Regional inequalities in mortality

Raymond Illsley, Julian Le Grand

Abstract

Study objective—To examine the hypothesis of sustained and persistent inequalities in health between British regions and to ask how far they are a consequence of using standardised mortality ratios as the tool of measurement.

Design, setting and participants—Data are regional, age specific death rates at seven points in time from 1931 to 1987-89 for the British regions, reconstructed to make them comparable with the 1981 regional definitions. Log variance is used to measure inequality; regional rankings are also used.

Measurements and main results—There has been a substantial convergence in age specific death rates between regions in younger but not in older age groups. In younger age groups the historic north/south gradient has disappeared; it persists in older groups.

Conclusions—Use of standardised mortality ratios obscures differences in the convergence rates of age specific death rates between regions. Simple conclusions about the persistence of a north/south divide are not justified. Different processes of change seem to be at work in different age groups.

J Epidemiol Community Health 1993; 47: 444-449

The existence of inter-regional variations in death rates has been well documented for more than a century in reports of the Registrars General of England and Wales and of Scotland. They have been analysed by a succession of investigators interested in the impact of social conditions and health service interventions on mortality and, by inference, on health itself.¹⁻⁷ All these studies have shown a geographical gradient in mortality with death rates low in the southern areas of Britain and increasing from the south through the midlands to their highest levels in the north of England and Scotland. It was accepted that the north/south tendency reflected geographical patterns in standards of living and the physical environment rather than any simple climatic or other physical/geographical dimension.

The latest and most comprehensive analysis comes from the Office of Population Censuses and Surveys.⁸ Analysis of regional standardised mortality ratios calculated from the 1979-83 decennial data has confirmed the continuation of the familiar regional gradient in mortality from high in the North and West to low in the South and East for both males and females. For both men and women regional standardised mortality rates showed almost identical rates of fall between

1959 and 1983 with few and minor cross-overs between regions. Analysis by cause of death since 1920 showed, with few exceptions, "the same broad geographical pattern". In 1987 Gordon and Sutherland⁹ reported the disappearance of north/south differentials in post-neonatal mortality. Botting and Macfarlane,⁹ however, as part of the OPCS review,⁸ showed a continuation of the "clear geographic gradient in neonatal mortality rates" and noted that health districts with exceptionally high infant mortality rates tended to have above average proportions of mothers born in the New Commonwealth and Pakistan.

Almost all discussion of changing regional rates and inequalities, including the authoritative OPCS report, has been based on infant mortality, or standardised mortality rates, or both. This latter device is useful in facilitating the summary of much data in a single figure and in eliminating one biological factor, age, in order that a socio-economic pattern can be more sharply revealed. However, it has two great disadvantages. Firstly, if it uses the 15-64 years age range, as did the Black report,³ it ignores the great majority of deaths.¹⁰ Secondly, even if it takes the whole age range, as the OPCS study did, the conflation of the mortality experience of different age groups into one number means that it is no longer possible to study differences between age groups. Since deaths at different ages have different causes, the aggregation of the experience of separate age groups into a single figure means that the influence of different causes at different ages will be merged and their particular impact obscured. Opposing trends in different phases of the age cycle may cancel each other out. The use of standardised mortality rates in a long time series may be particularly misleading, for identical standardised mortality rates at two time points may result from quite different patterns and causes of death.

Methods

This paper examines the hypothesis that substantial convergence of mortality between regions has occurred in some age ranges and that this has been obscured by the use of standardised mortality rates. Instead of standardised mortality rates we have used 10 year, age specific death rates. We compare seven points in time from 1931 to 1987-89. Three years were used at the latest point because by then the number of deaths in a single year had become small in the youngest age groups. Data were drawn from the annual reports of the Registrars General and of the OPCS. Regional analysis has been based on the boundaries used in the official 1981 vital statistics. The data

School of Social
Studies, University of
Bath
R Illsley
Kings Fund Institute,
14 Palace Court,
London W2 4HT
J Le Grand

Correspondence to:
Professor J Le Grand

Accepted for publication
June 1993

for previous years have been reconstructed to make them comparable with the 1981 regional definitions.¹¹ In tables and diagrams the regions are listed in order of their ranking on infant mortality in 1931.

Three measures of inequality were calculated, the log variance, the Gini coefficient, and the absolute mean difference. Since they all showed very similar results we have used only one in this paper, namely log variance—that is variance in the logarithms of regional death rates. This measure has the property of scale independence¹⁰ and is therefore appropriate for measuring relative changes. Age specific death rates for each region, on a log scale, are used to examine the detailed changes underlying movements in log variance. Regions are also ranked according to their death rates to identify changes in the relative position of regions.

Results

INTER-REGIONAL INEQUALITY IN AGE SPECIFIC DEATH RATES

Inter-regional variance in the log of each age specific death rate for each 10 year period since 1931 is given in table I. The results, summarised diagrammatically in figures 1 and 2, show that except for a few rises in 1941, inequality fell sharply between 1931 and 1951 for both males and females, in infants, and in age groups 1–4, 5–14, and 15–24. It continued to fall until 1971 and remained at low levels to the end of the period. Through a time of falling death rates those regions with highest initial rates fell most sharply. Indeed, as will be seen later, the north/midlands/south ranking of the regions also changed so that the very small amounts of residual variance did not automatically signify the classic “health divide”.

Again, except for the wartime years, inter-regional inequality for young men between 25 and 44 years fell across the period to its lowest level in 1987–89. Variance for women was relatively very low, even in 1931. The amount of reduction across the period was correspondingly small.

The picture is very different for older men. Variance fell very slightly until 1961–71. Thereafter it increased and, at least in the two age groups 55–64 and 65–74, was rising quite sharply between 1981 and 1987–89. Again variance for women was small throughout the period but it was beginning to rise in the last two decades.

Table I Inequality in regional age specific death rates in Great Britain: log variance

Age (y)		1931	1941	1951	1961	1971	1981	1987–89
<1	M	0.0437	0.0508	0.0323	0.0189	0.0080	0.0078	0.0085
	F	0.0496	0.0525	0.0256	0.0143	0.0110	0.0124	0.0076
1–4	M	0.1294	0.0578	0.0108	0.0109	0.0096	0.0183	0.0122
	F	0.1346	0.0574	0.0213	0.0213	0.0243	0.0171	0.0185
5–14	M	0.0480	0.0368	0.0070	0.0096	0.0031	0.0054	0.0072
	F	0.0403	0.0489	0.0242	0.0143	0.0050	0.0038	0.0290
15–24	M	0.0259	0.0773	0.0092	0.0141	0.0048	0.0066	0.0051
	F	0.0389	0.0653	0.0431	0.0030	0.0152	0.0092	0.0039
25–34	M	0.0274	0.0588	0.0275	0.0176	0.0122	0.0130	0.0127
	F	0.0252	0.0412	0.0371	0.0170	0.0066	0.0126	0.0116
35–44	M	0.0256	0.0363	0.0251	0.0274	0.0194	0.0257	0.0132
	F	0.0229	0.0259	0.0149	0.0149	0.0127	0.0133	0.0049
45–54	M	0.0224	0.0302	0.0214	0.0181	0.0194	0.0233	0.0210
	F	0.0213	0.0186	0.0089	0.0090	0.0112	0.0178	0.0148
55–64	M	0.0145	0.0219	0.0142	0.0142	0.0141	0.0164	0.0203
	F	0.0208	0.0177	0.0125	0.0143	0.0115	0.0198	0.0235
65–74	M	0.0181	0.0236	0.0078	0.0122	0.0078	0.0089	0.0126
	F	0.0243	0.0273	0.0142	0.0140	0.0073	0.0109	0.0147
75+	M	0.0094	0.0085	0.0043	0.0044	0.0020	0.0026	0.0024
	F	0.0122	0.0080	0.0070	0.0076	0.0012	0.0011	0.0020

We therefore need to identify sets of causes consistent with a falling variance in younger adults, very low variance and changed rankings in childhood and adolescence, and wide or increasing variance in late middle age and early old age.

TIMING AND SCALE OF INTER-REGIONAL VARIATION

Trends in age specific death rates for selected regions are given in figure 3. For brevity and diagrammatic clarity we have restricted this illustration to selected age groups, to males (for whom variance has been greater), and to the extreme regions (Scotland and the north of England compared with the south-east and south-west) and one midlands region. Where females or other age groups or regions show contrary findings, we note them in the text.

AGES 1–14 YEARS

Infant mortality fell very sharply over this period, particularly in the early years, and this fall was paralleled by increasing equality. By 1987–89 there was no longer any consistent difference between the death rates of the extreme regions—sometimes those in the north had the lowest rate. This applied to both sexes. Equally dramatic falls and similar convergence took place in the 1–4 and 5–14 years age groups. Rates for both sexes showed almost identical patterns, although female rates were consistently and substantially lower. One important exception begins to appear in the 5–14 years male group, namely the tendency for Scotland to have slightly higher rates than the remaining regions. The divergence is accentuated with age.

Death rates fell so much over the 1931–89 period, that by the 1980s they were so low that both rates and regional rankings were subject to marked annual variations—hence our decision to base final outcomes on three years of data rather than on a single year. The situation is illustrated in table II which ranks regions according to their annual death rates. Regions are listed in the order of their 1931 infant mortality rate, the north of England having the highest rate (10th rank) and the south west the lowest (first rank). The 1931 gradient was maintained unchanged across the earlier part of the period. By 1971 some shifts in ranking were beginning to appear. Further shifts occurred between 1971 and 1987–89. The last column of table II gives regional rankings for 1987–89, obtained by taking an average rank across the three childhood age groups. East Anglia and the south west consistently show the lowest rates followed by the south east and Wales, the latter having risen from a lower than average position. Then come Scotland and the north, previously at the bottom of the rankings. The east midlands, previously in third position has dropped to seventh and the bottom three places are occupied by Yorkshire and Humberside, the west midlands, and north west England.

One hypothesis consistent with these changes is that they may partly reflect the high death rates at these ages of immigrant and ethnic minority populations. Each of these four lowest ranking regions contain a sizeable immigrant population¹² and we note that death rates at these ages are relatively high in cities and areas of high

settlement.¹³ There are comparatively few immigrants or ethnic minorities in the regions which have improved their rankings (Scotland, the north, and Wales) or have maintained their already high position (East Anglia and the south west). The impact of this factor would be obscured in the south east where immigrants are numerous but nevertheless a small proportion of the total population. If this hypothesis proves to be correct, it would mean that the previous geographical inequality based on differences in regional living standards has disappeared and been replaced by ethnic inequality, again based on differences in living standards or possibly on less effective use of health services.

AGES 15–44 YEARS

Throughout the whole period regional inequality measured by log variance (table I and fig 1) and by age specific rates (fig 3) fell continuously in young adults (15–44 years). As in childhood years the

classic geographical divide virtually disappeared (except for Scotland) in the 15–24 years group, and was much weakened in the 25–34 and the 35–44 years groups.

AGES 45 YEARS AND OVER

At ages 45–64 falls in death rates were less pronounced, and after gradual convergence up to 1961, variance began to increase for both men and women. This was partly due to the exceptionally slow decline in Scottish deaths for both men and women. These findings would be at least consistent with the possibility that earlier poverty driven causes lost some of their force and were replaced by other causal factors. A further possible explanation, that of an age lag, is discussed below.

Discussion

Most of the scientific debate about long term trends in inequality in health has been based on comparison over time of the death rates of occupational classes. Class rates of infant mortality have shown a gradual tendency to converge, but marked differences persist. Adult rates have widened substantially since 1931, and particularly since 1961. The latter changes have been interpreted as reflections of increasing socioeconomic inequality.^{3 5 14 15} We have questioned this interpretation on the grounds that occupational classes have themselves changed greatly in their size, composition, and meaning. Being themselves unstable, they are not suitable for use as measuring rods of other phenomena, results being influenced or even caused by the very instrument by which they are measured.^{10 16 17} It was partly for this reason that we turned to the study of regional differences as indicators of the presence of socioeconomic influences, their nature, and their growth or decline.

The use of standardised mortality rates for regional comparisons suggested that no narrowing of regional differentials had occurred. The concept of the “health divide” came to include the “north/south divide” alongside the “class gap” as evidence of persisting or increasing inequality in health. The present analysis, in which standardised mortality rates have been replaced by age specific death rates, shows that such a simple conclusion is unjustified. Quite different processes of change have been at work in different age groups.

CHILDREN AND YOUNG ADULTS

The narrowing or disappearance of regional differentials in these age groups does not mean that disparities in regional wealth, income, or unemployment etc have disappeared. Direct indicators of these phenomena confirm their existence and that of the general north south gradient.¹⁸ Recent annual unemployment rates, for example, with minor exceptions, show the same ranking as infant mortality in 1931.¹⁹ Therefore the initial assumption underlying regional comparisons is no longer valid at these ages: known differences in wealth and poverty are no longer reflected in death rates. This does not mean that regional variations in health or disease no longer exist—although it is interesting to note recent findings which suggest

Figure 1 Inter-regional log variance in men—1931 to 1987–89

that socioeconomic variations in health have narrowed in adolescence.²⁰⁻²² It does mean that whatever regional variations do exist in health and disease do not result in variations in death in these age ranges. This might mean that medical technology makes death from socially related disease avoidable at these ages and that health services deliver technology equally effectively across the regions. It could also mean that general levels of prosperity and living standards, experienced across all regions, are so high that resistance to disease and its consequences is equally strong—or that the social and economic conditions which are most likely to lead to death no longer apply.

This is a new situation. If we still wish to monitor the relationship between socioeconomic experience and health and its differential distribution across regions, we shall need a more sensitive but equally objective measure of health at these ages. For infants and children this is quite possible: possible measures include birth weight,

height, and weight at specific ages, dental health, eyesight and hearing, and other measures based on examination. Many of these measurements either are or could be easily made as part of routine assessments.

The changed regional rankings and the possibility of an emerging ethnic divide point to the need for closer monitoring of ethnic minority groups and research into their living standards and their use of and by the health services.

ADULTS AGED 45 YEARS AND OVER

For adults aged 45–64 years inter-regional variation in death rates still conforms to the historic north/south gradient. The meaning of this persistence is less clear than the meaning of its disappearance at younger ages. It could be that the high death rates of Scotland and northern England still reflect their continuing relative poverty; that while their death rates have gone down in parallel with the midlands and south they have not, unlike in the younger age group, passed the threshold at which poverty no longer results in death. If, for example, as suggested by Barker,²³ the class and regional patterns of death from ischaemic heart disease in late middle age reflect the distribution of deprivation in utero and the first year of life, regional convergence can occur only when cohorts born in the less deprived wartime and postwar years begin to reach middle age. There are, however, strong arguments against this “lag” hypothesis.

Inspection of the changes of log variance (table I) shows no sign of cohort effects. The major consistent changes affect almost all age groups at the same historical point. Variance increased sharply for all adults between 1931 and 1941. It fell, also sharply, for all age groups between 1941 and 1951. It rose slightly for all age groups except infants between 1971 and 1981. Changes of this kind suggest immediate responses to contemporary influences rather than cohort mediated effects. The big fall in deaths occurred almost simultaneously in all age groups rather than through the gradual “feeding in” of new low risk cohorts.²⁴

To clarify the reasons for the persistence of regional inequality at these ages when it had almost disappeared at earlier ages requires an analysis of changes in age specific death rates for each major cause of death. These data have been collected and are being analysed.²⁵ In the meantime, the most likely explanation is that the persistent divide at late middle age reflects complex movements in the pattern of causes. The post war fall in deaths from the classical poverty disease reduced one source of regional variation at these ages, as it had also done at younger ages. New sources of variation came in the “lifestyle” diseases, particularly ischaemic heart disease and lung cancer, which in both absolute and relative terms increasingly dominated male deaths in late middle age. They do not result, as did the earlier diseases they replaced, from deprivation, but from the excess consumption of harmful substances. As consumption of cigarettes fell and dietary habits responded to knowledge and to changes in availability, the fall in related deaths occurred earlier and faster in the south than in the north thus reinforcing existing inequality.

Figure 2 Inter-regional log variance in women—1931 to 1987-89

Figure 3 Selected age specific death rates in men—1931 to 1987-89

The effect of inequality of changing behaviour and related deaths can also be seen at the inter-country level in Europe.^{26 27} Deaths from ischaemic heart disease and lung cancer have until recently been lowest in poorer countries such as Greece and Spain and high in the richer countries of northern Europe. Behavioural responses to knowledge leading to lower death rates in northern Europe now coincide with higher death rates in Mediterranean countries as they adopt lifestyles that are being rejected in the north. This tends to increase inter-country inequality in Europe.

This explanation receives some tangential support from two features of the data presented above. Firstly, the increase in inter-regional variation at these ages was most noticeable in men, who have particularly high death rates from ischaemic heart disease and lung cancer compared with women. Variations in wealth or poverty on the other hand might be expected to

affect both men and women and produce comparable disparities in death rates. Deaths resulting from health related behaviour, however, could well produce male/female differences in regional inequality because of women's lower exposures.

Secondly, in these age groups, but not in others, there is a slight tendency for inter-regional variation to decline and then rise again. This could indicate an initial reduction due to the decrease in poverty related disease, succeeded by an increase due to rising behaviourally related disease.

Finally, it should be noted that our main objective in this paper has been to determine how far regional death rates have converged, to establish the present state of regional inequality and to examine the current policy implications of persisting inequality. We have not therefore dealt in any detail with the changes occurring before and around the Second World War. It should be noted, however, that it was in those years that the greatest shifts in inequality occurred.

Table II Regional ranking of youngest age groups 1931 to 1987-89

Region	<1 y			1-4 y			5-14 y			<1-14 y	
	1931	1971	1987-89	1931	1971	1987-89	1931	1971	1987-89	1931	1987-89
North	10	7	6	10	3	4	10	3	5	5	5
Scotland	9	10	5	8	9	3	6	10	9	6	6
North west	8	9	7	9	10	10	6	6	10	10	10
Wales	7	5	2	6	6	6	5	8	2	3	3
West midlands	6	4	10	7	2	9	6	2	6	9	9
Yorks/Humberside	5	8	9	5	4	8	9	4	6	8	8
East Anglia	4	1	1	3	1	2	4	5	2	1	1
East midlands	3	6	8	4	8	7	2	7	6	7	7
South east	2	2	4	2	5	4	3	1	2	3	3
South west	1	3	3	1	7	1	1	9	1	1	1

Conclusion

The regional divide in mortality (north/midlands/south) has not, as frequently claimed, remained unchanged over time. The apparent persistence of differences results from the method of measurement (age standardised mortality ratios). These measures deliberately eliminate age as a factor in change and thus obscure the fact that, at earlier periods, standardised mortality rates included heavy death rates across all ages, whereas today they overwhelmingly reflect death at middle to late ages. The narrowing of the differential in infancy, childhood, adolescence, and early adult life is thus hidden from view.

Increasing equality in death at young ages does not necessarily mean increasing equality in health. It is at least arguable that unequal health is only prevented from becoming unequal death by medical intervention. On the other hand no evidence exists that inequality in health has increased. Such a conclusion could only be reached through the analysis of a long times series of valid health indicators and no such series exists.

Increasing or persisting inequalities in death at ages 45–64 years do not necessarily mean increasing inequality in deprivation. Experience in the USA²⁸ and in Europe^{26 27 29} suggest that, particularly with behaviourally induced diseases and their related deaths, shifts have occurred which, at least temporarily, increase differentials as populations respond at varying rates to stimuli and pressures. Our data are compatible with the interpretation that, as affluence increases, populations may adopt consumption behaviour or lifestyles hostile to health, and that, as knowledge of causes becomes available the quickest responses come from the most informed and well-to-do socioeconomic groups, regions and countries, and from those best placed to change behaviour.

The issue is important for its policy implications. Death rates have fallen throughout the post war years, particularly those associated with poverty, malnutrition, housing standards and poor hygiene. They have also fallen at those vulnerable young ages where poverty conditions have previously had their maximum impact. The only pieces of evidence which could be used to claim increasing inequality in health are the widening or persisting gaps produced by occupational class analysis. If such evidence were to be accepted, it would mean that the NHS, the provisions of the welfare state, the existence of full employment throughout the 1950s and 60s, and the general rise in the standard of living have only served to increase inequality in health.

Our contrary interpretation of the class and regional analyses and the positive findings presented above showing the massive convergence of rates at young ages point in a different direction. They suggest that past NHS and welfare measures should be continued and strengthened because of their demonstrated effectiveness. They also direct attention towards more urgent problems and policies—those related to the bulk of premature

death in the middle/late years where past policies have not had a comparable success. They suggest closer monitoring of the health of immigrant and ethnic minority populations. Equally, they emphasise the need for sound data which would permit the long term monitoring of health rather than death.

The research reported in this paper was supported by the ESRC under grant no X206322001. We are greatly in debt to Christine Mullins for her invaluable research assistance. Denise Marchent and Nicky Tynan helped at key points.

- 1 Titmuss R. *Poverty and population*. London: Macmillan, 1938.
- 2 Morris J. Heady J. Social and biological factors in infant mortality. *Lancet* 1955; i: 343–49.
- 3 Department of Health and Social Security. *Inequalities in health: report of a research working group*. London: DHSS, 1980.
- 4 Shaper AG. Geographic variations in cardiovascular mortality in Great Britain. *Br Med Bull* 1984; 40: 366–73.
- 5 Whitehead M. *The health divide: inequalities in health in the 1980s*. London: Health Education Council, 1987.
- 6 Gordon R, Sutherland R. Equality in death: disappearance of differences in post-neonatal mortality between northern and southern regions in England and Wales. *BMJ* 1987; 295: 528–9.
- 7 Townsend P, Phillimore P, Beattie A. *Health and deprivation*. London: Croom Helm, 1988.
- 8 Britton M, ed. *Mortality and geography*. London: HMSO, 1990; 48–56.
- 9 Botting B, Macfarlane AJ. Geographic variation in infant mortality in relation to birthweight. In: Britton M, ed. *Mortality and geography*. London: HMSO, 1990.
- 10 Illsley R, Le Grand J. The measurement of inequality in health. In: Williams A, ed. *Economics and health*. London: Macmillan, 1987.
- 11 Illsley R, Le Grand J, Mullins C. *Regional inequalities in health*. Welfare State Programme Discussion Paper no 57. London: London School of Economics: STICERD, 1990.
- 12 Haskey J. The ethnic minority populations resident in private households—estimates by county and metropolitan districts of England and Wales. *Population Trends* 1991; 63: 23–35.
- 13 Office of Population Censuses and Surveys. *Mortality statistics: area 1987, 1988, 1989*. London: HMSO, 1989, 1990, 1991.
- 14 Smith GD, Bartley M, Blane D. The Black report on socioeconomic inequalities in health 10 years on. *BMJ* 1990; 301: 373–7.
- 15 Delamothe T. Social inequalities in health. *BMJ* 1991; 303: 1046–50.
- 16 Illsley R. Occupational class, selection and the production of inequalities in health. *Quarterly Journal of Social Affairs* 1986; 2: 151–65.
- 17 Illsley R, Baker D. Contextual variations in the meaning of health inequality. *Soc Sci Med* 1991; 32: 359–65.
- 18 Lee CH. *The British economy since 1700*. Cambridge: Cambridge University Press, 1986.
- 19 Office of Population Censuses and Surveys. *Regional trends 1990*. London: HMSO, 1991.
- 20 West P. Inequalities? Social class differentials in health in British youth. *Soc Sci Med* 1988; 27: 291–6.
- 21 Glendinning A, Love JG, Hendry LB, Shucksmith J. Adolescence and health inequalities: extensions to Macintyre and West. *Soc Sci Med* 1992; 35: 679–87.
- 22 Rahkonen O, Lahelma E. Gender, social class and illness among young people. *Soc Sci Med* 1992; 34: 649–56.
- 23 Barker DJP, Osmond C. Infant mortality, childhood nutrition and ischaemic heart disease in England and Wales. *Lancet* 1986; i: 1077–81.
- 24 Baker D, Illsley R, Vagero D. To-day or in the past?: the origins of ischaemic heart disease. Accepted by *J Public Health Med* 1993 (in press).
- 25 Baker D, Illsley R. Trends in inequalities in health in Europe. *Int J Health Sciences* 1990; 1: 89–106.
- 26 Wnuk-Lipinski E, Illsley R. Non-market economies in health: international comparative analysis. *Soc Sci Med* 1990; 31: 879–89.
- 27 Illsley R. Equity, health and policy. In: Vagero D, Illsley R, eds. *Inequality, health and policy in east and west Europe*. *Int J Health Sciences* 1992; 3/4: 117–26.
- 28 Wing S, Casper M, Davis W, et al. Trends in the geographical inequality of cardiovascular disease mortality in the United States 1962–1982. *Soc Sci Med* 1990; 30: 261–6.
- 29 Valkonen T, Martelin T, Rimpela A, Notkola V, Savola S. *Socio-economic mortality differences in Finland*. Helsinki: Central Statistical Office of Finland, 1993.