developments. Both scenarios involve a fall in the proportion of prime aged individuals in the 15-64 year old population from about 64 percent in 2007 to 61 percent in 2031.

In order to quantify the impact of the projected changes in Ireland's demographic profile on future labour force developments, we assume that individual cohort participation rates remain constant at their 2007 levels. The 2007 participation rates are then combined with the population projections out to 2031 and the aggregate participation rates are calculated. These are displayed in Table 7. The results show that the demographic developments do not have a significant impact on the aggregate 15-64 year old participation rate over the projection horizon. Under the Low Migration scenario, holding cohort participation rates constant at their 2007 levels, the aggregate participation rate for the Irish population would decrease by only 1.5 percentage points over the projection horizon, from a rate of 72.2 percent in 2007 to 70.7 percent in 2031. Similarly with the High Migration scenario, the direction and size of change in the labour force participation rate over the projection horizon is broadly the same.

In broader terms, the implications of the demographic projections in terms of labour supply can be observed from Figure 7.

Table 7: Irish Labour Force Participation Rate Projections under Low and High Population Scenarios (%)

Scenario		2007	2015	2023	2031
Low Migration	Male Participation Rate	81.2	81.6	80.8	80.4
	Female Participation Rate	63.1	62.5	61.3	60.9
	Total Participation Rate	72.2	72.2	71.1	70.7
High Migration	Male Participation Rate	81.2	81.7	80.9	80.5
	Female Participation Rate	63.1	62.6	61.6	61.2
	Total Participation Rate	72.2	72.2	71.4	71.0

Figure 7: Contribution to Labour Force Growth under Low and High Migration Scenarios

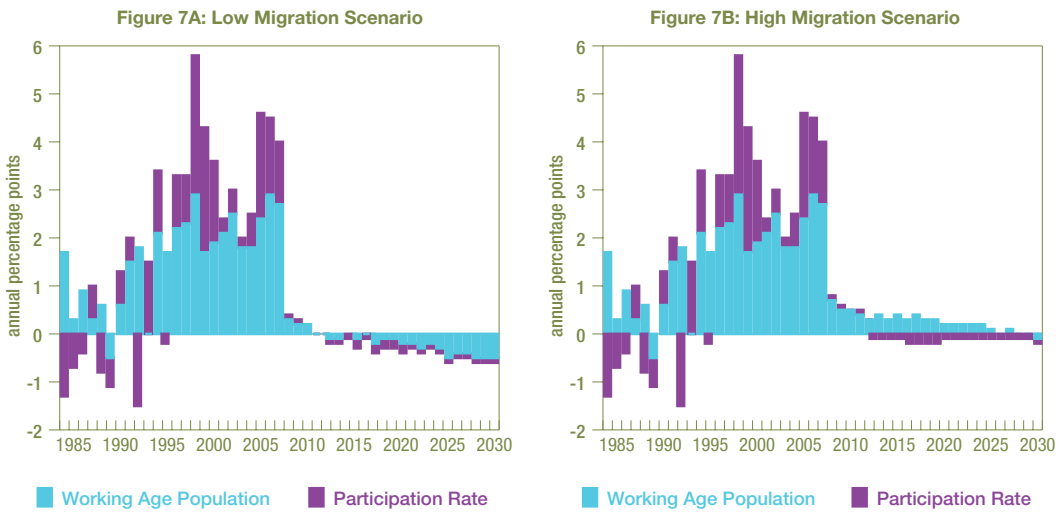


Figure 7 documents annual labour force growth over the projection horizon for the Low and High Migration scenarios, employing the results for the aggregate participation rate presented in Table 7. From the graphs it is clear that total labour supply growth, at 2007 participation rates, would slow to less than 1 percent over the period to 2025 under the High Migration scenario, thereafter becoming negative. On the other hand, under the Low Migration scenario, labour force growth would be negative from 2012 onwards. Following growth in the total labour force of 4.0 percent between 2006 and 2007, under the High Migration scenario, annual labour force growth would slow to 0.3 percent by 2015, 0.1 percent by 2023 and by 2031, annual labour force growth would actually be negative at — 0.2 percent. This would mark the first fall in the total labour force since 1989. The results are even more dramatic under the Low Migration scenario. Annual labour force growth becomes negative in 2012 under this scenario, and remains negative over the projection horizon. In 2015, annual labour force growth would register -0.1 percent; by 2023 the corresponding value would be -0.4 percent and by 2031, the labour force would fall by 0.5 percent on an annual basis.

3.2 Other Scenarios

What about potential changes in the participation rates of the different cohorts? Given recent changes in Irish participation rates, it does seem unlikely that no changes will occur in the cohort participation rates over the projection period. Figure 1 demonstrates that, while Irish participation rates have increased considerably over the past 10 to 15 years, they still remain somewhat below those of Germany, Finland and, particularly, the Netherlands. It is interesting to speculate therefore, as to the implications for the aggregate Irish participation rate and future labour supply of a continuation of this apparent convergence of Irish cohort participation rates to those of the Euro area leaders. For example, what would happen if Irish female participation rates (starting in 2008) converged to those of the 2007 Dutch rates by 2031? In Table 8 we present the results of such a scenario (Scenario 1) highlighting the implications for both the aggregate participation rate and labour supply. The participation rate presented in the table is the rate for the year concerned, whereas the labour force growth figure is the five-year annual average ended in the year concerned.[12]

From the Table, it can be seen that female participation rates rise to 71.6 percent under the High Migration scenario by 2031. Male cohort participation rates, on the other hand, are assumed to remain at their 2007 rates. As a

[12] So the figure for 2016 is the five-year annual average for the period 2012-2016.

Table 8: Simulated Future Irish Participation Rates and Labour Force Growth under Scenario 1 (%)

Scenario		2007	2015	2023	2031
			Participation Rate		
Low Migration	Male	81.2	81.6	80.8	80.4
	Female	63.1	66.1	68.4	71.1
	Total	72.2	73.9	74.7	75.7
High Migration	Male	81.2	81.7	80.9	80.5
	Female	63.1	66.2	68.8	71.6
	Total	72.2	74.0	74.9	76.2
			Labour Force		
Low Migration	Male	3.1	0.0	–0.3	–0.5
	Female	4.2	0.5	0.3	0.0
	Total	3.6	0.2	0.0	–0.3
High Migration	Male	3.1	0.4	0.2	0.0
	Female	4.2	0.9	0.7	0.4
	Total	3.6	0.6	0.4	0.2

result, the aggregate male participation rate falls over the projection horizon, from 81.2 percent in 2007, to 80.5 percent in 2031 — due solely to the demographic changes outlined earlier. The combined effect of changes in male and female participation rates would lead to a rise in the total labour force participation rate from 72.2 percent in 2007 to 76.2 percent in 2031. Despite this increase in the total participation rate, the rate of growth in the labour force is projected to slow under the CSO population projections. In particular, the Table shows that by 2015, labour force growth would slow to less than 1 percent on average — compared with a five-year average annual rate of 3.6 percent growth in 2007. By the end of the projection period, despite the increase in Irish female participation rates to those of the 2007 Dutch rates, the projected demographic changes would mean that the Irish labour force would grow by only 0.2 percent on average.

Table 9: Simulated Future Irish Participation Rates and Labour Force Growth under Scenario 2 (%)

Scenario		2007	2015	2023	2031
			Participation Rate		
Low Migration	Male	na	na	na	na
	Female	na	na	na	na
	Total	72.2	85.7	103.5	127.5
High Migration	Male	na	na	na	na
	Female	na	na	na	0.0
	Total	72.2	83.3	97.5	116.1
			Labour Force		
Low Migration	Male	na	na	na	na
	Female	na	na	na	na
	Total	3.6	2.2	2.2	2.2
High Migration	Male	na	na	na	na
	Female	na	na	na	na
	Total	3.6	2.2	2.2	2.2

As a final exercise, in Table 9, we assess the level that the aggregate participation rate would need to be at in order to sustain the long-term average growth in Ireland's labour supply (Scenario 2).[13] Over the period 1984 to 2007 Irish labour supply of 15-64 year olds grew by an average rate of 2.2 percent per annum. If this level of growth were to be maintained in the future, an ever-increasing participation rate would be required over the projection horizon under both the Low and High Migration scenarios. For example, the aggregate participation rate would need to increase from its current level of 72.2 percent in 2007 to 83.3 percent by 2015, 97.5 percent by 2023 and, by 2031, to a rate of 116 percent under the High Migration scenario! The results are even more dramatic under the Low Migration scenario, with an aggregate participation rate of 127.5 percent required in 2031 to maintain long run growth. Clearly this is unfeasible. This outcome serves to highlight that, given likely population changes, the Irish economy is unlikely to enjoy the same stimulus for growth that the labour market has provided in recent times. This means that increasing attention will need to focus on other means to stimulate labour input, e.g. increasing hours worked, as well as a continuing focus on productivity performance.

4. Conclusions

Increasing participation rates and, hence, improving the supply of labour have been clearly identified as a key component in stimulating economic activity within the Euro area. Improving economic activity and in particular increasing potential output has been a growing concern amongst Euro area policy makers. The relatively stagnant nature of European labour markets over the past 10 to 15 years has received much comment, especially when compared with the more robust performance of the United States — see McQuinn and Whelan (2006) for example. In this paper we have examined the issue of changing European participation rates by focussing on the labour market performance of one of the more dynamic economies within the Euro area — that of Ireland.

One of the contributions of the paper has been to extend the growth accounting exercise in McQuinn and Whelan (2006), which focussed solely on the Euro area aggregate and the United States to all 13 members of the Euro area. This provides a complex picture of the different determinants of growth within the Euro area over the period 1980 — 2006, while focussing on the contribution of different aspects of the labour market.

A substantial component of the recent Irish economic success story has been the dynamic performance of the labour market and, in particular, the increased contribution of female labour supply. At its height in the late 1990s, increases in the aggregate participation rate were adding almost 2 percentage points to annual Irish economic growth. Simulations conducted in this study reveal that this contribution emanated from increases in rates of participation across all the major cohorts of the Irish working population — with particular increases of note in female participation rates. This trend is typical of many countries that have experienced significant increases in participation, most notably the Netherlands.

However, forecast scenarios conducted demonstrate that, in the future, the Irish economy faces quite a challenge in continuing to enjoy significant growth from this aspect of the labour market. Given likely population trends, further increases in the participation rates of different age cohorts are required in order to derive economic growth from labour supply. Also, an inability to achieve such increases may lead to pressures on the public finances, for example in relation to meeting future pension commitments.

Finally, it is noteworthy that, despite the recent increases in Irish participation rates, overall rates are still less than those of some other Euro area countries such as Germany and the Netherlands. Therefore the Irish case would appear to be an example of an economy deriving significant benefit out of a convergence process to best practice within the Euro area.

[13] Due to data limitations, the long term average is taken to be that pertaining over the 1984-2007 period.

References:

Aaronson, S., Fallick, B., Figura, A., Pingle, J. and W. Wascher (2006). The recent decline in the labour force participation rate and its implications for potential labour supply, Brookings Panel on Economic Activity, Vol 2006, No. 1, pp. 69-134.

Alesina, A., Glaeser E. and B. Sacerdote (2005). ''Work and Leisure in the US and Europe? Why So Different?'' NBER Macroeconomics Annual.

Barry, F. (1999). Understanding Ireland's Economic Growth, MacMillan Press.

Barrett, A. Bergin, A. and D. Duffy (2006). ''The Labour Market Characteristics and Labour Market Impacts of Immigrants in Ireland,'' The Economic and Social Review, Vol. 37, pp. 1-26.

Bergin, A. and I. Kearney (2007). ''Human capital accumulation in an open labour market: Ireland in the 1990s,'' Economic Modelling, 24, pp. 839-858.

Blanchard, O. (2004). ''The Economic Future of Europe,'' Journal of Economic Perspectives, 18, Issue 4, 3-26.

EU KLEMS Database, March 2007, Available online at http://www.euklems.net.

Darby, J., Hart, R.A. and M. Vechhi Gordon (1998). ''Labour Force Participation and the Business Cycle: A Comparative Analysis of Europe, Japan and the United States,'' University of Glasgow, Discussion Paper (98) 02.

Dew-Becker, I. and R.J. Gordon (2006). ''The Slowdown in European Productivity Growth: A Tale of Tigers, Tortoises and Textbook Labor Economics,'' working paper, NBER and Northwestern University.

Fahey, T., Fitzgerald, J. and B. Maitre (1998). ''The economic and social implications of demographic change,'' Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXVII, Part V.

Fahey, T., Russell, H. and E. Smyth (2000). ''Gender Equality, Fertility Decline and Labour Market Patterns Among Women in Ireland,'' in Nolan, B., O'Connell, P.J. and Whelan, C.T (eds.) Bust to Boom? The Irish Experience of Growth and Inequality, Dublin: Institute of Public Administration.

Fallick, B., and J. Pingle (2007). A cohort-based model of labor force participation Finance and Economics Discussion Series 2007-09, Federal Reserve Board, Washington, D.C.

Hamilton, R. (2005). Education, demographics and the Irish economic miracle, Central Bank and Financial Services Authority of Ireland Quarterly Bulletin, No. 2, pp. 103-130.

Honohan, P. and B. Walsh (2002). Catching up with the leaders: The Irish hare, Brookings Panel on Economic Activity, Vol 2002, No. 1, pp. 1-57.

Langedijk, S. and W. Roeger (2007). A model-based analysis of country experiences, European Economy Economics Papers Number 274, March 2007.

McGuire, M., O'Donnell, N. and Ryan, M. (2002). Interpolation of quarterly data for ECB/NCB multicountry modelling exercise — Data update to 1999q4, Research Paper, Central Bank and Financial Services Authority of Ireland.

McQuinn, K. and K. Whelan (2006). Prospects for growth in the Euro area, Research Technical Paper 12/RT/06, Central Bank and Financial Services Authority of Ireland.

Musso, A. and T. Westermann (2005). Assessing Potential Output Growth in the Euro area: A Growth Accounting Perspective, ECB Occasional Paper No. 22.

Prescott, Ed (2004). Why do Americans work so much more than Europeans? Federal Reserve Bank of Minneapolis Quarterly Review, Vol. 28, No. 1, pp. 2-13.

Schwerdt, G. and J. Turunen (2006). Growth in Euro area Labour Quality, ECB Working Paper No. 575.

Walsh, B. (1999). ''The persistence of high unemployment,'' in Frank Barry (ed.), Understanding Irish Economic Growth, Macmillan, pp. 193-226.

Walsh, B. (2000). ''Cyclical and structural influences on Irish unemployment,'' Oxford Economic Papers, 52, pp. 119-145.

Walsh, B. (2004). ''The transformation of the Irish labour market: 1980-2003,'' Journal of the Statistical and Social Inquiry Society of Ireland, Vol. XXXIII.

A. Data Appendix

A.1 Growth Accounting Data

All data used in our analysis are annual. GDP and investment data cover the period 1970 to 2006, while the labour data are over the period 1983 to 2007. Data for GDP, real investment, the unemployment rate, employment and population are all taken from NewCronos, which is the principal database of EuroStat, the Statistical Office of the European Communities. For German GDP and investment, data prior to 1990 are backcast with quarterly data kindly provided by DG Economics of the European Central bank (ECB). Investment data for Greece prior to 1989 are taken from the OECD's statistical warehouse. GDP and investment data for Portugal prior to 1988 and for Luxembourg prior to 1985 are also taken from the same source. All data for Ireland prior to 1989 are taken from a macroeconomic model database maintained at the Central Bank and Financial Services Authority of Ireland (CBFSAI).[14]

For Finland, France, Greece, Italy and the Euro area as an aggregate, data on GDP and investment are available from 1970 onwards, for Austria the same data are available from 1976 onwards and for Slovenia, the earliest available data are 1990. For all remaining countries the GDP and investment data are from 1980 to 2006.

[14] See McGuire et al. (2002) for more details on this.

There are no official capital stock data for individual Euro area countries. Following most other studies, we adopt the perpetual inventory method to ''roll out'' the capital stock as per equation (1) in the text. We do this using a depreciation rate of six percent per year. However, the issue of a starting value for the stock still arises. In approximating a starting value, we follow the approach of McQuinn and Whelan (2006) and assume that the capital stock level in the earliest possible year for each country was such that the corresponding capital-output ratio (K/Y) was equal to its steady-state level in that quarter.[15] Our growth accounting calculations were not much affected by the choice of starting value for the capital stock series or the choice of depreciation rates.

The labour data are from Eurostat (described in more detail below), the total population figure is for the age cohort 15 to 64. Participation rates are, accordingly, for this age cohort as well. The data on the average Euro area workweek were constructed from figures taken from the Groningen Growth and Development Centre (GGDC), available online at www.ggdc.net. This annual series was scaled by 1/52 to arrive at the average weekly amount of hours worked in the different countries.

A.2 Labour Data

The historical labour data used in this paper are from the European Community Labour Force Survey (LFS) while the population projections data are from the ''Population and Labour Force Projections 2006-2036'' produced by the Irish Central Statistics Office (CSO). A detailed description of the sampling methodology used in the LFS is available in ''The European Union Labour Force Survey — Methods and Definitions, 2001''[16] while ''EU Labour Force Survey database — User guide'' also provides useful information on LFS variables. The LFS labour data used refer to spring data for each country. The Euro area aggregate refers to the 13 countries that formed the euro area in 2007. Data prior to

[15] See the Appendix of McQuinn and Whelan (2006) for more on this.

[16] http://circa.europa.eu/irc/dsis/employment/info/data/eu-lfs/index.htm

1996 have been obtained on the basis of the growth rate of the largest aggregate available (i.e. 12 countries in 1996, 10 countries before 1996, 8 countries before 1986).

The methodology and assumptions underlying the CSO's population projections are available from the "Population and Labour Force Projections 2006-2036" publication. The CSO population projections used in this paper are based on two scenarios, a Low Migration with medium fertility assumptions scenario and a High Migration with medium fertility assumptions scenario. In these scenarios it is assumed that the total fertility rate will fall to 1.85 by 2011 and remain constant thereafter. On mortality it is assumed that there will be an increase in life expectancy over the projection period — to 86.9 years for females and 82.5 years for males. Net migration under the Low Migration scenario is assumed at 20,000 per annum over the period to 2011, falling to 10,000 per annum in the period 2011 — 2016, falling again to 5,000 per annum over the 2016 to 2036 period. The High Migration scenario assumes that annual net migration would be 30,000 over the period to 2016 followed by a slowing of growth to 20,000 per annum over the period 2016 to 2026 and to 15,000 per annum over the remaining period.