Working Paper

Disability and Mortality Among Middle-Aged Males in Counties of Finland in 1975-1988

Marie Reijo

WP-92-37
May 1992

IIASA

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ABOUT THE AUTHOR

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ABSTRACT

This study compares trends and differentials in disability retirement among counties of Finland using mortality as an approximation of morbidity. The ratio of disability to mortality (the age-standardized prevalence of disability pensions for males aged 35-64 divided by the age-standardized mortality for males aged 45-74), for selected causes and for Ischemic Heart Disease (IHD) in particular, was examined for eleven counties over the period 1975-1988. Multivariate regression analysis was used to assess the effect of selected socio-economic factors on the variation across counties in the disability/mortality ratio for IHD.

The association between disability and mortality from IHD was high in all counties but the ratios for northern and central counties were higher than others, in particular those for the southern counties. However, the distinctiveness of this grouping disappeared toward the end of the period, primarily due to a decline in disability in three of the four northern and central counties. Over the entire period, differences in industrial composition of the work force and unemployment account for much of the geographic variation in the IHD disability/mortality index. Higher proportions of the work force in the agriculture sector and higher levels of unemployment were associated with greater IHD disability relative to mortality. On the other hand, higher proportions of the labor force in industry were associated with lower IHD disability/mortality indices.

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DISABILITY AND MORTALITY AMONG MIDDLE-AGED MALES IN COUNTIES OF FINLAND IN 1975-1988

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1. BACKGROUND OF THE STUDY

Although male life expectancy in Finland has been increasing steadily since 1975, over much of the period 1975-88 expectation of economically active life has paradoxically decreased. Both the rapid aging of labor force and a decrease in the proportion of persons who remain economically active after age 50 are social and economical problems in Finland. One reason for the latter is the growth in the number of people obtaining work disability pensions before age 65, the legal age of old retirement.

How much disability is due to worsening health and how much results from other factors such as changes over time in the generosity of disability benefits? This question has generated much discussion and some research (e.g. Crimmins et al. 1989), but analysts have not agreed in their conclusions about changes in health status over time. Some studies have reported that health has been deteriorating (e.g. Crimmins 1987), while others have concluded that there is no evidence of increased morbidity in older working age groups (Manton 1982; Poterba and Summers 1987). Crimmins and colleagues (1989) listed several reasons for the inconsistent findings in previous studies such as differences in constructing measures, the effect of age distribution within broad age groups, and lack of comparability between surveys conducted at different points in time. In addition, changing rates of disability and changing rates of mortality generally have not been linked to the analysis of morbidity trends, because easily comparable measures of change in mortality and morbidity have not been available in studies that have concentrated on morbidity.

Disability represents an incompatible relationship between environmental demands and the psychobiological ability of individuals. Disease, damage or defect are the causes of disturbances or impairment at organ level, the consequence of which is disability. Disability can be as much social as medical in origin. Medical morbidity reflects the physical health state of a person (WHO 1981), while social morbidity depends upon which system of the individual is affected. Specifically, whether or not medical morbidity results in handicap or work disability depends on the occupation of the individual affected (WHO 1981). It follows that diseases of the same medical meaning may cause different handicaps depending upon the tasks and conditions in which the individual works. So it is possible that handicaps, and thus the number of disabled persons, can vary when

occupational structure and work change, even if the incidence rates of specific diseases remain unchanged (see more about Finnish pension systems in Appendix 1).

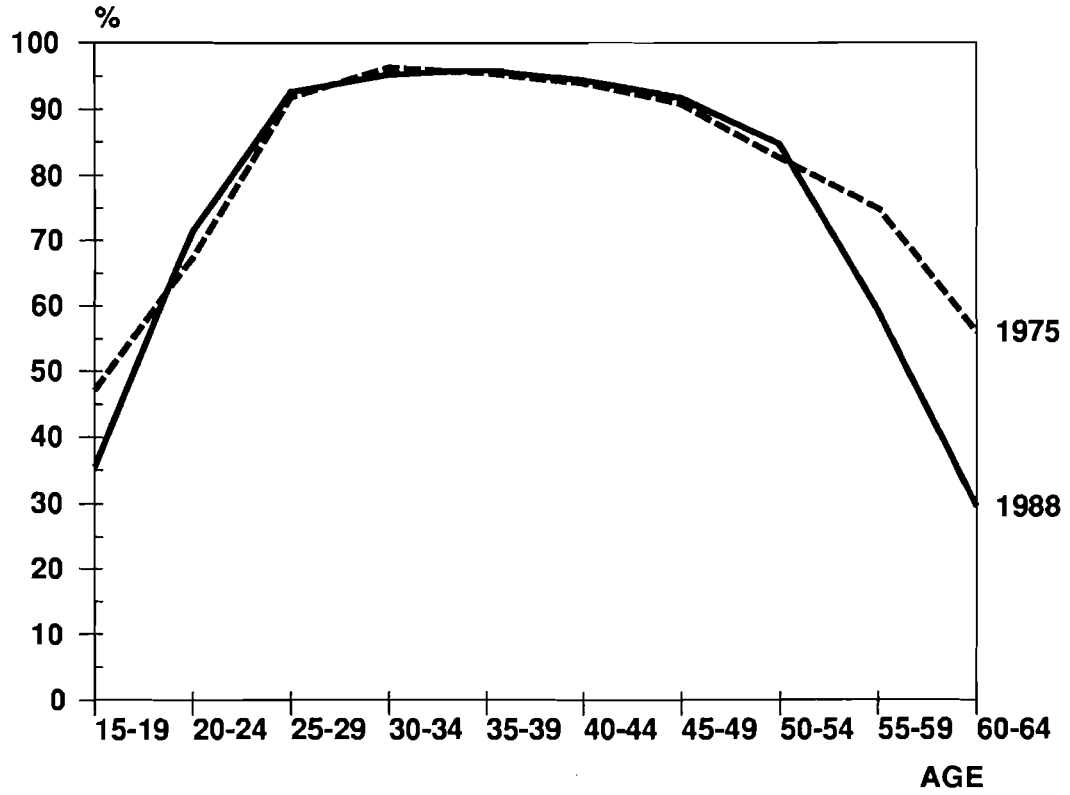

Figure 1. Labor force participation rates by age in 1975 and 1988. Source: Central Statistical Office of Finland 1990.

It is reasonable therefore, to identify two groups of causes that can influence work disability and its variation in different subcategories of population: 1) objective or true differences in biological morbidity and 2) economical, juridical and other social factors that cause work disability, provided that the level of biological morbidity is the same in different population groups.

One possible way to assess regional differences in the level of medical (biological) morbidity in the population and its effect on disability is to use mortality statistics by cause of death as morbidity approximations. The most important considerations in constructing health status indicators at the regional level are the completeness of coverage and comparability. Mortality statistics cover the entire population, and the quality of the statistics, including the determination of the cause of death, is high. More sensitive and informative measures are needed when studying morbidity which unlikely will lead to death, and when mortality is low. (e.g. Graham 1979).

Comparing mortality rates with work disability rates from specific diseases like cardiovascular diseases (one of the three main causes of disability in Finland) may reveal whether disability indicates medical or social morbidity, and whether the prevalence of

disability can be regarded as a single, one-dimensional phenomenon, that can be measured in an objective way in different regions. If the association between disability and mortality is high across regions and time, and if the ratio between disability and mortality does not vary over regions and time, then the level of work disability would be an accurate reflection of the level of medical morbidity. Conversely, lack of associations between cause specific disability and mortality rates, and variation in the disability/mortality ratio would lead to the conclusion that the prevalence of work disability is an indicator of social morbidity.

According to earlier studies (e.g. Valkonen 1984), there is a strong positive association between disability and mortality, but there has been marked variation in the ratio of disability to mortality (disability/mortality ratio) across the different regions in Finland.

This regional variation in the disability/mortality ratio from all causes leads to the supposition that the level of disability is affected not only by differences in the level of medical morbidity, but differences in social and economic factors as well. Change related to economic development (for example, technological innovations) has altered occupational structure and created the need for a more highly educated and recently trained labor force. Early retirement programs or lenient approval policies with respect to disability pension applications have possibly been used as a means to reduce the costs of an older labor force and/or to free younger people during periods of unemployment and inflation.

2. OBJECTIVES OF THE STUDY

The basic purpose of this study is to examine the relationship between disability and mortality rates in the middle-aged male population within counties (administrative districts) of Finland during the period 1975-1988. The descriptive analysis includes disease groups that are important as causes of both disability and mortality, cardiovascular diseases--ischemic heart disease (IHD), cerebrovascular disease, and other cardiovascular diseases--and neoplasms (see Appendix 2). The effects of socio-economic factors on regional variation in the level of disability from ischemic heart disease are then estimated, standardizing for mortality, which is used as an approximation of biological morbidity.

The model relating socio-economic factors to variation in the prevalence of disability was developed in several stages. First, specific hypotheses about the relationship between selected relevant factors and the disability/mortality ratio were specified. These hypotheses were then combined in a single logically integrated equation, i.e. the derived operational model, that should ideally provide empirical testing of the specified hypotheses using the technique of multiple regression. Relevant variables have been included in the final form of the equation, if they were statistically significant over counties and time periods. Finally, the best explanatory equation (combinations of variables) was estimated for different time periods.

3. DATA AND METHODOLOGY

The study examines disability and mortality in the male population of working-age (age 35-74) in 11 counties of Finland, using annual mortality and disability data for the period 1975-1988 by ten-year age groups for selected causes. The county of Ahvenanmaa (Åland) was excluded from the analysis because of its small population. In addition, three-year moving averages were used in the final analysis to minimize random variation of disability and mortality rates. The mortality data were obtained from official statistics. Disability data consisted of men with ordinary disability pensions; unpublished data was obtained directly from the Social Insurance Institution. Selected socio-economic indicators for each county--industrial structure, occupational status structure, unemployment rates and net migration--were obtained from official statistics, either annually or for selected years.

Descriptive findings are presented in this study in terms of age-standardized mortality rates, age-standardized disability rates, their ratios and indices of level relative to that of the country as a whole. Disability is measured by prevalence rates, which are usually more appropriate morbidity measures of chronic conditions that last for longer periods than incidence rates, which are not influenced by the duration of disease. In any case, it would not be more reasonable to use disability incidence rates, since about 300 continuous days of illness (national sickness allowance) are required for an individual to become eligible for a work disability pension. Moreover, regional differences in disability incidences and prevalences have been similar. The incidences and prevalences of early retirement have been much lower in southwestern Finland than in other regions of the country (compare, for example, Heliövaara et al. 1986; Statistical Yearbook of the Social Insurance Institution 1989).

Annual mortality and disability rates according to provinces were age-standardized by the direct method. The following formula was used to calculate the age-standardized mortality rate (m^t):

$$m^t = \frac{\sum m_x^t \; {}^N\bar{p}_x^s}{\bar{p}^s}$$

where m_x^t = *mortality rate in age x in year t*

$^N\bar{p}_x^s$ = *mean population in age x in standard population*

$\bar{p}^s$ = *mean population of standard population*

Annual mortality ratios for each county were calculated:

$$mr^t(A) = \frac{m^t(A)}{m^t(W)}$$

where $m^t(A)$ = *age-standardized mortality rate for county A*
$m^t(W)$ = *age-standardized mortality rate for the whole country (W)*

Age-standardized disability prevalence rates and ratios were calculated similarly. Based on these formulas, an annual disability/mortality index (i^t) for each county was calculated as follows:

for county A:

$$i^t(A) = \frac{dr^t(A)}{mr^t(A)}$$

These indices reflect the disability/mortality level of each county relative to that for the entire Finnish male population in each year.

The total Finnish population aged 40-69 in 1975 (Table 1) was used as the standard. Because disability frequently precedes mortality by a number of years, and because mortality is quite uncommon among men aged 35-44, mortality rates for ages 45-74 were applied to the standard population, while the disability rates applied to the same standard population were for men aged 35-64.

Table 1. The population of Finland by ten-year age groups in 1975.

Age	Number	Relative (in %)
40-49	563,760	.3774
50-59	494,574	.3311
60-69	435,434	.2915
Total	1,493,768	1.0000

More detailed analysis of regional variation in the ratio of disability to mortality was performed using statistical techniques of correlation analysis and multiple linear regression and covariance analysis. Least-squares regression models assessing the effects of socio-economic factors on the disability/mortality index were estimated both in linear and logarithmic forms. For specific time periods, the most parsimonious model was selected through the technique of backward elimination, in which successively the least important variable was dropped from the model.

The importance of each successive model compared with a fuller model (importances of independent variables) was assessed by examining the change in the variance. The models were compared by calculating the F-statistics defined as

$$F = \frac{\textit{change in deviance/change in df}}{\textit{residual variance from the larger model}}$$

If the excluded variable has no effect on the relative level of disability, differences in the variances of the fuller and restricted models are entirely due to chance. This null hypothesis is rejected at the 0.05 probability level. In addition, significance of parameters of each explanator was examined by using t-tests for regression coefficients (0.05 level of probability). All models were estimated using the GLIM statistical package (Aitkin et al. 1989; Payne 1986).

4. RESULTS

4.1. Mortality and disability trends in Finland in 1975-88

Trends for the country as a whole

Finland has been a country with exceptionally high disability and mortality rates, especially from cardiovascular diseases in the working age population, compared with--for example--other Scandinavian countries.

Figure 2a shows the trends in age-standardized disability from all causes for Finnish males aged 35-64, and age-standardized all-cause mortality for Finnish males aged 45-74. Figures 2b and 2c show age-standardized trends in the rates of disability and mortality from cardiovascular diseases, neoplasms, diseases other than cardiovascular diseases and neoplasms, and accidents. During the period 1975 through 1988, work disability from all causes was highest in 1977. Disability prevalence declined steadily between 1975 and 1985, then began to increase rather sharply. The increase in disability after 1985 was due to a rise in disability from diseases other than cardiovascular disease and neoplasms--primarily mental disorders and diseases of the musculoskeletal system and connective tissue (Statistical Yearbook of the Social Insurance Institution 1989). Mortality from all causes declined from 1976 to 1988, with the single exception of 1985; in the broad cause groups considered here, only accident mortality shows a slight increasing trend, after the mid-1980s.

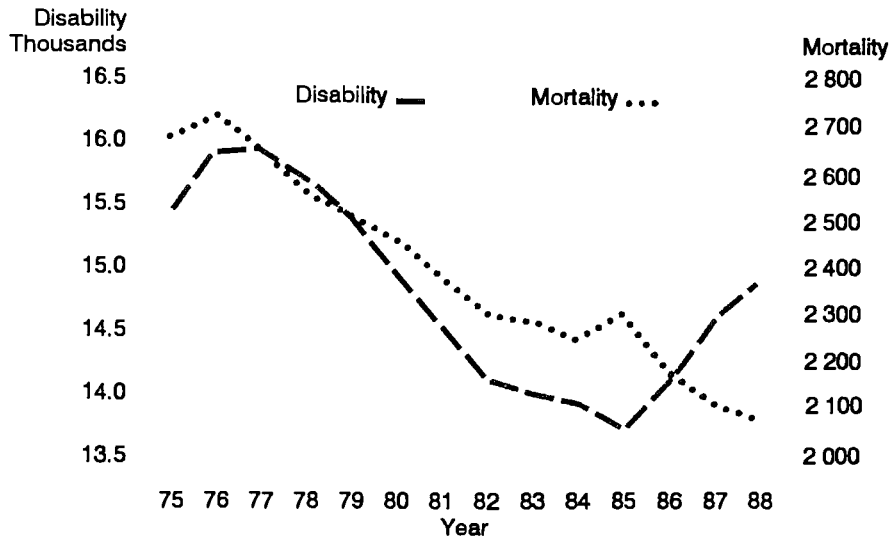

Figure 2a. Age-standardized disability (ages 35-64) and mortality (ages 45-74) rates (per 100,000) from all causes in Finland in 1975-1988, males.

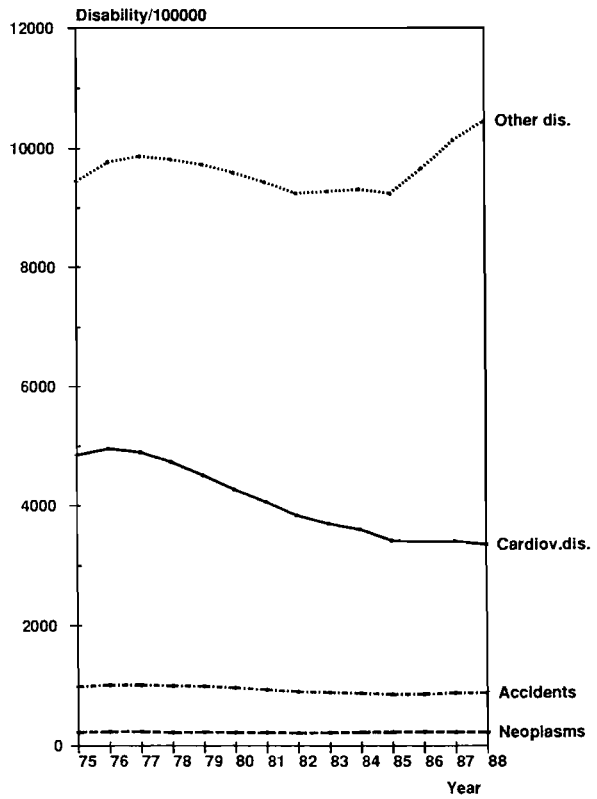

Figure 2b. Age-standardized disability rates (per 100,000) from selected causes in Finland in 1975-1988, males aged 35-64.

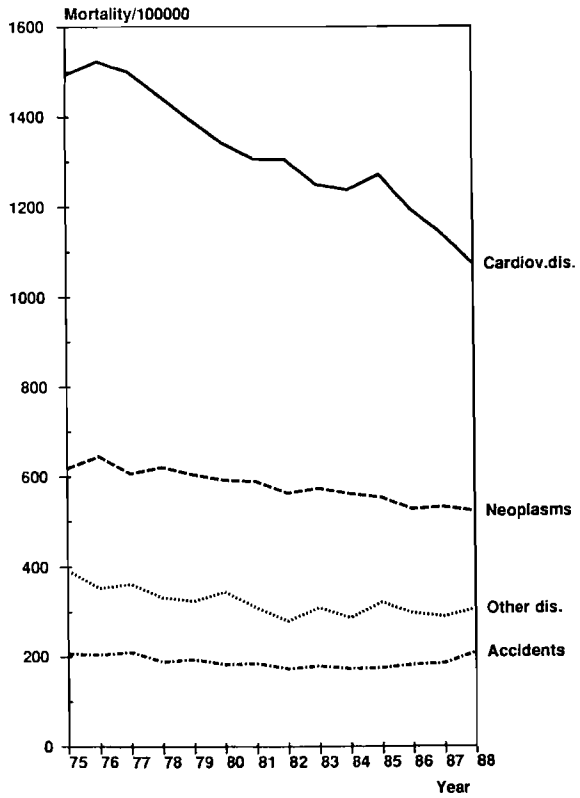

Figure 2c. Age-standardized mortality rates (per 100,000) from selected causes in Finland in 1975-1988, males aged 45-74.

Regional variation in disability and mortality

Over this same period of time, labor force participation rates and the prevalence of work disability pensions have varied markedly in different regions in Finland. Regional differences in work disability and mortality were analyzed using administrative areas (counties) in Finland. A map of Finnish counties with their names and numbers used in this report is presented in Figure 3.

The percentage of working age people receiving disability pensions has been highest in the eastern and northern parts of Finland and lowest in the southern and western parts. Differences in mortality between the northeast and southwest have been similar, due almost entirely to differences in mortality from cardiovascular diseases, particularly ischemic heart diseases. The largest differences between the southwest and northeast in the prevalence of work disability were also for disability due to ischemic heart diseases (see Appendix 3 and Heliövaara et al. 1986; Pyörälä and Valkonen 1981; Takala 1984), and variation in disability from this cause exceeds variation in mortality (see Figures 4a and b, and standard deviations in Appendix 4).

Regional variation in the prevalence of disability due to ischemic heart disease narrowed over the time period under consideration; in counties with a high prevalence of IHD disability, disability has decreased more rapidly than in counties with a low disability

prevalence. Oulu is an exception among counties with a high IHD disability prevalence in that its level of disability relative to the country as a whole increased after 1983.

On the other hand, the amount of regional variation in mortality from ischemic heart disease, as measured by the standard deviations of county-specific prevalence rates, has remained relatively stable for the entire period. Fluctuations in the rates in counties where IHD mortality was high produced variation in the ordering of these counties over the period, but the relative differences have not been large. The exception is North-Karelia where, after 1980, mortality from ischemic heart diseases was extremely high compared to the national average.

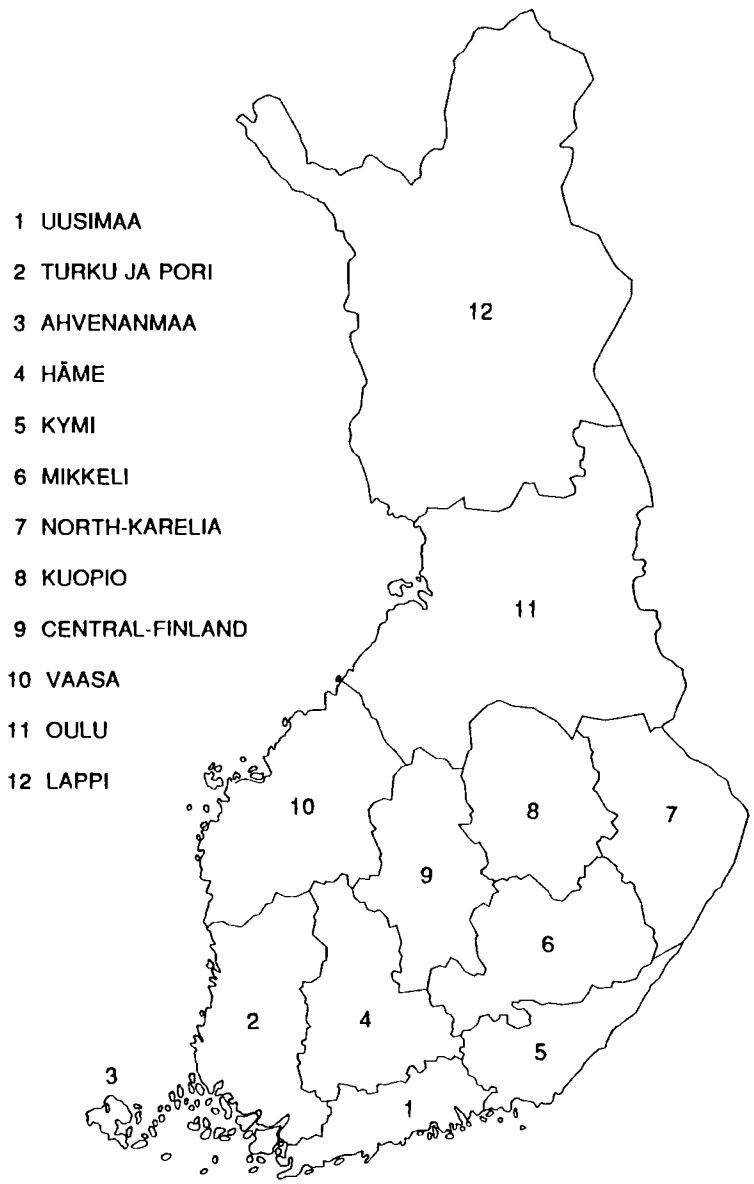

Figure 3. Counties of Finland.

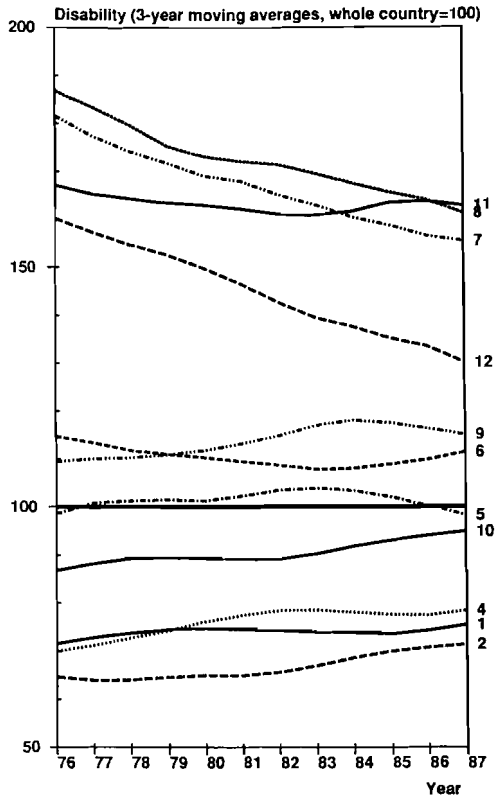

Figure 4a. Age standardized disability indices (three-year moving averages) from ischemic heart diseases among males aged 35-64 in counties of Finland in 1976-87 (whole country = 100).

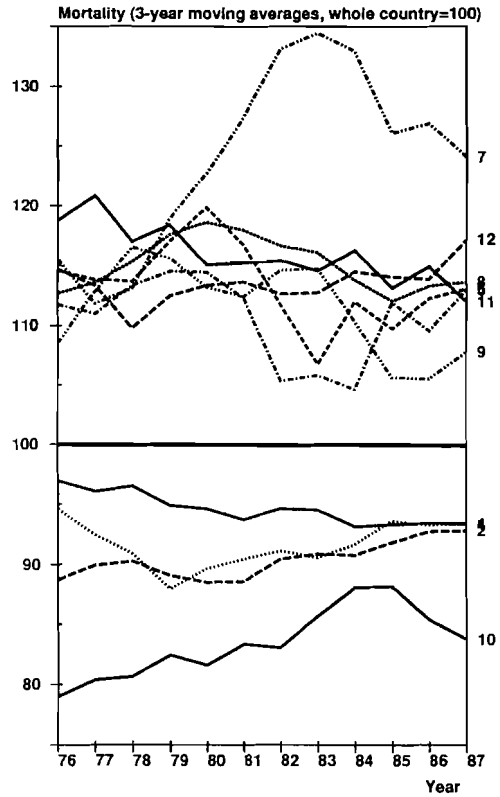

Figure 4b. Age-standardized mortality indices (three-year moving averages) among males aged 45-74 from ischemic heart diseases in counties of Finland in 1976-87 (whole country = 100).

Association between disability and mortality at the county level

For the country as whole, the correlation coefficients between annual disability and mortality rates during the years 1975 through 1988 were strongly positive (+.90 or over) in all subcategories of cardiovascular diseases. In general, the trend in both disability and mortality from cardiovascular disease has been downward from the beginning of the period, as shown in Figures 2b and 2c. Correlation coefficients were generally weak for neoplasms, diseases other than cardiovascular diseases and neoplasms, as well as for accidents.

The focus of this study was restricted to disability and mortality from causes that are most likely to lead to death, cardiovascular diseases and neoplasms. The stability of the yearly correlation coefficients between county-level disability and mortality rates indicated that regional differences in mortality and disability from all causes remained much the same over the period 1975-1988. There was a clear association between work disability and mortality for cardiovascular diseases, particularly for ischemic heart diseases. The association between disability and mortality was weak for cerebrovascular diseases and almost nonexistent for neoplasms and cardiovascular diseases other than ischemic heart diseases and cerebrovascular diseases (Table 2). Mortality from neoplasms was much higher than disability due to this cause group, and whereas mortality from neoplasms declined throughout the period, disability remained quite stable.

Table 2. Correlation coefficients between disability (ages 35-64) and mortality (ages 45-74) from selected causes in 1975-88, males.

Year	All causes	Cardiov. diseases	IHD	Cerebrov. diseases	Other card. diseases	Neoplasms
75	.77	.76	.76	.59	.15	.13
76	.80	.81	.78	.47	-.08	.15
77	.80	.73	.69	.53	.13	.81
78	.80	.77	.74	.52	.13	-.17
79	.64	.56	.67	.44	-.51	.55
80	.82	.75	.82	.46	-.16	.46
81	.77	.75	.80	.53	.28	.36
82	.78	.73	.83	.20	-.05	.07
83	.78	.82	.85	.08	.55	-.11
84	.73	.74	.85	.21	-.15	-.07
85	.82	.78	.81	.32	.07	-.16
86	.62	.67	.73	.28	.15	.06
87	.79	.72	.84	-.06	-.37	.01
88	.76	.62	.62	.30	.33	-.54

Correlation coefficients between disability at ages 35-64 and mortality at ages 45-74 were higher than the correlation coefficients between disability and mortality at the same ages 35-64 (Appendix 4). The only exception was for neoplasms, where the association became

stronger but consistently negative, indicating that for men in the same age range, lower neoplasm mortality tends to be accompanied by higher disability from this cause.

Therefore, for neoplasms, it would appear to be inappropriate to use mortality as an indicator of the true level of biological morbidity. It is more difficult to conclude at an aggregated level which one, disability or mortality, is the cause and which one is the consequence. Analyzing neoplasms over time is also difficult, because of changes in the composition of the group. It is probable that improvements in treatment or early diagnosis might prolong the length of time people can live with neoplasms, because in the whole country mortality levels were declining but disability levels were about same. Again, one possible reason for unclear correlations in neoplasms is random variation due to few cases of disability.

For cardiovascular diseases, and particularly for ischemic heart diseases, the decline in both disability and mortality rates might well lead to the conclusion that the decline in the disability pension rates for these causes was due primarily to improvement in the cardiovascular health of the working age population. However, without longitudinal cohort data it is difficult to establish whether this was indeed the case or if the decline was in fact a function of social and economic changes.

The complementary trends over time and the generally strong positive correlations between disability and mortality from ischemic heart diseases supports the supposition that the level of mortality from this cause is a reasonable proxy for true prevalence of biological morbidity in the population.

4.2. Disability/mortality index: Ischemic heart disease

Figure 5 shows disability/mortality indices from ischemic heart diseases for males based on three-year moving averages expressed relative to the national average, which is set at 100. It is easy to distinguish four counties in which the indices were markedly over the national average for the entire period: Oulu, Kuopio, North-Karelia and Lappi. In Central-Finland, Mikkeli and Vaasa disability/mortality indices for ischemic heart diseases were close to the national average. The indices were clearly lower in the southern part of Finland in the counties of Turku ja Pori, Uusimaa and Häme. In Kymi the indices were also lower than for the country as a whole except in 1983.

Figure 5 shows that regional differences in the IHD disability/mortality index have narrowed over time. This narrowing was due to a decrease in regional differences in the level of disability, whereas regional variation in mortality remained quite stable over the period (Appendix 4). In two counties, Lappi and North-Karelia, the decline in the disability/mortality indices was striking. In Lappi, the index had fallen almost to the national level by the end of the period. In these two counties, differences in disability relative to the country as a whole diminished sharply over the period (Figure 4a), even though relative differences in mortality increased (Figure 4b). In Lappi the relative increase in mortality from ischemic heart diseases has been slight; in North-Karelia relative IHD mortality increased rapidly through 1983, after which it decreased, but remained over 25 percent higher than the national level. A smaller decline in the IHD

disability/mortality index was observed in Kuopio, the county with the highest index at the beginning of the period. Oulu was an exception among the counties with higher index values in that its index actually increased slightly over the period, due to a small rise in the relative level of IHD disability, while mortality relative to the national average declined somewhat.

It is difficult to assess the reasons for the narrowing of the relative differences in disability from cardiovascular diseases among counties, when relative mortality differences have not narrowed. One explanation for this is that disability was more reflective of biological morbidity towards the end of the period compared to the beginning of the period. The results based on the descriptive part of this report and correlation coefficients between disability and mortality did not give strong support to the assumption that this would have happened particularly in all those counties, in which disability has been either extremely low or high.

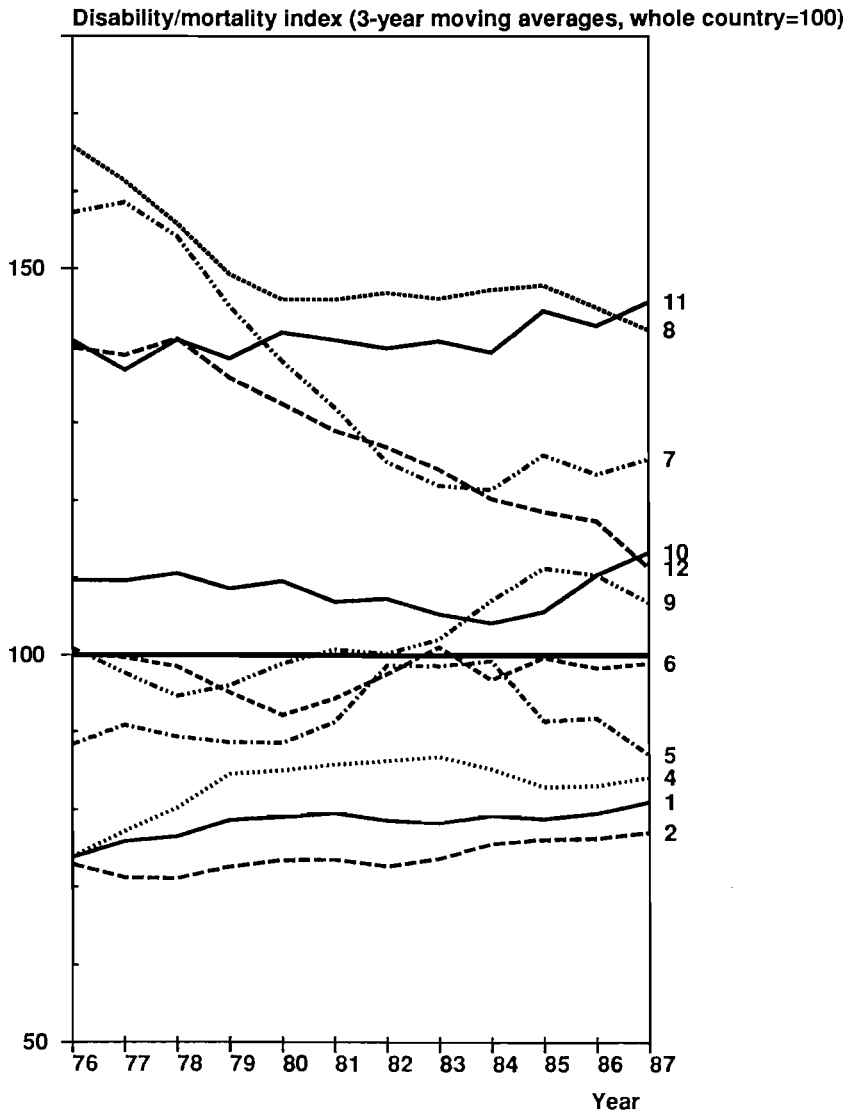

Figure 5. Age-standardized disability (ages 35-64) and mortality (ages 45-74) indices (three-year moving averages) from ischemic heart diseases in different counties of Finland in 1976-1987 (whole country = 100), males.

The connection of regional differences in disability/mortality indices to socio-economic factors

A short review of time trends in regional variations in disability/mortality indices from ischemic heart diseases for males has been given above. The next part of this study examines regional variation of disability/mortality indices in relation to selected socio-economic factors.

The relative effects of socio-economic factors on the level of the IHD disability/mortality index were assessed using regression models that included counties as dummy variables. The county of Vaasa was chosen as the reference because its disability/mortality index was close to the national average and its population was large enough to minimize random variation in the indices. In presenting the results the IHD disability/mortality index for Vaasa is set at 100.

Parameter estimates of the disability/mortality index for each county compared to Vaasa were statistically significant (t-statistics) during the whole period. The entire period was divided into three parts. The first period included years 1976-80, the second period 1981-85 and the third period 1986-87. The reason for the shortness of last period was the institution of a new pension system in 1986 that could have affected disability rates. Dummy variables were added both for the time periods 1981-85 and 1986-87 and for the years 1981-87 (1976-80 was the reference). There was still an effect of time period unexplained by the levels of the other significant independent variables: the effect of the period 1986-87 or the years 1986-87 on the variation of the disability/mortality index over counties was significant, when socio-economical factors (variables shown in Table 4) were standardized.

Definitions of the socio-economic factors included in the model, and the years for which they are available are presented in Table 3. The research hypothesis regarding the effects of industrial structure were that the disability/mortality index would be high in counties with high proportions of the labor force employed in agriculture and industry. The proportions employed in agriculture and industry have been declining over the period and the service sector expanding. It was reasoned that disability pensions might be awarded with looser criteria to compensate for the loss of income security when workplaces close and unemployment increases. Alternatively in an expanding service sector, increased demand for labor would have made it more difficult for workers to get premature retirement.

The proportion of the labor force employed in agriculture and in industry were included separately in the regression models, using the proportions employed in services as the reference group. Because net migration is usually connected to changes in industrial structure, it was also hypothesized that in contracting industrial areas experiencing negative net migration, the disability/mortality index would be higher.

Table 3. Variable definitions.

Variable name	Definition
Dependent variable	Actual disability/mortality ratio (three-year moving averages, yearly 1976-87)
Independent variables:	
BLUE service as referent	proportion of blue collar workers from occupational status structure (years 1976, 1980, 1984, 1988, the missing values for the years 77-79, 81-84 and 85-87 were interpolated linearly)
AGRI service as referent	The proportion of agricultural status from industrial status structure (years 1975, 1980, 1985, the missing values for the years 76-79, 81-84 and 86-87 were interpolated linearly)
INDU	The proportion of industrial status from industrial status structure (years 1975, 1980, 1985, the missing values for the years 76-79, 81-84 and 86-87 were interpolated linearly)
UNE	The proportion of unemployment person (including unemployment pensions) from the whole labor force (yearly 1976-1988)
MIGR	Net migration rates (yearly 1975-1988)

The effects of these socio-economic factors on differences in disability/mortality indices from ischemic heart disease were estimated by ordinary least squares linear regression models. Final linear regression models for all periods are shown in Appendix 5. Regression coefficients for the most parsimonious model relevant to the entire period are given in Table 4.

Table 4. The final regression model for the whole period 1976-87.

Variable	Estimates	Standardized estimates	t-values
1	122.1		
AGRI	166.6	.42	7.99
INDU	-190.1	-.38	-6.75
UNE	2.9	.29	5.28
R^2=.69	N=132		

Estimating models in logarithmic form did not significantly alter the results. No evidence of non-normality, nonlinearity or heteroscedaticity in the residuals was found by plotting the standardized residuals against the fitted values or through exploring error terms. Autocorrelation was tested with the Durbin Watson statistic. Results showed positive autocorrelations, which could not be eliminated. One possible result of autocorrelation is the exaggregation of the statistical significance of variables included in the model.

Furthermore, autocorrelation indicates that there are other variables, not included in the model, that explain the systematic variation in error terms.

Regional differences during the period 1976-87

The signs of parameter estimates in regression models proved to be as was theoretically supposed except for the proportion of industry. The proportion in industry and the proportion employed in blue collar occupations were correlated (correlation coefficient=.38), and both were negatively associated with the IHD disability/mortality index: the larger the proportions, the lower the indices. The proportion of the labor force employed in agriculture had an opposite effect on the index: the larger the proportion, the higher the index. High unemployment increased the index as well. However, the standardized effect estimates were much lower for unemployment than for the industrial structure variables. Moreover, for the model covering the entire period, the t-statistics in Table 4 indicate that all variables except the proportion employed in blue collar occupations and net migration were significant at the .05 level.

Interpretation of these results might be assisted by examining the changes in the relative level of IHD disability/mortality index in each county after successively including each statistically significant variable into the model. The socio-economic variables were unstandardized, so it is possible to interpret the differences between successive models as the effect of the added variable. From Table 5 it is possible to see that adjusting for industrial structure affected the amount of regional variation of the disability/mortality index for ischemic heart diseases. Adjusting for the proportion of the labor force employed in agriculture raised all of the indices relative to Vaasa except for Mikkeli. But the total amount of variation over the counties did not diminish after adjusting for the proportion in agriculture. Adjusting for the proportion employed in industry had the greatest effect on differences in the IHD disability/mortality index among counties. Except for the county of Mikkeli, the index was raised in counties with underdisability compared to Vaasa. To a lesser extent, adjusting for the proportion in industry also lowered the index in counties with overdisability, except for the county of Lappi where the adjusted disability/mortality index was nearly the same as in the crude model.

Almost all underdisability could be explained by variation in the socio-economic factors included in the model; but there were still three counties--Kuopio, Oulu, and Lappi--in which the disability/mortality index for ischemic heart disease remained relatively high, after adjusting for all significant variables.

Table 5. Relative disability/mortality indices from ischemic heart diseases in 1976-87 (Vaasa is 100, statistically significant factors in the final model have been fitted one by one in the model, explanators were unstandardized).

County		+agri.	+ind.	+unempl.
	(108)	(89)	(126)	(129)
Vaasa (10)	**100**	**100**	**100**	**100**
Uusimaa (1)	72	88	101	101
Turku ja Pori (2)	68	72	98	99
Häme (4)	76	86	115	115
Kymi (5)	85	93	109	109
Mikkeli (6)	90	87	87	87
North-K. (7)	123	131	112	112
Kuopio (8)	139	150	129	129
Central-F. (9)	94	100	105	105
Oulu (11)	131	143	127	127
Lappi (12)	118	131	119	119
std	23.51	25.26	12.19	12.11

Regional differences during the periods 1976-80, 1981-85 and 1986-87

As shown earlier, regional differences in the disability/mortality index from ischemic heart diseases have diminished since the mid-1970s (see Figure 5). There have been some changes in which factors have explained the variation of disability/mortality indices among counties during different periods. For the periods 1976-1980 and 1981-85, the proportions in agriculture and industry, and the unemployment rate were significant factors. In 1986-87 net migration was significant rather than unemployment. Agriculture had relatively less effect on disability/mortality differences in the 1980s than in the end of the 1970s.

During each period, Kuopio and Oulu still had relatively high IHD disability after adjustment for significant predictors, and during the first period this was true of North-Karelia and Lappi as well. There have to be other factors explaining overdisability in Kuopio and Oulu.

5. DISCUSSION

Regional variation in the prevalence of work disability was examined using age-standardized mortality by county as a proxy for the level of medical morbidity. Using the magnitude of correlations between work disability and mortality as the criterion, disability appeared to reflect medical morbidity in specific disease groups such as cardiovascular diseases and particularly ischemic heart diseases. It is difficult to interpret the results from other diseases, like neoplasms, that produce both disability and mortality, in part

because of the relatively low levels of disability from these causes resulting in random variation and above all because the neoplasms group is very heterogenous with large variation in prognosis after diagnosis.

The level of mortality and disability in the counties of Finland reflected large regional differences in cardiovascular diseases, particularly in ischemic heart diseases. For IHD, both disability and mortality have been highest in the eastern and northern parts of Finland and lowest in the western and southern parts. However, variation in the prevalence of work disability across counties greatly exceeds county-level variation in mortality.

Regional differences in the ratio of IHD disability to mortality have diminished during the period 1975-88, because differences in the level of disability have diminished, while mortality differences have remained quite stable. One possible explanation of this phenomenon is that disability in ischemic heart diseases was a better reflection of the true level of medical morbidity towards the end of this period than in the beginning, and diminishing disability differences did not depend on diminishing differences in medical morbidity.

For the period as a whole, excess work disability compared to mortality in ischemic heart diseases appears to be related to high proportions of the labor force employed in agriculture and low proportions employed in industry relative to proportions employed in the services sector, and high unemployment. However, there were two counties--Kuopio and Oulu--where high IHD disability relative to mortality could not be entirely explained by these factors. Relatively low levels of IHD disability appeared to be nearly completely explained by differences in these socio-economic conditions.

For the entire period, industrial structure appeared to have the strongest effect on the level of IHD disability relative to mortality. The largest standardized regression coefficients were for the proportions in agriculture and industry was relatively highest, but the signs on these two variables were opposite. A positive association between the proportion in agriculture and excess disability in Finland has been found in previous studies (e.g. Heliövaara et al. 1986; Takala 1984; Sauli 1979). The mortality hazard has been proved to be much higher among people working in industrial occupations than among people working in agriculture occupations, although the risk of disability is similar in both groups. One possible explanation for excess disability among people working in agriculture might be that the physically heavy job demands of this type of labor reduce their ability to work with a given level of morbidity. On the other hand persons seeking pensions from industrial employment may have higher real morbidity, but lighter physical demands on the job (Aromaa 1979). In addition, there are fewer possibilities for changing employment with worsening health for persons in agricultural occupations, whereas it is easier for an industrial worker to find physically less demanding work (for example, the service sector) without relying on disability pension. In addition to there being fewer opportunities to change work in rural areas because of the simpler, one-sided production structure, employment opportunities in general are much weaker in rural areas compared to urban areas. Seasonal and business fluctuations in employment are higher in rural areas as well.

The high correlation between explanators was partly due to technical correlation because of aggregate level data, and few observations. There is probably structural correlation too, for example between industrial structure, especially the proportion of agriculture and migration (correlation coefficient = -.43), which was difficult to interpret because of relatively short-time longitudinal data based on three-year moving averages.

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APPENDIX 1. Short description of the Finnish pension system (summary from the English section of the Statistical Yearbook of the Social Insurance Institution of Finland, 1989).

The aim of social insurance is to provide an income security against a number of social risks, particularly illness, disability, unemployment, old age, or the death of a breadwinner. The Social Insurance Institution (SII) is responsible for the social insurance that covers the entire population of Finland, i.e. for National Pension Insurance, National Sickness Insurance, certain rehabilitation benefits, and the Basic Unemployment Allowance scheme. In addition, the SII manages various disability benefit programs and pays out the child home care allowance.

Finnish pension insurance provides old age pension, invalidity pension, unemployment pension, and survivors pension. Finnish pension benefits fall into three categories: basic pensions, earnings-related pensions, and special benefits. Pension recipients can draw benefits from all these categories at the same time. The SII-operated schemes provide basic pensions called national pensions which ensure a minimum standard of living for the population. Earnings-related pensions together with the national basic pensions preserve the prepension level of consumption of the insured.

As people may be beneficiaries under several different pensions schemes, the SII and Central Pension Security Institution produce statistics which analyze total pension provisions in Finland.

All residents of Finland are eligible for the national pension. National Pension Insurance provides various pension benefits: old age pension, invalidity pension, unemployment pension, widows pension, orphans pension, front-veterans pension, front-veterans supplement payable outside Finland, burial grant and widow's training allowance.

Ordinary invalidity pension is payable to insured people between 16 and 65 who on account of disease, defect, or injury are unable to maintain themselves by their regular work or any other kind of work, which considering their age, occupation, education and place of residence, would be suitable for them.

The pension is also payable to people between 55 and 65 (special invalidity pension which came into force in 1986) whose capacity for work has been permanently reduced. The determining factors here are type of disease, aging, length of service, deterioration of health, and working conditions. This special invalidity pension is awarded on less strict award criteria than ordinary invalidity pension.

APPENDIX 2. Analyses by type of disease.

	ICD[1]
All causes	000-999
All diseases	000-799
Neoplasms	140-239
Cardiovascular diseases	390-458
-Ischemic heart disease	410-414
-Cerebrovascular disease	430-438
-Other cardiovascular disease	
Other diseases	
Accidents, poisonings and violence	E800-E999

[1]Manual of the International Statistical Classification of Disease, Injuries and Causes of Death, Geneva, 1967 (ICD 8th Revision).

APPENDIX 3. Age-standardized disability rates (prevalences) according to selected causes for males ages 35-64 in 1975-1988 in counties of Finland.

COUNTY	Year	All causes	Cardiov. diseases	IHD	Cerebro-vasc. dis.	Other cardiov. dis.	Neoplasms	Other dis. than card. dis. & neop.	Accidents
UUSIMAA (1)	75	11762	3683	1984	632	1066	212	6964	902
	76	12320	3823	2073	638	1112	219	7348	930
	77	12552	3857	2094	654	1109	215	7550	931
	78	12561	3800	2058	661	1081	213	7607	942
	79	12266	3630	1982	644	1004	212	7491	933
	80	11957	3435	1898	627	910	209	7407	906
	81	11594	3255	1795	611	849	210	7249	880
	82	11191	3013	1678	579	756	199	7129	849
	83	11202	2927	1652	575	700	199	7226	849
	84	11144	2837	1583	589	664	207	7274	826
	85	10946	2665	1488	567	610	204	7264	813
	86	11531	2704	1499	572	633	218	7782	827
	87	12198	2779	1517	583	679	225	8353	842
	88	12536	2764	1484	591	690	214	8700	857
TURKU JA	75	12050	3477	1867	626	984	231	7483	859
PORI (2)	76	12394	3498	1868	639	991	234	7803	860
	77	12458	3426	1821	655	951	236	7918	878
	78	12369	3325	1781	667	877	236	7936	872
	79	12374	3225	1727	664	834	232	8053	864
	80	12141	3107	1640	682	785	221	7957	856
	81	11985	2983	1567	673	743	216	7942	844
	82	11766	2835	1478	669	688	220	7879	832
	83	11869	2785	1487	660	638	221	8034	830
	84	11993	2749	1476	640	634	244	8160	839
	85	11809	2603	1428	608	568	245	8139	822
	86	12338	2622	1443	598	581	256	8638	822
	87	12956	2652	1419	599	634	250	9192	863
	88	13307	2646	1396	601	650	243	9574	844
AHVENANMAA (3)	75	6018	1891	1017	364	510	104	3821	202
	76	6015	1656	953	243	460	133	3969	258
	77	6479	1748	963	151	634	128	4372	231
	78	6179	1853	1105	302	447	74	4073	179
	79	6630	1906	1147	327	431	104	4413	207
	80	6705	1967	1186	329	453	78	4458	203
	81	6340	1788	1079	256	453	79	4167	307
	82	6180	1685	992	237	455	77	4087	332
	83	6378	1641	839	367	435	52	4330	356
	84	6367	1615	840	389	387	104	4216	431
	85	6492	1689	808	389	492	104	4172	526
	86	6843	1861	917	420	524	104	4431	447
	87	7285	1852	991	392	469	131	4759	543
	88	7512	1805	950	389	467	301	4817	589
HÄME (4)	75	13351	3819	1946	692	1181	198	8354	981
	76	13856	3979	2031	712	1237	202	8658	1017
	77	14048	3955	2031	702	1222	211	8875	1007
	78	13980	3886	2027	690	1170	204	8896	994
	79	13801	3724	1989	671	1065	197	8876	1004
	80	13511	3539	1905	660	975	188	8808	975
	81	13183	3416	1886	655	875	179	8635	954
	82	12893	3296	1791	675	830	170	8512	914
	83	12802	3173	1736	645	792	190	8551	889
	84	12770	3097	1689	645	763	201	8594	878
	85	12437	2858	1574	600	685	189	8536	855
	86	12918	2827	1560	596	671	201	9024	866
	87	13351	2857	1562	596	698	211	9423	861
	88	13626	2855	1554	594	708	217	9704	850

KYMI (5)	75	14743	4885	2733	923	1230	231	8719	908
	76	15433	5075	2869	931	1275	229	9182	947
	77	15555	5031	2867	891	1273	210	9357	958
	78	15675	4993	2871	897	1225	219	9488	974
	79	15449	4624	2674	812	1138	228	9643	954
	80	15111	4412	2547	783	1082	225	9527	947
	81	14896	4241	2472	773	995	230	9494	932
	82	14531	4027	2357	749	922	218	9386	900
	83	14630	3886	2309	713	864	239	9581	925
	84	14658	3775	2231	730	814	250	9687	946
	85	14235	3526	2081	690	755	255	9531	924
	86	14590	3483	2027	692	764	244	9902	961
	87	14954	3432	1964	691	777	225	10298	999
	88	14826	3283	1858	676	750	234	10303	1007
MIKKELI (6)	75	18449	5629	3288	783	1557	207	11571	1042
	76	18887	5669	3323	800	1546	224	11904	1090
	77	18765	5497	3238	800	1460	223	11975	1071
	78	18310	5178	3124	738	1317	202	11860	1071
	79	17857	4884	2934	733	1217	217	11668	1087
	80	17452	4708	2781	760	1168	209	11481	1054
	81	16987	4443	2660	733	1051	209	11322	1013
	82	16376	4106	2457	725	924	205	11096	970
	83	16097	3959	2385	720	854	220	10976	942
	84	15911	3848	2311	687	850	193	10913	957
	85	15624	3628	2211	628	789	199	10890	907
	86	16222	3709	2240	642	827	219	11363	932
	87	16687	3699	2204	624	870	193	11807	989
	88	17120	3682	2188	651	843	213	12223	1002
NORTH-	75	24143	8121	5312	774	2035	280	14509	1232
KARELIA (7)	76	24495	8091	5227	824	2040	287	14892	1224
	77	24146	7889	5053	825	2012	285	14753	1219
	78	23491	7598	4870	806	1923	262	14452	1179
	79	22736	7132	4560	788	1784	276	14167	1160
	80	21878	6608	4269	744	1595	277	13850	1143
	81	21059	6177	4019	741	1417	270	13542	1070
	82	20272	5835	3820	728	1287	250	13161	1026
	83	19781	5513	3558	754	1201	266	12998	1004
	84	19498	5287	3453	758	1077	259	12960	992
	85	18991	4973	3261	721	992	234	12839	944
	86	19359	4840	3151	758	931	223	13356	940
	87	20043	4791	3073	795	924	187	14110	955
	88	20304	4740	3025	787	928	161	14429	975
KUOPIO (8)	75	21999	8038	5354	802	1882	263	12649	1050
	76	22245	8043	5378	794	1871	240	12885	1077
	77	21910	7861	5302	760	1799	242	12728	1079
	78	21228	7379	4980	743	1657	226	12536	1087
	79	20779	6967	4659	728	1580	232	12483	1097
	80	20123	6525	4344	709	1472	244	12293	1062
	81	19621	6212	4153	688	1370	248	12124	1037
	82	18796	5853	3915	698	1241	224	11738	980
	83	18647	5569	3758	686	1124	217	11878	984
	84	18551	5378	3588	738	1052	225	12028	919
	85	18286	5124	3378	764	982	226	11998	938
	86	18740	5055	3328	741	986	244	12481	960
	87	19219	4949	3236	744	969	236	13071	963
	88	19680	4779	3047	744	989	247	13676	977
CENTRAL-	75	18570	5573	3068	810	1696	225	11671	1101
FINLAND (9)	76	19298	5679	3179	816	1685	235	12252	1133
	77	19264	5631	3153	812	1666	235	12275	1123
	78	18750	5390	3065	781	1545	239	12054	1066
	79	18327	5180	2941	787	1451	218	11878	1051
	80	17707	4866	2826	748	1292	195	11617	1029
	81	17273	4622	2718	717	1187	209	11465	977
	82	16861	4408	2611	708	1089	247	11292	914
	83	16812	4305	2588	697	1019	256	11377	874
	84	16720	4192	2563	671	958	241	11422	865
	85	16290	3917	2399	617	902	240	11285	849
	86	16378	3803	2337	598	868	242	11479	853
	87	16969	3802	2311	604	887	247	12054	866
	88	17282	3687	2202	589	896	241	12472	883

VAASA (10)	75	14326	4006	2388	523	1095	253	9186	880
	76	14619	4192	2510	544	1139	254	9267	906
	77	14534	4161	2547	523	1091	262	9228	883
	78	14095	3990	2468	519	1003	248	8988	870
	79	13799	3860	2400	523	937	245	8845	850
	80	13465	3682	2263	529	890	238	8727	819
	81	13048	3466	2126	494	846	250	8542	791
	82	12685	3303	2035	487	781	238	8372	772
	83	12501	3194	1984	479	731	233	8327	748
	84	12413	3145	1971	468	706	245	8283	741
	85	12206	3039	1917	463	659	240	8218	708
	86	12489	2998	1891	453	654	228	8562	702
	87	12948	3015	1884	443	689	237	8971	725
	88	13248	3041	1873	452	715	244	9246	718
OULU (11)	75	23030	7455	4774	779	1902	258	14062	1254
	76	23486	7571	4827	768	1976	257	14384	1274
	77	23366	7410	4748	759	1903	254	14447	1256
	78	22791	7073	4541	784	1749	237	14263	1218
	79	22202	6814	4372	798	1644	242	13961	1185
	80	21600	6443	4114	794	1535	270	13750	1137
	81	20886	6125	3899	815	1411	281	13390	1091
	82	20045	5784	3678	809	1297	271	12954	1036
	83	19549	5537	3536	801	1200	278	12727	1008
	84	19282	5450	3464	838	1149	262	12606	964
	85	18891	5276	3344	853	1079	281	12393	941
	86	19120	5289	3344	852	1093	277	12614	939
	87	19343	5214	3234	892	1089	255	12937	937
	88	19439	5046	3126	880	1040	264	13181	949
LAPPI (12)	75	20850	7171	4614	653	1905	267	12205	1207
	76	21467	7293	4636	692	1964	252	12645	1278
	77	21402	7187	4506	737	1943	279	12676	1260
	78	20938	6805	4292	720	1793	242	12670	1221
	79	20287	6389	4060	688	1641	265	12423	1211
	80	19540	5972	3804	681	1487	253	12144	1171
	81	18868	5561	3513	659	1390	243	11929	1134
	82	18049	5139	3251	641	1247	233	11569	1107
	83	17603	4897	3085	673	1140	239	11404	1063
	84	17405	4732	2927	708	1097	238	11397	1038
	85	17147	4584	2800	731	1054	213	11363	986
	86	17308	4472	2671	704	1097	234	11632	970
	87	17460	4453	2619	713	1121	234	11787	986
	88	17598	4293	2462	743	1089	224	16632	966
WHOLE	75	15509	4850	2830	695	1325	230	9448	981
COUNTRY	76	15972	4956	2893	706	1358	232	9777	1007
	77	16004	4896	2865	703	1328	233	9872	1004
	78	15765	4730	2783	700	1247	225	9816	994
	79	15456	4510	2663	686	1162	226	9734	986
	80	15049	4276	2524	678	1074	222	9591	960
	81	14650	4065	2408	665	992	223	9430	932
	82	14195	3837	2274	656	907	217	9243	899
	83	14085	3700	2210	647	844	223	9276	886
	84	14017	3607	2148	652	807	228	9308	874
	85	13733	3415	2040	629	746	225	9240	853
	86	14155	3400	2022	626	752	232	9663	861
	87	14647	3406	1994	632	780	228	10135	879
	88	14912	3351	1936	634	781	229	10451	881

Age-standardized mortality rates according to selected causes for males ages 45-74 in 1975-1988 in counties of Finland.

COUNTY	Year	All causes	Cardiov. diseases	IHD	Cerebro-vasc. dis.	Other cardiov. dis.	Neoplasms	Other dis. than card. dis. & neop.	Accidents
UUSIMAA (1)	75	2723	1430	1020	209	200	655	423	215
	76	2723	1456	1040	220	196	675	365	227
	77	2737	1464	1030	233	201	643	391	239
	78	2578	1386	977	238	171	640	341	211
	79	2517	1373	972	229	172	614	321	209
	80	2429	1235	889	180	166	618	387	189
	81	2462	1230	892	194	145	668	348	216
	82	2292	1255	894	202	159	592	270	175
	83	2352	1222	863	204	155	590	354	187
	84	2301	1193	839	191	163	613	310	185
	85	2304	1206	836	188	183	573	354	171
	86	2216	1158	805	200	153	537	320	201
	87	2152	1102	770	172	160	552	296	202
	88	2112	1011	691	165	156	543	339	219
TURKU JA	75	2497	1336	909	215	212	606	378	177
PORI (2)	76	2570	1392	982	191	219	632	361	185
	77	2484	1314	937	174	204	585	382	203
	78	2427	1318	932	180	207	588	336	184
	79	2403	1313	917	193	203	591	335	164
	80	2270	1166	818	182	167	617	348	139
	81	2217	1200	842	190	168	573	295	150
	82	2056	1192	868	155	168	497	235	132
	83	2109	1120	823	155	143	569	284	135
	84	2119	1148	805	164	178	552	271	148
	85	2193	1146	846	157	143	581	311	155
	86	2074	1099	790	161	148	526	320	129
	87	2046	1113	757	183	173	521	249	163
	88	2010	1008	703	154	151	519	302	182
AHVENANMAA (3)	75	2485	1302	737	288	277	773	175	235
	76	1929	1187	733	172	282	375	179	189
	77	1871	862	668	59	136	570	211	229
	78	1809	642	504	69	69	756	262	149
	79	1131	641	393	126	122	303	64	123
	80	2181	1108	640	126	343	611	245	217
	81	2014	922	710	31	181	607	241	245
	82	1862	1112	843	150	119	415	211	123
	83	1518	860	592	89	179	416	89	154
	84	1715	888	503	118	267	442	118	267
	85	1893	828	621	89	118	474	355	236
	86	1441	560	295	147	117	441	146	295
	87	1547	819	527	147	145	494	89	145
	88	1013	579	351	57	171	203	175	57
HÄME (4)	75	2641	1472	1003	228	241	615	350	203
	76	2591	1475	1007	254	215	601	354	160
	77	2524	1430	1004	222	204	564	336	194
	78	2476	1374	921	248	205	628	295	178
	79	2394	1315	883	218	214	579	331	170
	80	2316	1190	830	172	188	596	339	190
	81	2339	1280	894	212	175	572	316	171
	82	2376	1278	857	211	210	600	324	174
	83	2234	1156	801	191	164	555	349	174
	84	2238	1227	829	191	207	570	276	165
	85	2286	1264	869	197	198	578	269	174
	86	2134	1167	791	202	174	512	270	186
	87	2095	1087	750	190	147	524	296	189
	88	2051	1026	722	164	140	526	298	201

KYMI (5)	75	2827	1699	1192	262	245	565	336	228
	76	2889	1676	1156	269	251	689	324	201
	77	2707	1676	1213	222	241	532	307	192
	78	2789	1672	1150	279	243	621	315	182
	79	2764	1565	1136	222	207	591	379	229
	80	2622	1592	1138	242	212	524	303	203
	81	2396	1461	1055	224	181	530	245	159
	82	2434	1448	1014	207	228	500	279	206
	83	2370	1263	884	214	165	616	272	219
	84	2263	1376	1009	213	155	510	241	137
	85	2366	1324	958	220	146	485	359	198
	86	2441	1396	1004	215	178	542	306	197
	87	2245	1191	864	173	153	576	307	172
	88	2146	1200	873	179	148	453	292	201
MIKKELI (6)	75	2999	1624	1168	238	219	667	446	262
	76	2953	1703	1237	203	263	628	379	243
	77	2894	1762	1248	280	235	550	345	237
	78	2750	1521	1125	236	160	625	325	279
	79	2743	1591	1136	268	186	635	296	221
	80	2659	1647	1234	219	194	506	305	200
	81	2618	1513	1115	177	221	545	312	248
	82	2424	1393	987	213	193	535	278	219
	83	2484	1366	1026	150	190	565	282	272
	84	2310	1235	919	160	156	520	335	219
	85	2483	1446	1109	178	158	496	305	236
	86	2528	1252	895	215	143	645	410	220
	87	2269	1242	900	189	153	515	312	200
	88	2376	1276	939	179	158	497	347	257
NORTH-	75	3177	1820	1268	277	275	705	456	196
KARELIA (7)	76	3009	1795	1219	323	253	622	383	210
	77	2899	1764	1195	320	249	667	318	150
	78	2927	1670	1132	268	269	623	428	206
	79	2880	1622	1162	264	197	680	354	224
	80	2994	1713	1258	227	228	665	413	202
	81	2763	1642	1149	174	319	631	309	180
	82	2624	1618	1229	173	216	540	314	152
	83	2849	1761	1344	157	261	598	328	162
	84	2691	1558	1119	249	190	548	365	219
	85	2604	1526	1159	222	145	517	346	214
	86	2548	1512	1073	253	186	486	293	257
	87	2418	1362	1042	193	127	541	314	201
	88	2423	1263	897	181	185	618	278	264
KUOPIO (8)	75	2807	1591	1147	230	214	634	396	186
	76	2957	1668	1226	215	227	692	373	225
	77	2942	1760	1219	302	239	588	368	226
	78	2839	1614	1157	286	172	695	356	173
	79	2706	1608	1183	243	182	509	347	242
	80	2622	1573	1175	262	136	504	378	167
	81	2564	1453	1093	196	164	575	347	189
	82	2658	1519	1101	236	182	556	368	216
	83	2617	1460	1073	197	190	624	333	201
	84	2294	1337	1014	157	166	511	280	167
	85	2412	1348	1014	191	144	491	385	188
	86	2337	1289	951	174	164	574	300	174
	87	2310	1316	957	200	160	449	340	205
	88	2234	1137	848	160	130	540	327	230
CENTRAL-	75	2737	1616	1104	255	257	541	336	244
FINLAND (9)	76	2796	1672	1161	261	250	565	315	244
	77	2906	1706	1196	259	252	579	406	214
	78	2740	1661	1218	233	210	587	313	179
	79	2681	1556	1182	188	186	627	291	207
	80	2534	1531	1060	260	210	553	297	153
	81	2477	1442	1052	222	168	527	321	188
	82	2512	1492	1096	236	160	548	281	191
	83	2443	1441	1060	194	187	524	317	161
	84	2385	1350	995	214	141	569	237	230
	85	2383	1354	953	227	174	505	308	216
	86	2266	1220	862	240	118	511	282	253
	87	2297	1291	907	204	181	523	276	207
	88	2319	1184	844	202	139	559	361	214

VAASA (10)	75	2354	1237	820	198	219	581	394	141
	76	2411	1260	844	216	200	652	343	156
	77	2377	1246	853	203	190	649	338	143
	78	2229	1207	851	196	160	530	356	137
	79	2207	1144	788	161	195	590	305	169
	80	2295	1215	826	171	218	580	342	158
	81	2002	1072	759	138	175	515	292	122
	82	2070	1111	796	165	151	556	257	146
	83	2006	1036	771	140	125	573	283	113
	84	2003	1065	786	164	115	551	270	118
	85	2102	1143	846	135	162	563	290	107
	86	1836	1015	715	155	145	446	250	124
	87	1845	906	651	150	105	512	301	126
	88	1807	893	664	119	110	493	256	166
OULU (11)	75	2980	1646	1236	201	208	649	442	243
	76	2942	1712	1320	223	169	680	312	238
	77	2871	1615	1231	230	155	633	377	246
	78	2789	1635	1280	181	175	659	323	171
	79	2557	1483	1103	220	160	648	268	157
	80	2612	1466	1160	170	137	632	305	209
	81	2562	1389	1083	190	116	672	301	200
	82	2413	1346	1049	165	133	618	274	175
	83	2466	1392	1099	164	129	568	286	220
	84	2387	1318	997	187	135	572	309	188
	85	2454	1395	1073	160	162	562	300	197
	86	2237	1280	939	189	152	543	239	174
	87	2286	1236	955	150	131	587	269	194
	88	2187	1139	822	152	165	529	277	242
LAPPI (12)	75	2946	1680	1236	257	187	566	428	273
	76	3019	1689	1255	270	163	686	402	242
	77	2896	1565	1165	207	193	732	363	236
	78	2738	1538	1174	215	150	714	276	210
	79	2573	1282	1053	118	111	708	366	218
	80	2620	1430	1136	123	171	643	281	266
	81	2592	1449	1105	145	199	583	272	287
	82	2469	1322	1004	155	164	708	251	187
	83	2302	1359	1044	121	194	525	209	210
	84	2385	1309	1044	120	144	584	287	206
	85	2536	1469	1032	228	209	602	311	154
	86	2309	1306	956	182	168	537	286	181
	87	2162	1186	950	132	104	479	278	219
	88	2236	1265	931	176	157	512	254	206
WHOLE COUNTRY	75	2712	1493	1046	226	222	619	393	207
	76	2726	1523	1077	231	215	645	353	205
	77	2677	1500	1064	227	208	607	361	209
	78	2586	1446	1028	227	191	620	331	189
	79	2514	1393	994	211	188	604	324	193
	80	2461	1343	968	192	182	592	344	182
	81	2391	1307	946	190	172	590	309	185
	82	2321	1306	940	191	175	564	279	173
	83	2312	1250	913	176	161	574	309	179
	84	2259	1238	892	183	164	563	286	173
	85	2319	1271	920	183	168	553	320	175
	86	2199	1194	846	192	156	527	296	182
	87	2144	1139	815	175	149	531	289	185
	88	2107	1071	763	161	148	522	306	209

APPENDIX 4. Correlation coefficients between disability (ages 35-64) and mortality (ages 35-64) from selected causes in 1975-88, males.

Year	All causes	Cardiov. diseases	IHD	Cerebrov. diseases	Other card. diseases	Neoplasms
75	0.33	0.39	0.48	0.30	-0.06	-0.43
76	0.17	0.31	0.36	0.16	-0.14	-0.43
77	0.27	0.28	0.32	0.32	-0.12	0.10
78	0.34	0.47	0.55	0.02	0.07	-0.58
79	0.21	0.24	0.33	0.39	-0.12	-0.12
80	0.28	0.41	0.49	0.12	-0.05	-0.28
81	0.17	0.23	0.34	0.26	0.05	-0.56
82	0.11	0.27	0.37	0.07	0.03	-0.59
83	0.32	0.46	0.55	0.19	0.02	-0.44
84	0.10	0.25	0.36	0.26	-0.09	-0.31
85	0.24	0.33	0.36	0.26	0.18	-0.44
86	0.12	0.04	0.08	0.00	-0.15	-0.41
87	0.17	0.29	0.39	0.06	-0.07	-0.14
88	0.28	0.32	0.31	0.28	0.11	-0.05

Standard deviations from disability (ages 35-64) from selected causes in 1975-88, males.

Year	All causes	Cardiov. diseases	IHD	Cerebrov. diseases	Other card. diseases	Neoplasms
75	27.9	35.5	46.3	15.4	28.7	11.4
76	26.9	34.0	44.1	14.7	27.7	9.3
77	25.9	33.2	42.8	13.8	27.7	10.9
78	24.9	31.8	40.9	13.2	27.1	8.0
79	24.2	31.1	39.5	12.0	27.2	9.8
80	23.6	29.9	38.4	10.9	25.9	12.5
81	23.1	29.3	37.5	12.4	25.1	12.9
82	22.4	29.0	37.4	12.7	24.5	12.1
83	21.4	27.9	35.4	12.8	23.8	11.5
84	20.8	27.4	34.8	14.2	22.1	9.8
85	20.8	28.2	34.8	16.2	23.6	11.4
86	19.7	27.5	33.9	16.6	23.3	8.6
87	18.7	26.2	32.7	18.3	20.5	9.3
88	18.4	25.0	31.6	17.8	18.7	11.3

Standard deviations from mortality (ages 45-74) from selected causes in 1975-88, males.

Year	All causes	Cardiov. diseases	IHD	Cerebrov. diseases	Other card. diseases	Neoplasms
75	8.3	11.0	13.2	11.2	11.3	7.8
76	7.2	10.5	12.8	16.1	15.1	6.2
77	7.1	11.8	12.2	18.7	14.0	9.3
78	7.7	10.7	12.9	15.6	18.8	7.8
79	7.4	11.1	13.1	20.0	14.5	8.5
80	8.1	14.2	17.0	21.9	16.6	9.1
81	8.4	11.9	13.3	14.0	28.9	8.8
82	8.0	11.0	13.0	15.4	16.2	10.1
83	9.6	15.2	17.8	16.2	22.6	5.4
84	7.3	10.1	11.9	18.2	15.2	5.4
85	6.1	9.6	11.9	16.4	12.9	7.4
86	9.0	11.0	12.1	15.3	11.7	9.1
87	7.0	10.8	13.7	12.6	16.4	7.1
88	8.0	11.3	12.5	12.6	12.6	7.7

Standard deviations from disability (ages 35-64)/mortality (ages 45-74) index from selected causes in 1975-88, males.

Year	All causes	Cardiov. diseases	IHD	Cerebrov. diseases	Other card. diseases	Neoplasms
75	20.9	26.1	33.8	12.5	31.2	13.2
76	20.5	24.4	32.0	15.4	38.7	10.7
77	19.7	24.1	32.7	15.6	34.4	6.2
78	18.3	22.8	30.1	15.9	34.0	12.8
79	19.5	25.8	29.7	25.7	48.5	9.3
80	16.7	19.7	23.0	22.3	39.3	12.3
81	16.5	20.5	25.5	13.9	38.3	13.0
82	16.1	21.3	25.3	19.3	33.4	14.7
83	14.5	16.4	20.4	22.5	25.1	13.6
84	15.7	20.1	23.4	24.8	30.7	11.7
85	15.6	20.3	24.1	19.8	27.5	14.9
86	15.2	20.6	24.5	18.9	25.9	11.3
87	13.2	18.7	20.6	26.3	37.5	12.2
88	12.8	19.0	24.0	17.9	19.5	15.1

APPENDIX 5. Final regression models for the periods 1976-87, 1976-80, 1981-85 and 1986-87.

PERIOD 1976-87:

	parameter estimate	standardized estimate	t-test: parameter=0
1.	122.0		
AGRI	166.6	.42	7.99
INDU	-190.1	-.38	-6.75
UNE	2.9	.29	5.28

R^2=.69 N=132

PERIOD 1976-80:

	parameter estimate	standardized estimate	t-test: parameter=0
1.	129.2		
AGRI	152.9	.37	4.28
INDU	-207.5	-.39	-4.32
UNE	3.4	.31	3.57

R^2=.72 N=55

PERIOD 1981-85:

	parameter estimate	standardized estimate	t-test: parameter=0
1.	116.6		
AGRI	122.2	.31	3.67
INDU	-177.3	-.37	-4.32
UNE	3.9	.41	4.86

R^2=.72 N=55

PERIOD 1986-87:

	parameter estimate	standardized estimate	t-test: parameter=0
1.	163.6		
AGRI	137.0	.31	2.12
INDU	-262.0	-.49	-3.67
MIGR	-3.0	-.32	-2.31

R^2=.74 N=22