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*Recent Trends in Mortality and Morbidity in Ireland*

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**Wealthier and healthier:**

**The recent decline in Irish mortality rates**

by

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In the first half of this paper I summarise the trend in Irish deaths rates over the period 1973-2006. In the second half I discuss some possible explanations of these trends.

### **The recent decline in Irish mortality rates**

While the long-run trend in Irish death rates has been downwards, since the end of the twentieth century they have been falling more rapidly than in earlier years and than rates in other European countries.<sup>2</sup> Between 1999 and 2005 the Irish age-standardised rate fell by 26 per cent, compared with a fall of only four per cent between 1994 and 1999.<sup>3</sup> Between 1999 and 2004 (still the latest year for which EU-15 data are available) the EU rate fell by nine percent, the Irish by 22 per cent. Figure 1 compares the rates for men and women in Ireland and EU-15 over the period 1994-2004/05. As recently as 1999 the Irish rate exceeded the EU-15 average by 26 per cent (men) and 18 per cent (women). By 2004 the gap had been eliminated for men and considerably reduced for women. In 2005 the Irish male rate fell by a further seven per cent and the female rate by three per cent.

Table 1 shows Irish death rates relative to the EU-15 average in 1994, 1999, and 2004 for four disease groups that accounted for over 70 per cent of all deaths in the 1990s. These are malignant neoplasms (C00-C97)<sup>4</sup>, ischaemic heart diseases (IHD) (I20-I25), cerebrovascular diseases (I60-I69), and diseases of the respiratory system (J00-J99). While there has been no improvement in Ireland's relative position for deaths from malignant neoplasms over the past ten years – the rate for men has been very close to the EU average since the 1990s, but the Irish rate for women has remained some 20 per cent above the EU average - for the other diseases groups there has been a marked improvement. Since 1999 the Irish death rate for diseases of the respiratory system declined by about 12 per cent since 1999 relative to the EU average. For ischaemic heart disease the rate of decline in the differential doubled for men after 1999 and increased slightly for women. In the case of cerebrovascular diseases, the differential with EU-15 widened between 1994 and 1999 for men and women, but fell by 20 per cent for both between 1999 and 2004. The acceleration in the rate of decline of the death rates from IHD, cerebrovascular, and respiratory diseases accounts for most of the catch-up in Irish mortality rates (especially among men) relative to the EU since the turn of the century.<sup>5</sup>

<sup>2</sup> Garrett FitzGerald drew attention to these developments and expressed surprise that they have received scant public attention in the *Irish Times*, 21 October 2006.

<sup>3</sup> These data are available at:

[http://epp.eurostat.ec.europa.eu/portal/page?\\_pageid=1996,45323734&\\_dad=portal&\\_schema=PORTAL&screen=welcomeref&open=/C/C2/C22&language=en&product=Yearlies\\_new\\_population&root=Yearlies\\_new\\_population&scrollto=518](http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/C/C2/C22&language=en&product=Yearlies_new_population&root=Yearlies_new_population&scrollto=518).

<sup>4</sup> WHO international statistical classification codes.

<sup>5</sup> It may seem puzzling that while Ireland's death rates for such major killers as IHD, cancer, and respiratory illnesses are still above the EU average, the overall rate is below it. This is accounted for by our relatively low death rates from cerebrovascular diseases, other diseases (such as diabetes, liver diseases etc) and most external causes such as accidents, homicide, and suicide.

Figures 2 through 8 give a longer-term perspective on Irish death rates over the period 1973-2006 and help identify more clearly structural breaks in trends.<sup>6</sup> All show the natural log of the four-quarter moving average of death rates on the Y-axis, so that changes in slope may be equated with changes in trend.<sup>7</sup>

Figure 2 shows the death rate for the total population from all causes. There are two clear changes of slope – a flattening out over the decade 1988-98 and a nosedive after 1998.<sup>8</sup> Much the same picture emerges from Figure 3, which shows the death rates for three older age groups. The percentage decline over the whole period was greatest among the 55-64 age group (57%), followed by the 65-74 group (51%), and then the 75+ group (37%). In all three age groups, but most strikingly for the 75+ group, the rate of decrease accelerated in the late 1990s. The death rate for the 75+ age group declined by 25% over the eight years 1998-2006, compared with a decline of only 20% over the previous twenty five years.

Figures 4 through 8 look at trends in the principal causes of death. Figure 4 shows that the death rate from respiratory illness fluctuated without a clear trend until the late 1990s and then fell sharply. Figure 5 shows that the rate from IHD fell much more rapidly over the most recent ten years than over the previous quarter of a century, when the rate of decline was not very marked. Figure 6 shows a similar pattern for cerebrovascular diseases, although the break in the 1990s is less pronounced. The behaviour of the cancer death rate has been idiosyncratic (Figure 7). First, the range of variation over time has been narrower than for the other causes of death and secondly, alone of all the major causes of death, this rate increased over the period 1980-94. This rising trend was reversed over the past decade, but even by 2006 the rate was still much as it had been in the early 1970s. Finally, the rate for all other causes declined steadily the 1970s but levelled off during the 1980s only to resume its decline again in the new century (Figure 8).

The generalisation seems warranted that the severe economic set-back of the 1980s was accompanied by a general stagnation in the rate of improvement in mortality rates, whilst the period of exceptional economic growth starting in the mid-1990s was characterised by an equally exceptional rate of improvement in mortality rates.

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<sup>6</sup>The data available on the CSO website at <http://www.cso.ie/px/pxeirestat/database/eirestat/Births%20Deaths%20and%20Marriages/Births%20Deaths%20and%20Marriages.asp>. These numbers are by quarter of registration. The number of deaths occurring in a year typically exceeds the number registered by about one percent, although in 1999 the excess was as high as 2.9 per cent. Changes introduced in 2007 are believed to have affected the quarterly pattern in a manner that is not yet clear – see *Quarterly Report on Vital Statistics First Quarter 2007*. It is not likely that this issue materially affects the main points made in the text, although it could be relevant to the comments on seasonality.

<sup>7</sup>As a more formal exploration of the changing trends in death rates, I examined the stability of regression parameters over time using a rolling regression over successive six-year (24-quarter) windows within the 1973-2006 period. The results from these tests support the interpretations in the text.

<sup>8</sup>These rates are not age-standardised, but the changing age structure of the population cannot account for the break at the turn of the century. The population aged 75 and over increased by 14 per cent between 1999 and 2006, compared with an increase of 13 per cent in the population aged 0-74.

## Modified seasonal pattern

The use of four-quarter moving averages as in Figures 2 through 8 removes the seasonal pattern in the quarterly death rates. But the seasonal pattern is of interest because of the pronounced winter peak in Irish mortality rates. The Irish “excess winter mortality” in the 1990s was estimated at 21 per cent— one of the highest in Europe (Healy, 2003). This seasonality is evident from a graph of the unadjusted quarterly death rate (Figure 9) and is most marked for deaths due to respiratory diseases (total population) and deaths from all causes among the population aged 75 and over (Figures 10 and 11).

While the seasonally uncorrected series shown in Figures 9, 10 and 11 suggest a reduction in the seasonal peak over the year, the data are subject to randomly occurring influences, such as weather patterns and the incidence of ‘flu epidemics. As a more formal test of changes in the pattern of seasonality, regression estimates of the seasonal factors were estimated for two sub-periods, namely 1973-1999 and 2000-2006Q2.<sup>9</sup> The statistical evidence for a significant change in seasonality is quite robust. For deaths from all causes, the estimate of intra-annual peak-to-trough variation in the crude death rate was 27 per cent for the first sub-period but fell to 18 per cent for the second. The biggest decline in seasonality was for deaths from respiratory diseases - from 82 per cent to 58 per cent. For cerebrovascular diseases seasonality fell from 33 to 27 per cent and for IHD from 27 to 23 per cent.

## Regional Convergence

We can say nothing about mortality patterns by socio-economic group from the published data, but the *Annual Reports of Vital Statistics* contain age-standardised death rates (SDR) by county and county borough. These provide a convenient way of looking at regional mortality patterns that may contain some clues about the broader issues of inequalities in health status. The only issue I address here is: Have regional disparities in mortality increased or decreased over the past ten years as the national death rate fell so dramatically?

Two measures of convergence (or divergence) are widely used in the economics literature in the context, for example, of regional income variations. The first looks at the behaviour of a measure of the dispersion of income— such as the standard deviation - across regions over time. If dispersion falls over time,  $\sigma$ -convergence is said to occur. The second asks whether the rate of growth of income has been highest in regions where the initial level of income was lowest. This involves estimating an equation of the form:

$$g = \alpha + \beta \ln Y_t$$

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<sup>9</sup>The log quarterly rates have been converted to their actual annual equivalents. The second sub-period contains only 26 quarters, which is short for estimating seasonal patterns. It should also be borne in mind that the measures of seasonality used here could also be capturing shifts in the discrepancy between quarter of occurrence and registration.

where  $Y_t$  is the initial level of income and  $g$  is the growth rate over a period  $t, t+n$  (calculated as  $(1/n)(\ln Y_{t+n} - \ln Y_t)$ ). If  $\beta < 0$ , initially poorer regions have experienced faster growth and  $\beta$ -convergence is said to occur.<sup>10</sup>

These concepts can be applied to the study of regional variations in death rates over time. When testing for convergence in death rates over short time intervals it is advisable to use three-year averages to avoid the risk that random variations in death rates would introduce a spurious (negative) correlation as rates in areas with abnormally high rates in an initial year revert towards their underlying levels. I therefore compared the rate of decline in regional death rates between the periods 1996-98 and 2002-04.

Between these two periods, the standard deviation of age-standardised mortality rates (SMRs) rose slightly, suggesting some increase in  $\sigma$ -convergence. When the  $\beta$ -convergence equation was fitted, the following result was obtained (Figure 12):

$$g = -0.40 + 0.0045 \ln Y_t \quad R^2 = 0.0$$

(1.1)      (0.3)

where  $g$  is the rate of change between 1996-08 and 2002-04, and  $Y_t$  is the level in 1996-98.

Thus there is no significant evidence of either  $\beta$ -convergence or  $\beta$ -divergence.

Overall, it may be concluded that the regions' mortality gain over the period was not related to their initial level of mortality and regional differentials neither widened nor narrowed significantly.

### Commentary

Accounting for the acceleration of the downward trend in Irish death rates after the mid-1990s is a challenging task. Many of the factors that might be expected to have played a role in improving the community's health have changed gradually over time, and some of them have changed more or less simultaneously, making it hard to disentangle their individual effects. What follows is a tentative first attempt at tackling these issues.

**Healthcare.** Expenditure on public and private health services has been increasing steeply in Ireland. Between 1996 and 2004 real current spending on health care per head of population rose from €1,226 to €2,223.<sup>11</sup> Between 2004 and 2008, current spending by the Department of Health and Children (including the Health Service Executive) will have risen by a further 50 per cent.

While the timing of this increase fits well with the observed reduction mortality, we have to acknowledge that the link between spending on healthcare and health outcomes is far from clear cut. The names of just two recent books - *Does Health*

<sup>10</sup> For a discussion of these concepts see Barro and Sala-i-Martin (1992).

<sup>11</sup> Central Statistics Office, *Measuring Ireland's Progress 2005*, Table 6.1

*Care Save Lives?* and *Why Too Much Medicine is Making Us Sicker and Poorer* – indicates the scepticism that has gained ground.<sup>12</sup>

A systematic approach to attributing population health outcomes to health care has been championed by Ellen Nolte and C. Martin McKee (Nolte and McKee, 2008). They define “amenable mortality” as “deaths from certain causes that should not occur in the presence of timely and effective health care”. In their recent paper they consider as “amenable” conditions such as bacterial infections, treatable cancers, diabetes, cardiovascular and cerebrovascular disease, half of the deaths from IHD, and complications of common surgical procedures.<sup>13</sup> They present SDRs for males and females aged 0-74 for the years 1997-98 and 2002-03 in nineteen advanced countries. Figure 13a shows the results “amenable” causes of death (both sexes combined). In 1997-98 Ireland had the highest rate of the countries in this study, but it recorded the largest proportional fall (23 per cent) over the study period and moved up two places in the rankings, so that by 2002-03 it was ahead of the United States and Portugal and only fractionally behind the United Kingdom and Denmark. Although the study does not give data on increases in expenditure on health care by country, the implication is Ireland’s higher spending was effective in terms of health outcomes. This contrasts with the situation in the United States, where there was little improvement despite a vast increase in expenditure.

According to the Nolte-McKee classification, Irish deaths to males aged under 75 years in 1997-98 were distributed as “amenable” 28%, “non-amenable” or “other” 58%, and 13% the half of IHD deaths not regarded as “amenable”. Thus “non-amenable” or “other” deaths constitute the majority of deaths. It is therefore important to note that, after Greece, Ireland recorded the largest proportional decline (12 per cent) in its “other” death rate over the study period (Figure 13b). As a result of our good showing with regard to both categories of causes of death, Ireland recorded the largest decline in the overall death rate in the under 75 population, with the fall in the “amenable” and “non-amenable” death rates contributed about equally to this outcome.<sup>14</sup>

Thus, while the Nolte-McKee approach seems to show that increased spending on health care made a significant contribution to Ireland’s recently improved health status, but it also suggests that about half of the reduction has been due to other factors.

**Changing lifestyles.** The health of the community should be benefiting from several recent lifestyle trends. Particularly relevant to declining death rates from circulatory and respiratory illnesses is the long-run decline in tobacco consumption and the rising proportion of non-smokers. By 2006 24.5 per cent of the population reported themselves as smokers compared with 33 per cent in 1998.<sup>15</sup> (Any population effects of the 2006 ban on smoking in the work place would not show in our data, although positive effects have been found among bar staff, Goodman *et al* 2007.) There also appears to be increased awareness of the need for healthier diets and more active lifestyles in Ireland today. But these changes have been occurring gradually and it is

<sup>12</sup> See Nolte and McKee, 2004 and Brownlee, 2007.

<sup>13</sup> This is a summary – the reader is referred to the original article for details.

<sup>14</sup> It is likely that Ireland’s relative position continued to improve after 2003.

<sup>15</sup> Office of Tobacco Control: [http://www.otc.ie/research\\_reports.asp#cigarette](http://www.otc.ie/research_reports.asp#cigarette).

difficult to believe that the sharp breaks in death rates documented above should be attributed to them. And of course there have been countervailing, negative trends such as increased alcohol consumption and rising levels of obesity.

**Environmental factors.** The importance of the reduced winter peak in mortality from respiratory and circulatory diseases points to a possible role for improvements in the Irish environment in the fall in mortality rates. And indeed it is possible to point to several possible contributory factors under this heading.

- *Improvements in urban air quality.* Smoke control legislation was introduced in the Greater Dublin area in 1990, in Cork in 1995, and had been extended to most other urban areas by 2003. Leaded petrol was phased out in 2000. All major population centres have enjoyed a progressive improvement in overall air quality since the early 1990s (O'Leary, 2006). One study credited the introduction of the coal ban in Dublin with a decline of 5.7 per cent in non-trauma deaths, and 15.5 per cent in deaths from respiratory diseases, in the city over the period 1984-1996 (Clancy *et al.*, 2002), but from Figure 4 it is evident that the national death rate from respiratory diseases fluctuated erratically between the early 1980s and the late 1990s, and only in the new century did a clear and sustained decline become apparent. If the main benefits of cleaner air legislation had been reaped by the mid-1990s, we are left with a puzzle regarding the reasons for the sustained fall in the death rate after 2000.
- *Improvements in housing standards.* Few countries can match Ireland's recent rate of housing stock renewal. The 2006 Census of Population revealed 17 per cent of private households were living in dwelling units built within the previous five years and 28 per cent in units built within the previous ten years. The proportion of households with central heating rose from 44 per cent in 1991 to 84 per cent in 2002 and 88 per cent in 2006.<sup>16</sup> Better heating has been shown to improve self-reported health and reduce the incidence of respiratory illnesses in New Zealand, where winter climatic conditions are similar to those in Ireland (Howden-Chapman *et al.*, 2007). But, once again, the impact of these improvements on the public's health is likely to be too gradual to account for the sharp fall in death rates at the start of the new century.
- *Milder winters.* To the extent that climate change is occurring in Ireland, it might include a trend towards milder winters, but hardly abruptly enough to account for the sudden kink in the death rate at the turn of the century. Nonetheless, I experimented with temperature data for Dublin and Shannon Airports to see whether they would better account for the seasonal pattern of mortality from respiratory and circulatory diseases than standard seasonal dummies in a regression that also included a trend variable.<sup>17</sup> This approach offered no support for the belief that milder

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<sup>16</sup>Central Statistics Office, 2007, Table 38c. The earlier figure for central heating was supplied by John FitzGerald.

<sup>17</sup>Using monthly data for the period 1958-2007 I found no upward trend in the *average minimum temperature* for the months of December, January, February, and March. What this says about global

winters are a reason behind the change in seasonal mortality patterns. Moreover, the fact that the death rates in the Republic of Ireland suddenly caught up with those in Northern Ireland – where similar climatic conditions obtain – argues against the role of milder winters.

**Cyclical economic factors.** Increased prosperity lies behind higher spending on medical care, improved housing and, arguably, improved environmental conditions. But while richer countries generally enjoy increased longevity, the link between income and health status is not close. Moreover, while over the long-run there is a positive association between prosperity and health status, it has been claimed that over the medium term mortality and morbidity tend to vary procyclically, increasing in good times and falling in bad times. This pattern has been attributed to a decline in smoking and excess weight and reduced working hours during recessions (Ruhm, 2005). It is difficult to see any evidence of these negative effects of the business cycle in the Irish mortality data. On the other hand, it is plausible to conjecture that the dramatic fall in the unemployment rate – from 16 per cent in 1993 to four per cent by 2001 – and the reduction in the incidence of poverty – the proportion of the population living below 60 per cent of mean income and experiencing basic deprivation fell from 15 per cent in 1994 to six per cent in 2000 – had a beneficial effect on the population's health status.

## Conclusion

This paper presents an overview of recent trends in Irish mortality rates. The most striking feature is the rapid convergence of the Irish age-standardised rate on the EU-15 average after 1999. Structural breaks in the trend are evident in the crude death rate and even more markedly in the death rate among those aged 75 and over and for deaths from respiratory and cerebrovascular illnesses and IHD. A significant part of the decline in these death rates reflects reduced seasonality and an especially steep fall in deaths in the winter months.

It is reasonable to speculate that many factors contributed to the kink in the death rates after the mid-1990s. Plausible explanatory factors include increased spending on health care, increased efficiency of this expenditure, improved environmental conditions (especially reduced air pollution and better housing conditions), and the dramatic reduction in the incidence of unemployment and poverty among the population. Given the coincidence of the timing of the improvement of many of these factors in Ireland towards the end of the 1990s they could well account for the dramatic improvement in mortality that was recorded but nonetheless the suddenness of this improvement remains somewhat of a puzzle and a phenomenon that merits much further research.

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warming in Ireland is beyond the scope of this paper! Ideally data on "degree days" would be used to measure the incidence of severe weather, but this is not readily available for Ireland.

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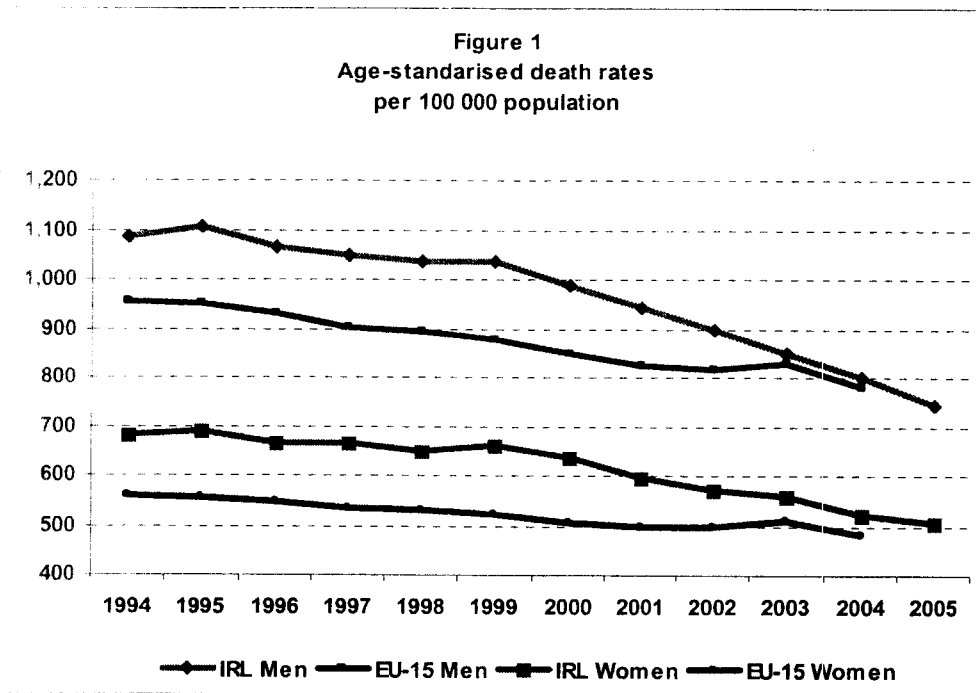
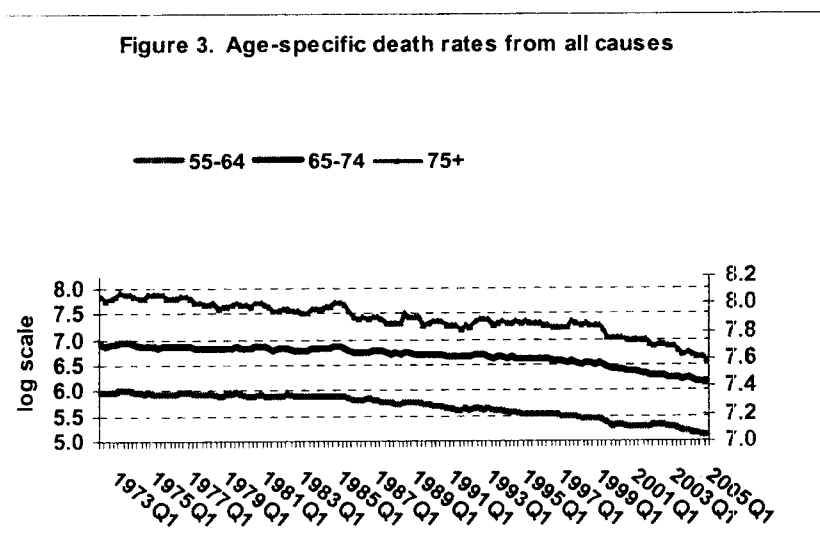
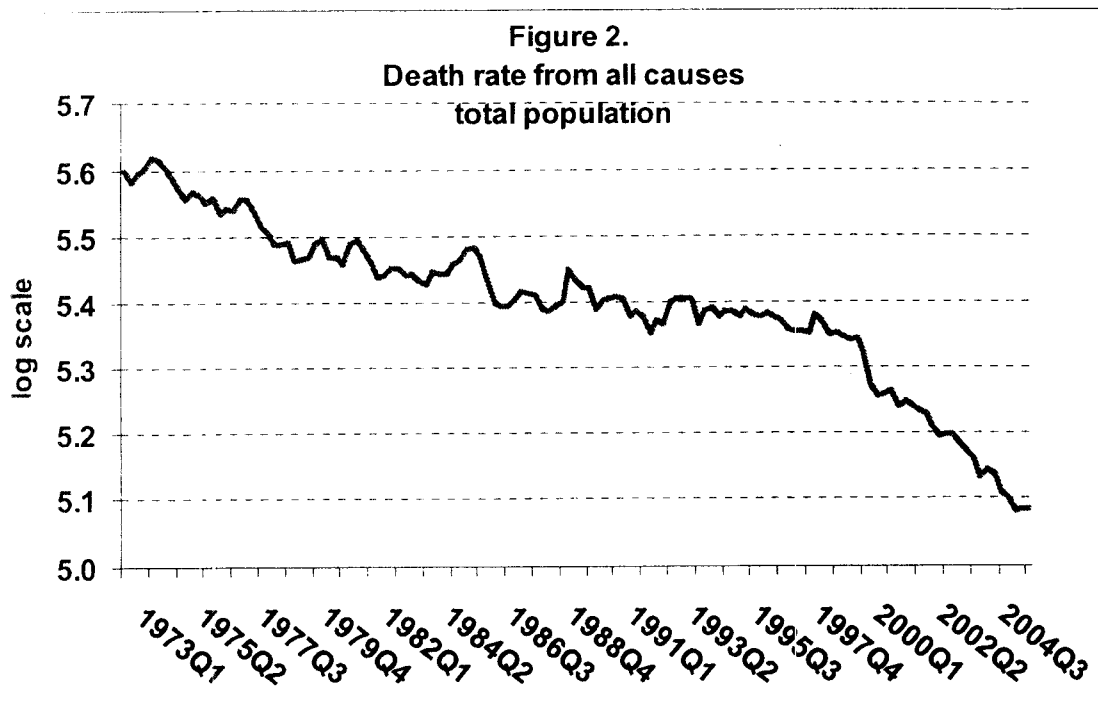
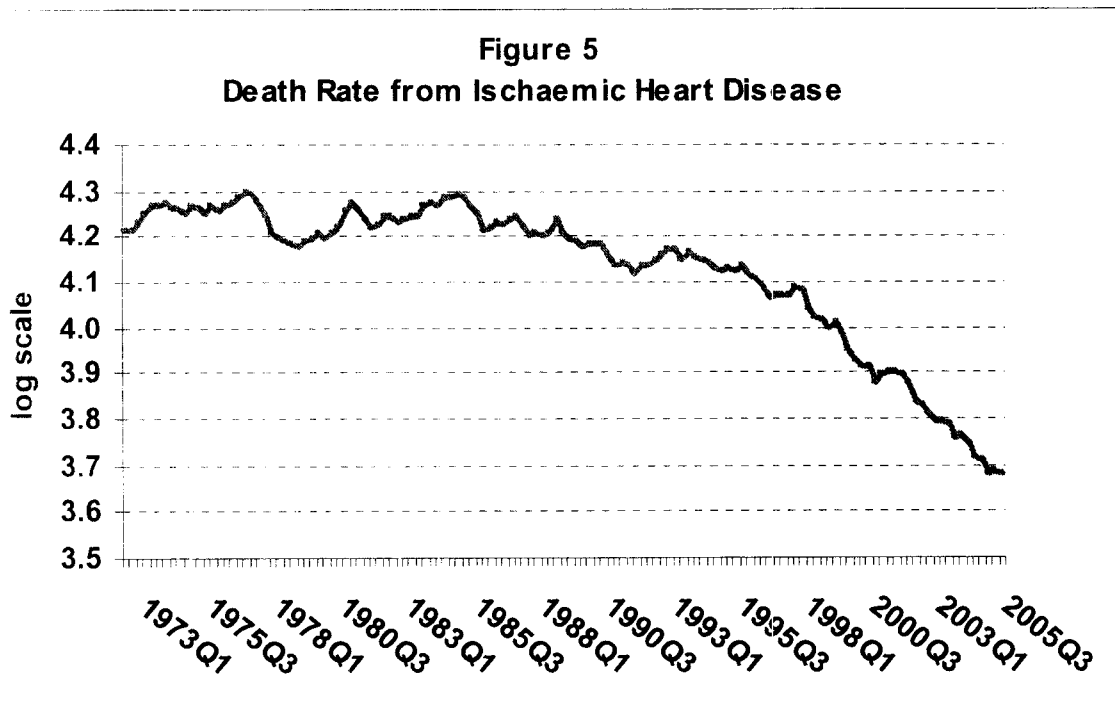
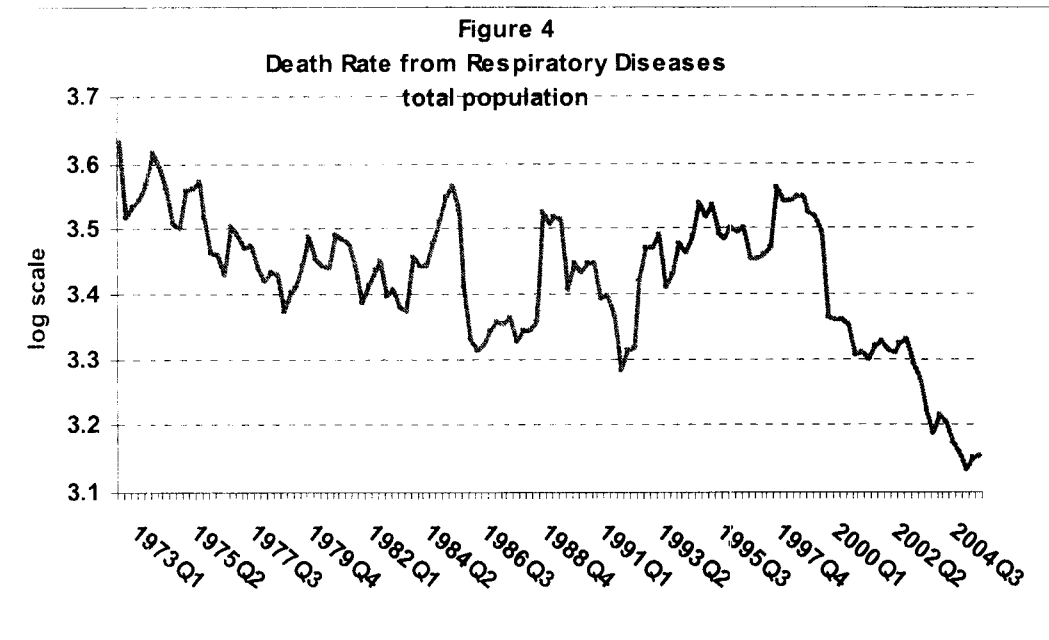


Table 1

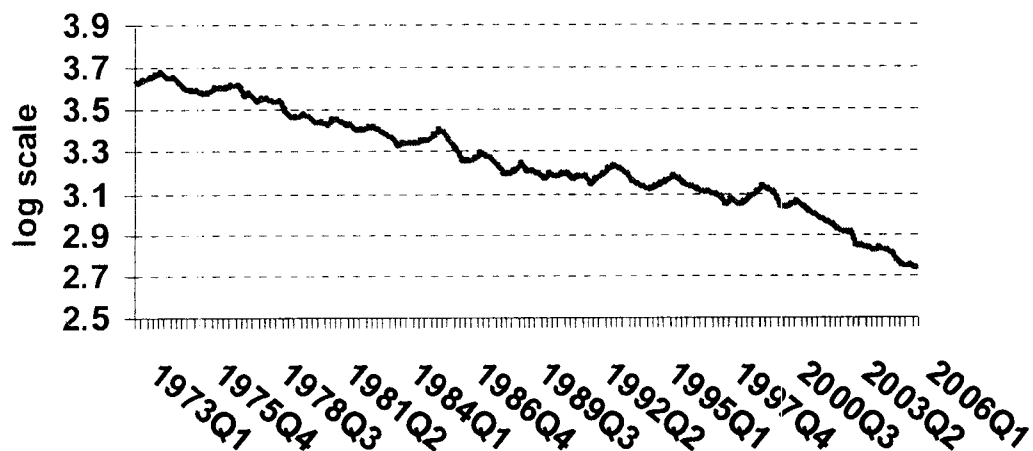
**Irish mortality relative to EU-15 average:  
Age standardised deaths rates by cause of death,  
Ireland as percentage of EU-15 average**

	1994	1999	2004
	<b>Malignant neoplasms (C00-C97)</b>		
Men	98.1	100.2	99.2
Women	123.2	122.2	119.2
	<b>Diseases of the respiratory system (J00-J99)</b>		
Men	187.2	188.1	165.4
Women	235.7	244.2	213.6
	<b>Ischaemic heart diseases (I20-I25)</b>		
Men	180.5	169.3	144.4
Women	187.7	165.8	143.0
	<b>Cerebrovascular diseases (I60-I69)</b>		
Men	92.7	99.0	79.6
Women	106.3	111.7	90.0





**Figure 6**  
**Death Rate from Cerebrovascular Diseases**



**Figure 7**  
**Death Rate from All Malignant Neoplasms**

