The Case of the Czech Republic
Determinants of the recent favourable turnover in mortality

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Determinants of Diverging Trends in Mortality

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Introduction

The determinants of mortality change other than age, sex, and cause are marital status, educational level, occupational class or regional dissimilarities. These variables are useful for evaluating health conditions of population sub-groups. A high level of premature mortality can reflect a lack in health care facilities including modern therapeutic approaches in some areas or a lower standard of living in specific population groups. Different cultures can in various ways utilize new information regarding appropriate medical treatment and/or life style. A latent factor can also be historical awareness. It is very likely that populations which temporarily deviated from a trajectory of lower mortality regime can revert more quickly to lower mortality settings than populations without this experience. The purpose of this presentation is to begin with a short historical perspective which shows the interwar mortality conditions in the former Czech lands (the current Czech Republic) contrasted with the post-war health situation. **The focus is on mortality variations in the 1990s compared with the situation in the 1980s**. **This analysis studies the differences in speed of mortality decline in the Czech Republic according to age, sex, cause, and education of populations aged 40 to 84 years.**

I. Historical perspective of mortality change in the Czech Republic

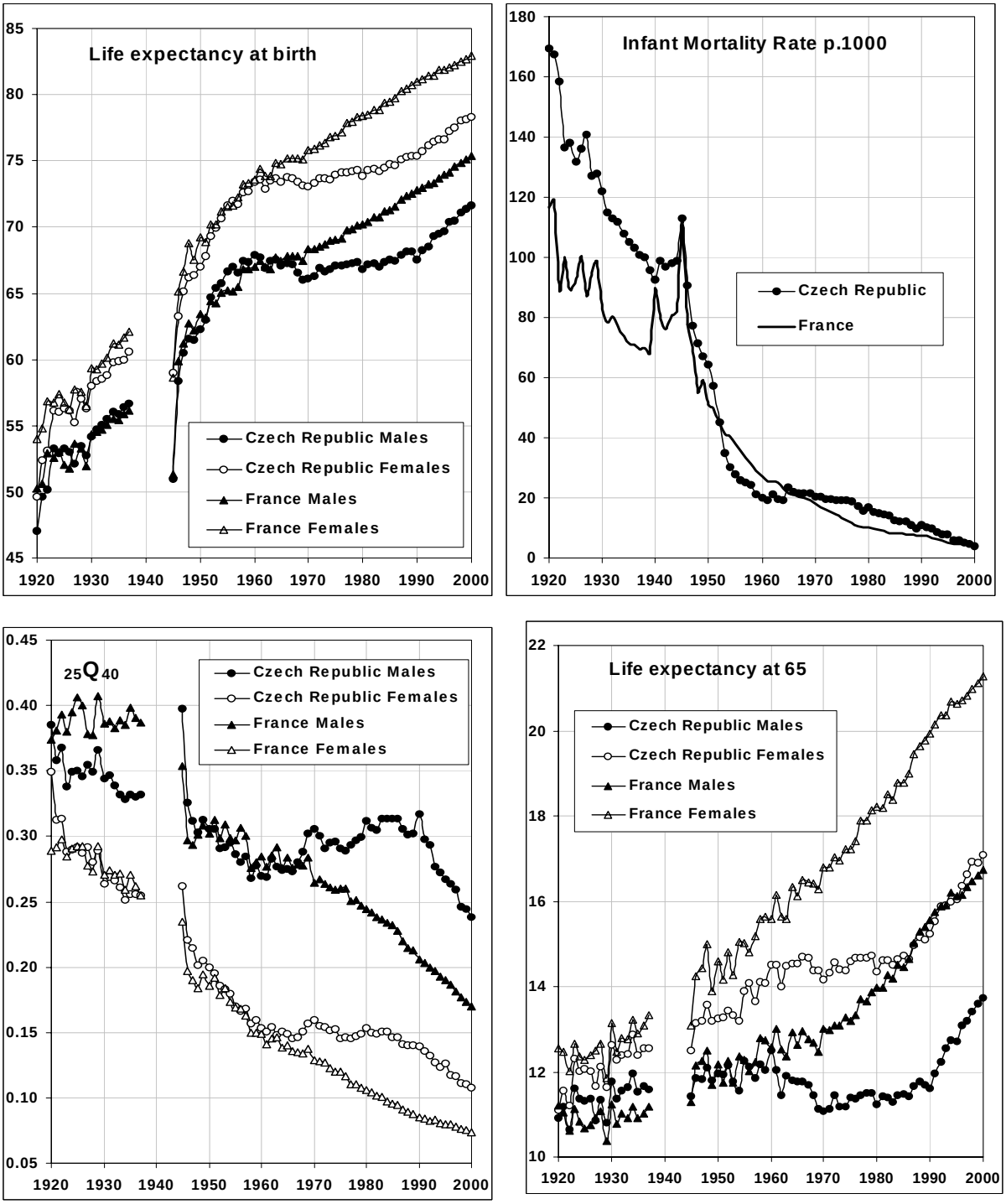
From the beginning of the 20th century and including the interwar period, mean length of life increased and male and female survival in the Czech Republic was close to the levels observed in France (Figure 1). At that time the Czech lands (Bohemia, Moravia and part of Silesia) belonged among the more economically advanced countries. In 1930, GDP per capita was 720 and productivity in agriculture was 145 (France: 890 and 176 respectively; Austria 715 and 134; Hungary 430 and 78; Poland 420 and 49; and Italy 525 and 73) [2,4].

After World War II three dissimilar stages in the development of **life expectancy at birth** became apparent in the Czech Republic: 1) between World War II and the mid-1960s characterized by mortality decrease; 2) from the mid-1960s to the mid-1980s, showing the deterioration of the survival rate; and 3) **from the mid-1980s or the beginning of the 1990s to the present with a reappearance of a new decline in mortality**.

During the first post-war period (the 1950s), mean length of life increased more rapidly in the Czech Republic than in France. Up to the early1960s life expectancy at birth for Czech females was the same as their French counterparts, but Czech males had a longer mean length of life than French males (Figure 1). This significant decrease in Czech mortality was due to the capability of a socialist country (historically industrialized) to develop rapid coverage of the entire population with basic but comprehensive health services. The "health-

extensive approach" - a large number of medical staff with limited expenditures for equipment, drugs and maintenance - was successful in reducing and controlling communicable and infectious diseases among the population as a whole.

Figure 1 ***Mortality indicators in the Czech Republic and France since 1950***



The decline/stagnation in health conditions from the mid-1960s to the mid-1980s affected most of the population of Central and Eastern Europe including the Czech Republic.

The deterioration was particularly marked for the elderly and middle-aged adults - and primarily for men. A substantial part of the mortality increase was attributable to an "epidemic" of heart diseases. To a lesser degree, an increase in cerebrovascular diseases, lung cancer and cirrhosis of the liver was observed [1,8,9,13]. At that time, the gap in life expectancy between the Czech Republic and France began to widen. For example, by the mid-1980s the mortality rate from cardiovascular and cerebrovascular disease was twice as high in the Czech Republic as in France [8]. These degenerative diseases required a "health intensive approach" involving specialized training, sophisticated equipment, expensive drugs, and high-cost medical procedures. In spite of growing awareness among the medical profession, the Czech health system was not able to adjust to the changing health needs of the population.

Health conditions had already slightly improved in the Czech Republic in the immediate pre-transition years (1985-1989) and life expectancy at birth began to increase again (Figure 1). The Czech Republic avoided a dramatic increase in the number of deaths (labelled the mortality crisis of the 1990s) observed in most post-communist countries [3]. The time delay of the Czech Republic in the reduction of mortality rate compared to France has not diminished and life expectancy at birth has followed an almost parallel trend (Figure 1). In 2000 life expectancy at birth was 71.65 years for men and 78.35 for women (France 75.41 and 82.92). However, the recent increase in life expectancy at birth has currently brought the Czech Republic a little closer to the European average.

Before World War II, **infant mortality** rate was substantially higher in the former Czech lands than in France (Figure 1). The difference is not easy to explain and it might suggest that Czech lands had a weaker social organization and less efficient health care system of mother/child protection. Contrary to the health situation prior to World War II, the infant mortality rate was lower in the Czech territory than in France during the 1950s. This rapid decrease in infant mortality rate at that time contributed the most to an increase in life expectancy at birth. A particularly active maternity and welfare policy, immunization, and universal access to health care resulted in rapid improvement of infant survival in the Czech Republic. On the contrary, the decline in infant mortality lessened from 1961. A more pronounced downward trend reappeared in the 1980s and has continued through the 1990s. In 2000 the Czech Republic and France experienced the same level of 4.1 infant deaths per 1000 live births (Figure 1). Therefore, infant survival in the Czech Republic is among the highest in Europe [10,13].

Older age groups show different trends in mortality than infants. Prior to World War II **life expectancy at age 65** was longer for males in the former Czech lands than in France and

only slightly shorter for women. However, the trend in the Czech Republic reversed at the beginning of the 1960s and an increase in mortality of 65+ was observed between 1960 and 1970 (Figure 1). The reduction in life expectancy at 65 primarily influenced a shortened life expectancy at birth. Almost the same pattern is seen for mortality development in the age group of 40-64 years. During the 1990s a decrease in mortality in the Czech Republic emerged and was primarily due to the reduction of mortality in the older age group, but with a delay of 25-30 years after the decrease had occurred in Western Europe [10]. Is the Czech recovery during the transition period a manifestation of an "historical" factor/awareness and evidence of a reappearance of historical inequalities in health in Europe? Apparently Central and Eastern Europe has become more heterogeneous in repeating historical inequalities in health conditions. However, southern Europe - delayed in an epidemiological transition - currently has the lowest mortality rate in the world.

II. Improvement in current Czech mortality

What are the reasons for recent health improvement in the Czech Republic? What ages and causes of death have contributed to the observed amelioration? To answer these questions, the differential in life expectancy between 1985 and 2000 was decomposed into age components and according to cause of death. The pre-transition mortality pattern is represented by the year 1985; 2000 includes the latest available mortality statistics in the Czech Republic. Figure 2 illustrates the contributions of specified age groups to the overall time differential in life expectancy. The formulae of Pressat [7] and Pollard [6] were used for the following decompositions.

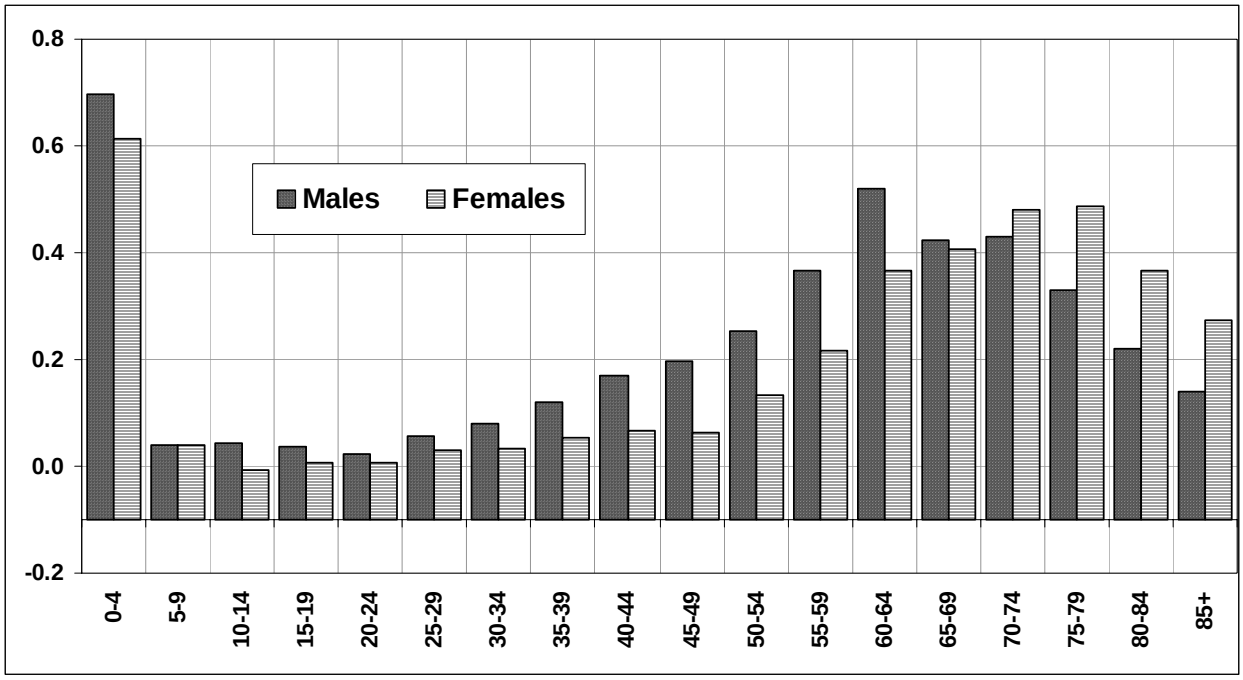
Mortality change by age and cause between 1985 and 2000

The age group of 55-79 and the particular group of 60-64 (Figure 2) contributed the most to the improvement of male mortality between 1985 and 2000. These age ranges represent 49.9 and 12.6 percent respectively of total improvement. Similar patterns were observed for females where the gain in life expectancy was due to mortality amelioration at ages 60-84 but primarily in the specific age group of 70-79; (58.0% and 26.6%, respectively). The continuing decline in the infant mortality rate contributed 17% for males and females in the prolongation of life expectancy. The observed favourable change in adult and elderly mortality in the 1990s has a wider impact than a simple lengthening of life expectancy at birth. The improvement has been a qualitative turning point in mortality trends and more closely aligns the Czech Republic to the patterns of low-mortality countries. However, this recovery still lags 20 years behind Western Europe where reduction in mortality at higher

ages began in the 1970s. The Czech Republic is currently in the group of European counties with a medium mortality level, i.e., Denmark, Portugal and Ireland [11]. The most advanced countries show sustained progress, while the Czech Republic has only started the fourth stage of Epidemiological transition. An apparently favourable position of the Czech Republic is evident primarily when compared with other Central and Eastern European countries.

Figure 2

Gains in life expectancy at birth in the Czech Republic between 1985 and 2000 by age

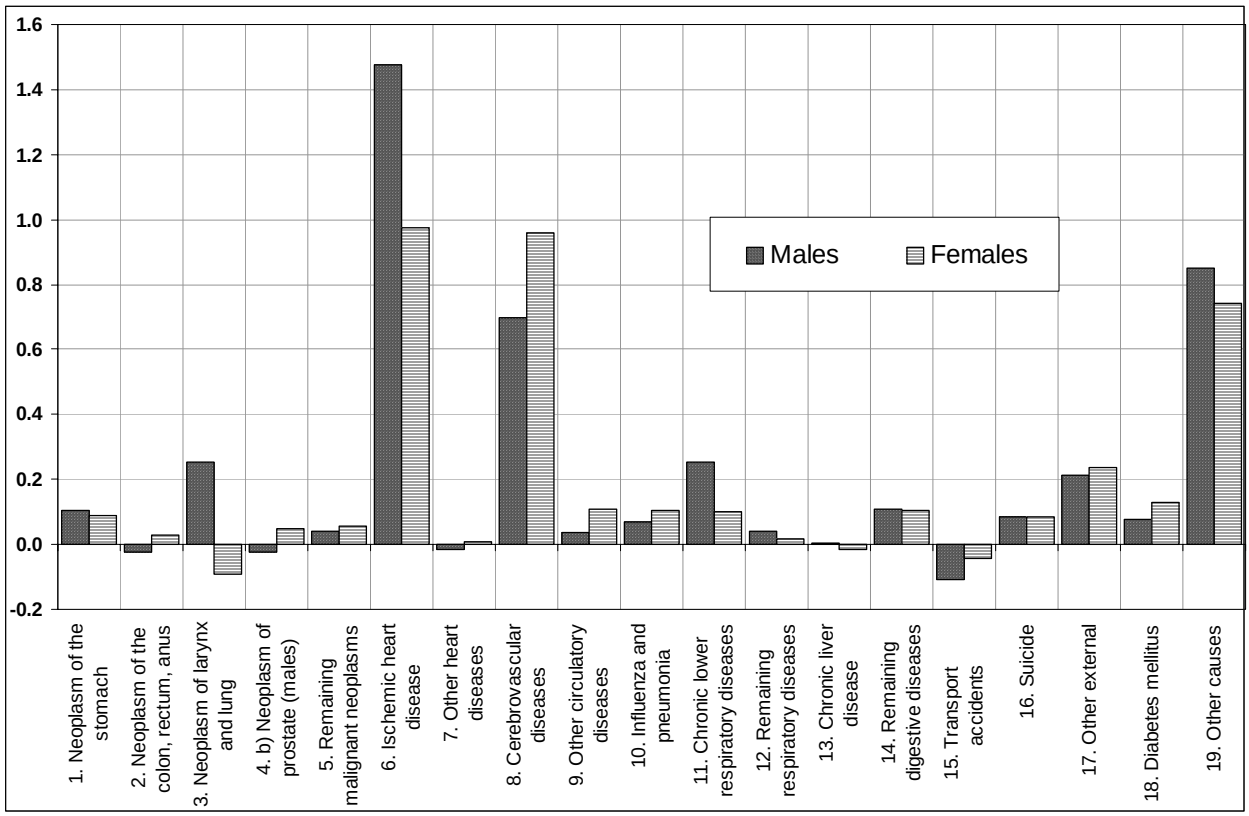


The decrease in advanced ages has been mainly due to diminishing mortality from cardiovascular and cerebrovascular diseases (Figure 3, Table 1). The list of causes and ICD-9 codes valid in the Czech Republic from 1979 to 1993 and ICD-10 codes valid since 1994 are in the Annex. The "cardiovascular" revolution of the West noticed from the 1970s and characterized by a manifest mortality decrease of circulatory diseases has also been observed since the end of the 1980s in the Czech Republic. The decrease in mortality from ischaemic heart disease has been initiated primarily by the considerable use of new technologies and practices (heart surgery and efficient drugs) and less by change in negative consumption habits such as alcohol and smoking. For older males and especially for older females the decrease in cerebrovascular diseases has been of particular importance. The decline of cerebrovascular mortality between 1985 and 2000 has resulted in an increase of about 1 year of life expectancy for women and about 0.7 for men. Nevertheless the biggest gains are observed in cases of ischaemic heart disease (1.5 years for males and at about 1 year for women). Malignant neoplasms, as in many European countries, have not shown a particular

trend; although some amelioration has been seen for neoplasms of the larynx and lung (males) and for neoplasm of the stomach. There has been, however, a noted rise in mortality in young people due to transport accidents, but has not greatly influenced life expectancy at birth.

Figure 3

Gains in life expectancy at birth in the Czech Republic between 1985 and 2000 by cause



Collapsing ages into three main groups of 0-39; 40-64; and 65+, the pronounced decrease in mortality from ischaemic heart disease at the age of 40-64 contributed the most to an observed amelioration of male survival (Table1). The reduction of mortality at age 65+ from cerebrovascular diseases primarily contributed to the prolongation of female survival.

In summary, the current favourable turnover in mortality pattern by cause is related to an important decrease in the age groups of adults (40-64) and the elderly (65+). In spite of the lower mortality level in the age groups of 40-64 compared with 65+, the contributions are almost equal for males (1.5). Female prolongation of life is predominantly attributable to mortality decrease in the age group of 65+.

Table 1

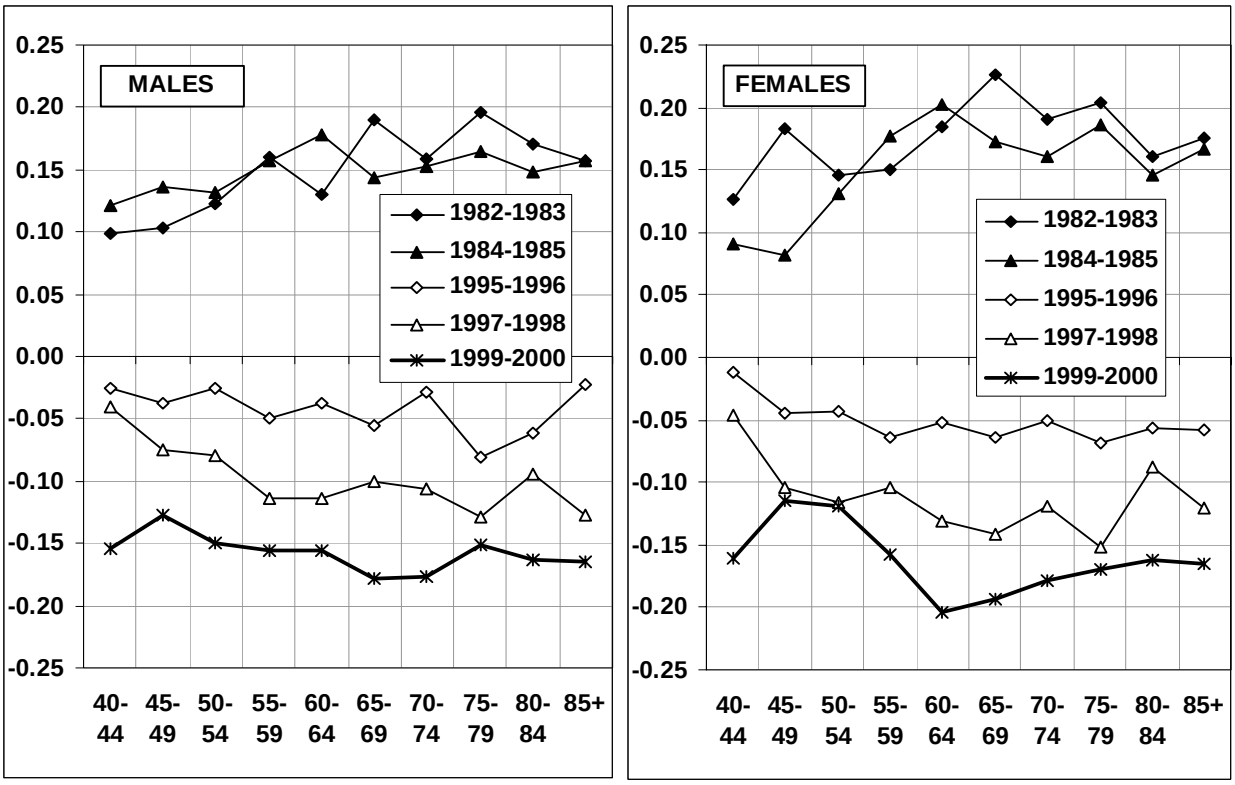
Gains in life expectancy at birth between 1985 and 2000 due to mortality change by age and cause

	Males				Females			
cause	**0-39**	**40-64**	**65+**	**Total**	**0-39**	**40-64**	**65+**	**Total**
1. Neoplasm of the stomach	-0.002	0.051	0.056	***0.106***	0.005	0.026	0.056	***0.087***
2. Neoplasm of the colon, rectum, anus	0.004	0.000	-0.027	***-0.023***	0.009	0.012	0.008	***0.029***
3. Neoplasm of larynx and lung	0.014	0.198	0.041	***0.252***	-0.003	-0.045	-0.043	***-0.091***
4. b) Neoplasm of prostate (males)	0.001	0.000	-0.025	***-0.023***	0.019	0.040	-0.011	***0.047***
5. Remaining malignant neoplasms	0.088	0.001	-0.046	***0.042***	0.030	0.065	-0.037	***0.057***
6. Ischemic heart disease	0.051	0.767	0.660	***1.477***	0.007	0.239	0.727	***0.973***
7. Other heart diseases	0.010	-0.013	-0.011	***-0.014***	0.004	-0.002	0.007	***0.009***
8. Cerebrovascular diseases	0.013	0.251	0.433	***0.697***	0.013	0.204	0.740	***0.957***
9. Other circulatory diseases	0.009	0.043	-0.017	***0.035***	-0.002	0.103	0.007	***0.108***
10. Influenza and pneumonia	0.032	-0.008	0.043	***0.067***	0.031	-0.002	0.078	***0.106***
11. Chronic lower respiratory diseases	0.014	0.100	0.139	***0.252***	0.004	0.041	0.055	***0.100***
12. Remaining respiratory diseases	0.017	0.012	0.013	***0.042***	0.014	-0.005	0.006	***0.015***
13. Chronic liver disease	0.006	-0.030	0.026	***0.003***	-0.004	-0.029	0.015	***-0.017***
14. Remaining digestive diseases	0.040	0.024	0.045	***0.109***	0.025	0.023	0.056	***0.104***
15. Transport accidents	-0.092	-0.022	0.004	***-0.109***	-0.044	-0.003	0.004	***-0.043***
16. Suicide	0.032	0.034	0.019	***0.085***	0.032	0.028	0.025	***0.084***
17. Other external	0.168	-0.004	0.051	***0.215***	0.067	0.000	0.172	***0.239***
18. Diabetes mellitus	0.006	0.035	0.034	***0.076***	0.007	0.050	0.073	***0.130***
19. Other causes	0.684	0.065	0.102	***0.851***	0.565	0.101	0.075	***0.740***
Total	**1.094**	**1.504**	**1.542**	**4.139**	**0.776**	**0.844**	**2.013**	**3.634**

Speed of mortality decline through five time periods

In order to conduct a more in depth study of mortality focusing on the role of education as a differentiating factor of the speed of mortality decline, five time periods have been utilized: 1982-1983; 1984-1985; 1995-1996; 1997-1998; 1999-2000. For these periods mortality data have available information on education on the death certificate. Regarding population distribution by sex, age, and education, data from the censuses of 1980 and 1991 were used (data from the 2001 census are not yet available). The relative frequencies of four categories of education within each age group were estimated: Basic (9 years of school), Vocational (12 years of school), Secondary (at least 12 years of schooling resulting in a ”Maturita” certificate), and University. The proportions (relative frequencies) were calculated for each generation (birth cohort) and applied to population distribution by age and sex on 1st January of 1983; 1985; 1996; 1998, and 2000. These years represent mid-year populations for the above-mentioned two-year time periods. The data deal with the five-year age groups of 40 to 84. Educational level is a reliable variable because it does not change after the age of 40. Sex and age-specific death rates according to education were computed. To measure the speed of mortality decline the rates were transformed to natural logarithms. The average value (i.e., geometric mean) was estimated from five values (corresponding to the five time periods) for each age group. Deviations of individual values from the average within the same age group measure the speed of mortality decline.

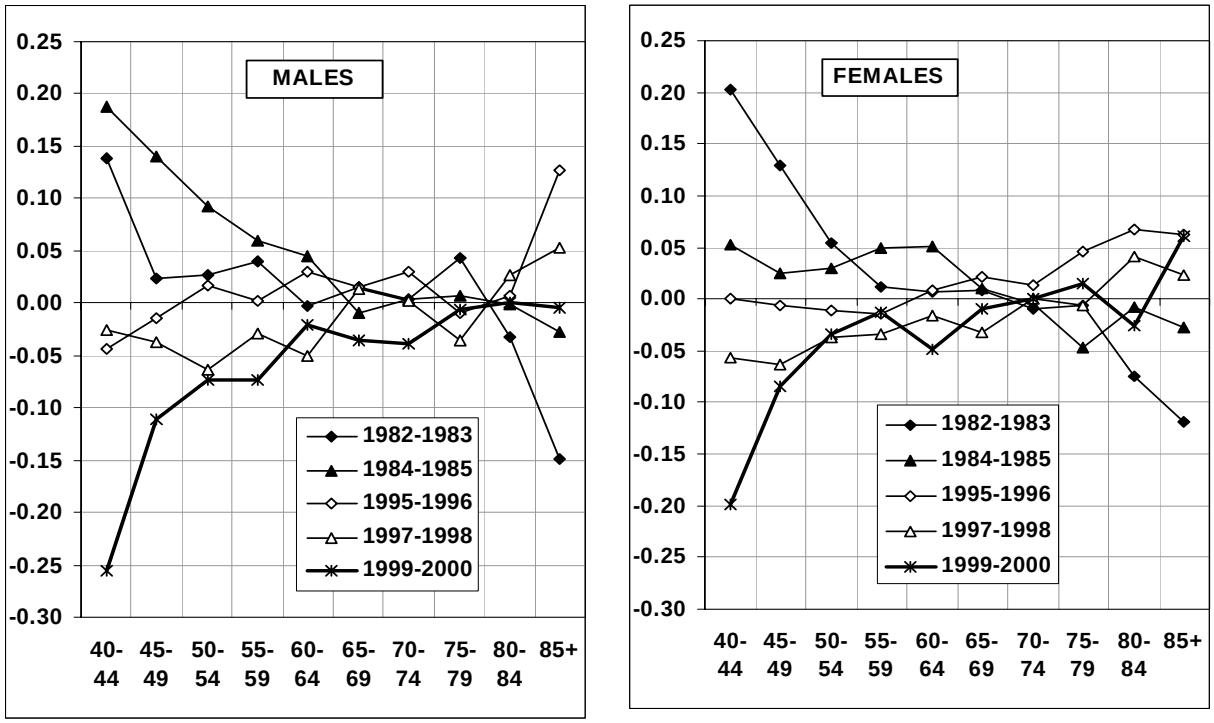
Figure 4 ***Mortality for all causes***
Czech Republic: Relative deviations from average for a given age in five time periods



The 1980s (1982-1983 and 1984-1985) clearly differ from the 1990s (1995-1996, 1997-1998, 1999-2000) for both males and females (Figure 4). While three curves of deviations referring to the 1990s show continuous mortality decline through 1995-2000, the mortality indices of the 1980s are almost at the same level and reflect a stabilized higher level of total mortality. The speed of decline through time is primarily the same for each age group. However, slightly increased values in the 1980s confirm that survival in the 1990s increased slightly faster for the older age groups.

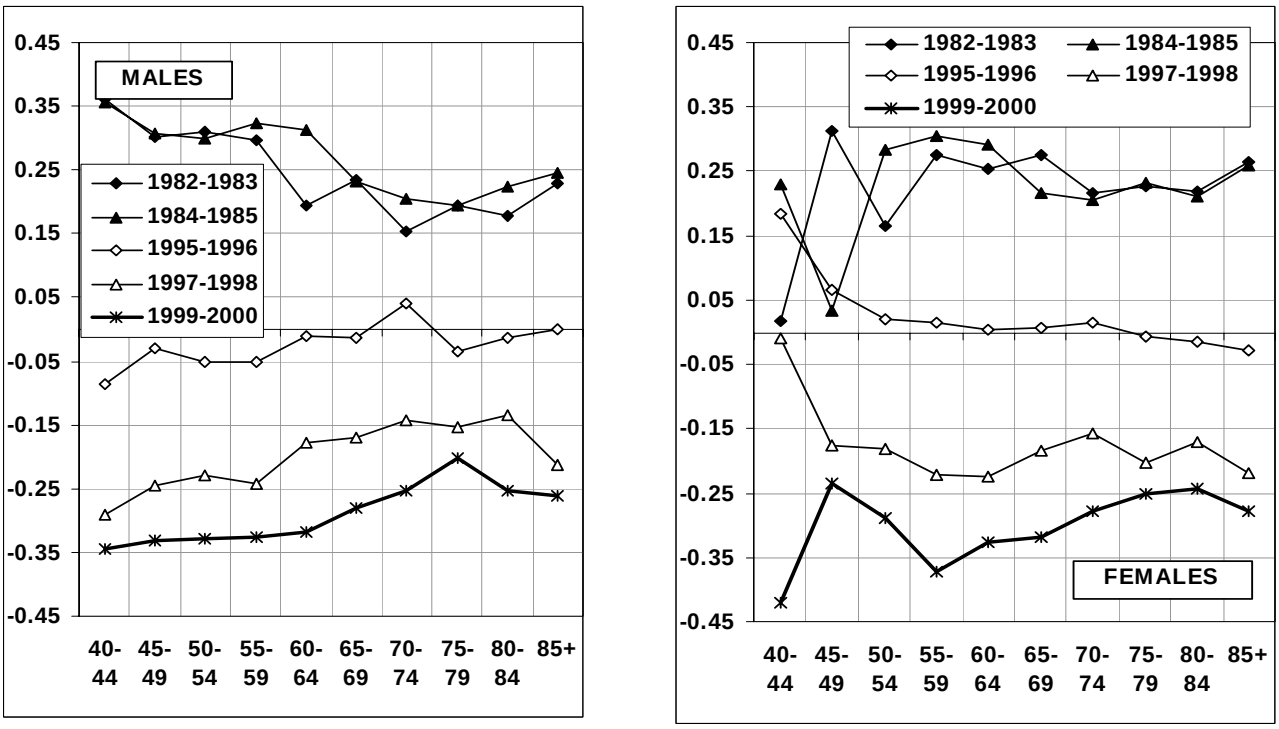
Mortality from malignant neoplasms does not display any time trend or any specific age profile (Figure 5). This result is in line with the previous investigation dealing with gains in life expectancy decomposed by cause. The absence of a significant change of cancer mortality in the Czech Republic is also observed in most European countries.

Figure 5 ***Mortality from neoplasms***
Czech Republic: Relative deviations from average for a given age in five time periods



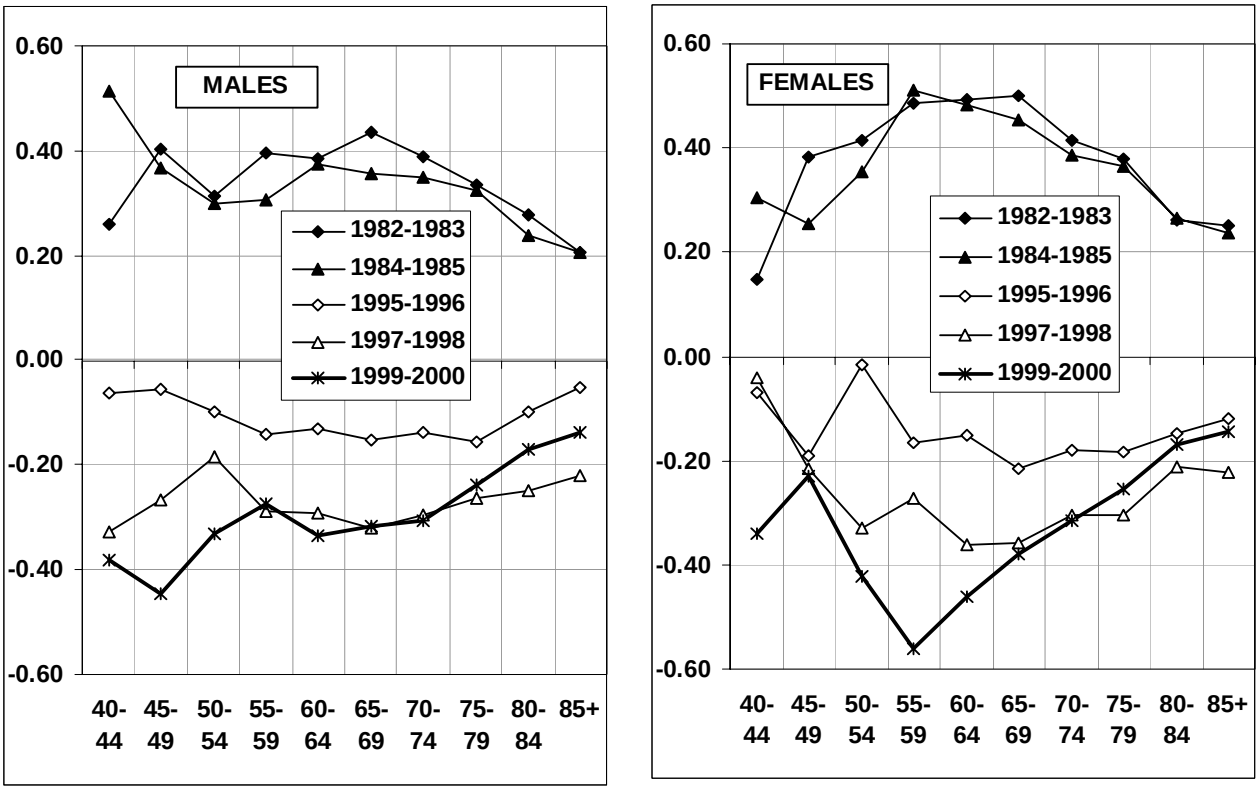
Using the deviations, circulatory diseases that contributed the most to prolong life expectancy at birth show the same trend of decrease between the 1980s and the 1990s (Figure 6).

Figure 6 ***Mortality from ischaemic heart disease***
Czech Republic: Relative deviations from average for a given age in five time periods



Ischaemic heart disease and cerebrovascular disease indices of the 1980s are very distinct when compared with the 1990s. While curves of deviations regarding ischaemic heart mortality exhibit a continuous decline through the 1990s, the change in cerebrovascular mortality (Figure 7) suggests a clear time break between health conditions in the 1980s and the 1990s. The excess mortality due to heart attack and to some extent due to cerebrovascular diseases was important in the pre-retirement age in the 1980s.

Figure 7 ***Mortality from cerebrovascular diseases***
Czech Republic: Relative deviations from average for a given age in five time periods



Educational level can be considered as a proxy for the socio-economic position/class. Higher education enables not only better working conditions, but also influences lifestyle. However, the level of acquired education can be dependent on the health situation. In spite of low social differentiation in former socialist societies and universal access to free health services, differences in mortality according to education were observed [12]. University graduates experienced better health conditions than people with only basic education and having higher mortality. The difference in mortality rate was mainly significant in the younger age groups, but converged in the older age groups. This discrepancy can be explained by the fact that older generations completed their education before World War II and often held higher occupational positions regardless of educational level. However, younger people

educated during the socialist era had to have a specific diploma for specific occupations. In other words, there were more favourable working conditions for the group of older generations with only basic education, and this situation markedly contributed to their improved health indicators [12].

Table 2

MORTALITY from ALL CAUSES

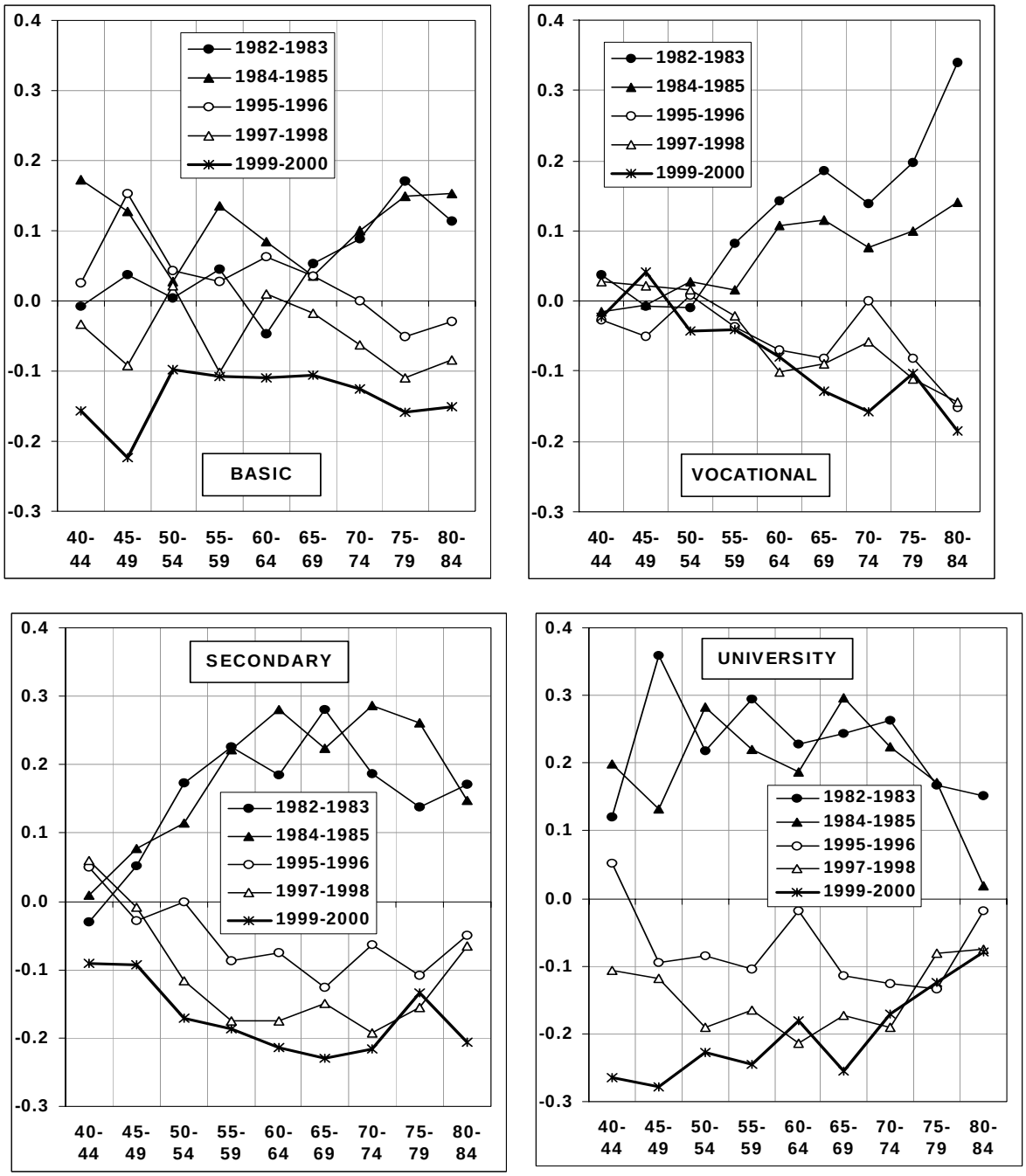
Standardized death rates (European standard) **1982-1983 = 1**

MALES	**40-84**									
	1982-1983	***1984-1985***	***1995-1996***	***1997-1998***	***1999-2000***	***1982-1983***	***1984-1985***	***1995-1996***	***1997-1998***	***1999-2000***
basic	0.03500	0.03649	0.03366	0.03127	0.02889	**1**	1.043	0.962	0.893	0.825
vocational	0.02996	0.02755	0.02370	0.02338	0.02265	**1**	0.919	0.791	0.780	0.756
secondary	0.02496	0.02593	0.01925	0.01809	0.01719	**1**	1.039	0.771	0.725	0.689
university	0.01841	0.01784	0.01358	0.01284	0.01248	**1**	0.969	0.738	0.698	0.678
total	0.02983	0.02958	0.02414	0.02285	0.02159	**1**	0.991	0.809	0.766	0.724

FEMALES	**40-84**									
	1982-1983	***1984-1985***	***1995-1996***	***1997-1998***	***1999-2000***	***1982-1983***	***1984-1985***	***1995-1996***	***1997-1998***	***1999-2000***
basic	0.01736	0.01718	0.01374	0.01260	0.01169	**1**	0.990	0.791	0.726	0.673
vocational	0.01430	0.01306	0.01266	0.01277	0.01265	**1**	0.913	0.885	0.893	0.885
secondary	0.01350	0.01567	0.01186	0.01105	0.01099	**1**	1.161	0.879	0.818	0.814
university	0.01205	0.01115	0.00867	0.00797	0.00748	**1**	0.925	0.719	0.661	0.621
total	0.01652	0.01620	0.01297	0.01217	0.01158	**1**	0.980	0.785	0.736	0.701

Inequalities in mortality according to education are also visible in the data from the 1990s (Table 2). Excess mortality for males and to a lesser extent for females with basic education is particularly striking at the beginning of the 1980s as well as at the end of the 1990s. Rates and ratios in Table 2 suggest that people with basic education have changed their health conditions very little. When comparing 1982-1983 with 1999-2000, the most pronounced relative worsening of health situation can be observed for females with vocational school and that university graduates experienced the most improved health situation (Table 2). The speed of mortality decline at all ages was more significant for males (Figure 8) with a university education. On the contrary, men having only a basic education have not benefited from mortality amelioration occurring in the 1990s in the Czech Republic (Figure 8). A similar pattern of no improvement is also visible for men in pre-retirement age groups and having vocational training, while those with basic education suffer from an unfavourable health situation during their entire life. In the 1990s men with vocational and secondary education benefited with a longer life at the age of 65+ (Figure 8) compared with the 1980s. For females, the patterns are less clear. The information on women's education is less expressive in demographic analyses because the indicators are significantly correlated with a partner's level of education (Figure 9).

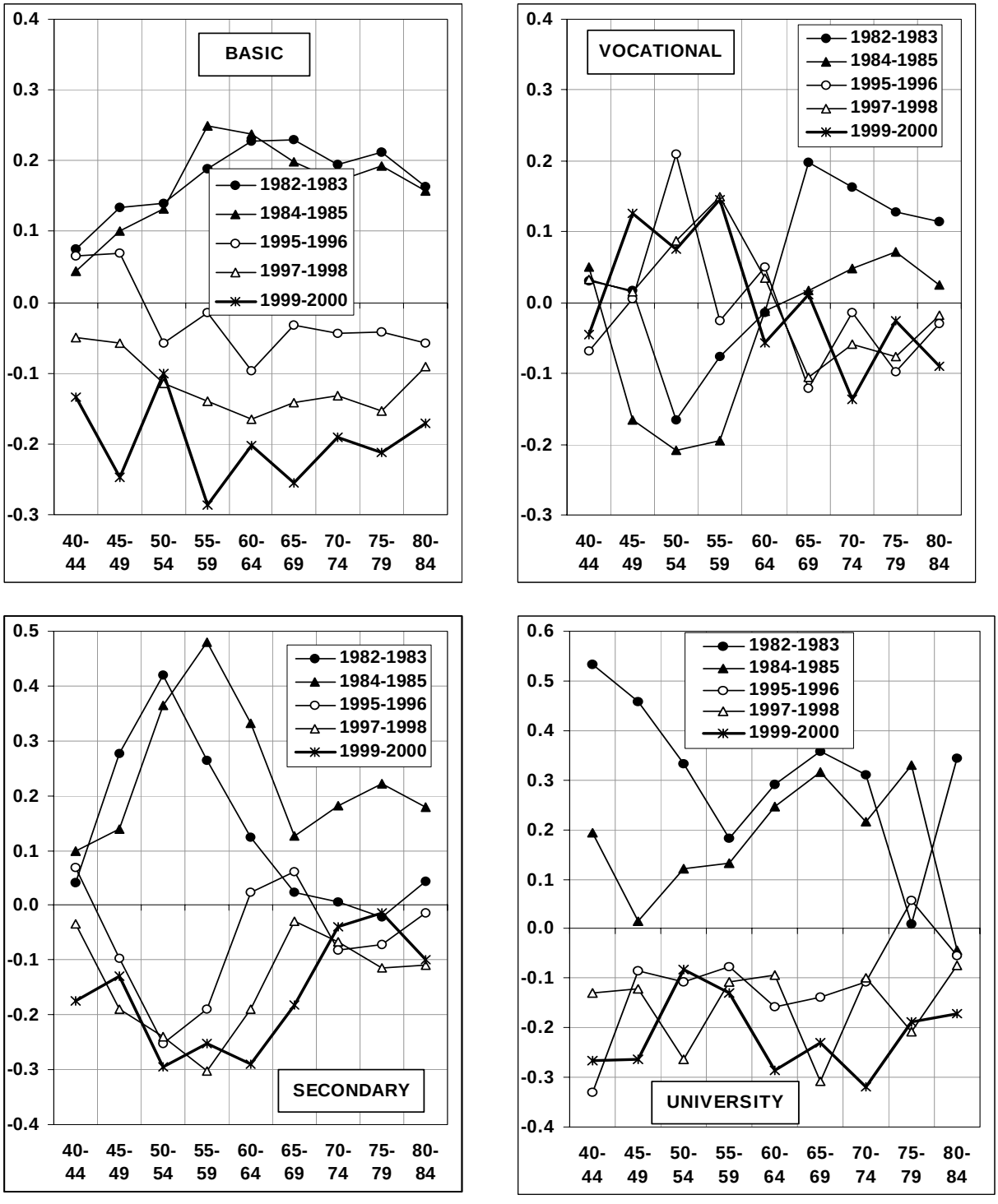
Figure 8 ***Mortality by education MALES***
Czech Republic: Relative deviations from average for a given age in five time periods



Unlike men, women with basic education have benefited from improvements in health conditions in the 1990s (Figure 9). The progress for women with a university degree or secondary education is observable. On the contrary, those with vocational training do not show any specific decline in mortality (Figure 9). To explain factors of the recent mortality change by education would need more extensive information, including unemployment by age, region, and education. Unlike common suppositions, the people benefiting the most from the health transition have been the most educated people living in big cities, rather in western

half of the Czech Republic. These people have also been the most successful in the economic transition. In the former socialist system of government, the blue colour workers were a privileged group, but now face a higher unemployment rate particularly in old mining and outdated-industrial areas.

Figure 9 ***Mortality by education FEMALES***
Czech Republic: Relative deviations from average for a given age in five time periods



III. Correspondence analysis perspective

Correspondence analysis was used in order to illustrate, in a condensed manner, relative mortality change by age and education through five two-year periods. Correspondence analysis (CA) is a multidimensional scaling technique (MDS) where the interest is primarily in joint plots of objects and variables. A basic concept is that of distance related to the issue of similarity or dissimilarity between an object and a variable. Mathematically, CA decomposes the χ^2 measure of association of a table into components in a manner similar to the decomposition of variance in principal components analysis. In CA the coordinates are computed so that each successive coordinate axis accounts for a decreasing portion of the total association (χ^2) between the rows and columns. The first coordinate axis accounts for the largest part of the total association (represented by χ^2 statistic) between the rows and columns. (The coordinates in correspondence analysis are based on the generalized singular value decomposition of the matrix of relative frequencies; χ^2/N is referred to as the total inertia having a similar meaning such as variance in principal components analysis.)

Table 3a **MALES** **Contributions to the Total Chi-Square Statistic**

Percents	B1m	V1m	S1m	U1m	B2m	V2m	S2m
40-44	0.845	0.369	0.547	0.406	1.911	0.236	0.560
45-49	1.724	0.769	0.616	0.369	***2.450***	0.407	0.654
50-54	1.531	1.140	0.383	0.593	1.541	0.474	0.665
55-59	1.024	0.474	0.156	0.351	1.755	0.234	0.259
60-64	0.139	0.471	0.197	0.199	0.829	0.093	0.047
65-69	0.122	0.251	0.144	0.023	0.007	0.039	0.009
70-74	0.005	0.436	0.016	0.172	0.034	0.059	0.324
75-79	0.019	0.001	0.050	0.016	0.085	0.038	0.229
80-84	***2.210***	***3.153***	0.450	0.287	1.966	0.620	0.007
Sum	7.619	7.064	2.559	2.415	**10.576**	2.200	2.753

Percents	U2m	B3m	V3m	S3m	U3m	B4m	V4m
40-44	0.262	1.511	0.046	0.120	0.169	1.457	0.014
45-49	0.600	***4.244***	0.119	0.230	0.509	1.736	0.039
50-54	0.311	***3.080***	0.063	0.162	0.525	***3.584***	0.039
55-59	0.378	1.735	0.001	0.250	0.579	0.976	0.004
60-64	0.151	2.001	0.043	0.178	0.116	2.033	0.073
65-69	0.101	0.619	0.032	0.130	0.213	0.697	0.022
70-74	0.245	0.000	0.273	0.013	0.052	0.000	0.056
75-79	0.286	0.735	0.093	0.032	0.010	0.612	0.030
80-84	0.018	***3.394***	0.044	0.729	1.592	2.908	0.000
Sum	2.352	**17.318**	0.714	1.843	3.765	**14.003**	0.277

Percents	S4m	U4m	B5m	V5m	S5m	U5m	Sum
40-44	0.077	0.243	1.041	0.020	0.124	0.336	**10.297**
45-49	0.141	0.469	1.153	0.010	0.146	0.624	**17.009**
50-54	0.272	0.624	***2.614***	0.063	0.230	0.647	**18.540**
55-59	0.337	0.605	1.516	0.011	0.190	0.747	**11.579**
60-64	0.324	0.519	1.259	0.004	0.218	0.345	9.238
65-69	0.063	0.260	0.493	0.031	0.082	0.491	3.829
70-74	0.102	0.106	0.002	0.027	0.008	0.025	1.955
75-79	0.028	0.213	0.365	0.233	0.191	0.098	3.362
80-84	1.328	1.200	2.587	0.007	0.214	1.476	**24.190**
Sum	2.673	4.240	**11.030**	0.406	1.403	4.789	100.000

B basic V vocational S secondary U university m males
1=1982-1983; 2=1984-1985; 3=1995-1996; 4=1997-1998; 5=1999-200

Analyzed data: mortality rates by age (9 rows) and education in combination with the time period (20 columns: 4 educational levels x 5 time periods) were used. Table 3a (males) of contributions to the total chi-square shows that 61% of the total chi-square statistic is contributed by basic education. Similarly, the two opposite age groups (80-84 and 45-54) together contribute almost 60% to the total chi-square, whereas the ages 65-79 contribute significantly less. The association between the rows (age) and columns (education with time period) is almost one-dimensional for males because the first axis accounts for 91% of inertia (Table 4).

Table 4 ***Row and column coordinates (dimensions) and quality of the fit***

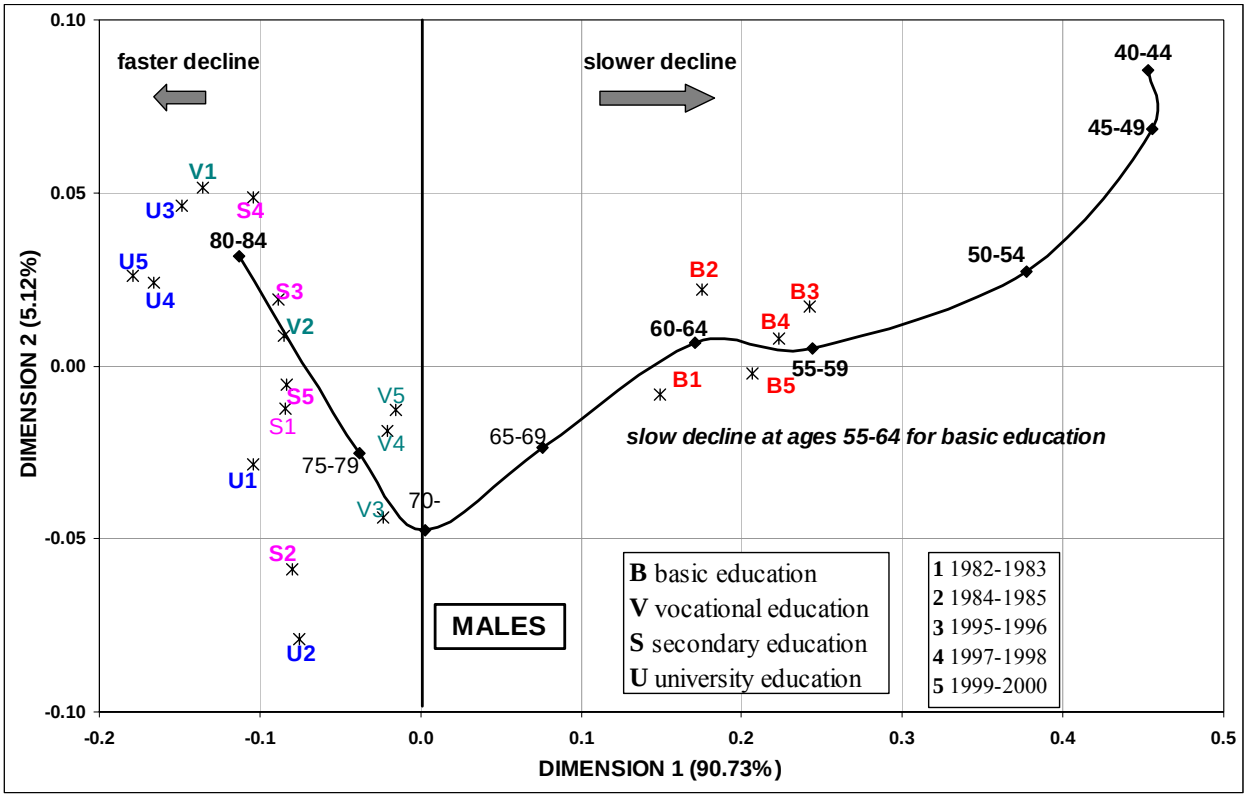
MALES					FEMALES				
	Quality	*Dim1*	*Dim2*	*Best*		*Quality*	*Dim1*	*Dim2*	*Best*
U5m	0.9734	-0.1790	0.0263	**1**	**U1f**	0.9694	-0.1851	0.0863	**1**
U4m	0.9601	-0.1656	0.0240	**1**	**U4f**	0.9651	-0.1841	0.0076	**1**
U3m	0.9742	-0.1486	0.0463	2	**U5f**	0.9330	-0.1656	-0.0293	**1**
V1m	0.9899	-0.1359	0.0515	2	**U3f**	0.9595	-0.1403	-0.0813	**1**
80-84	0.9979	-0.1129	0.0317	2	**80-84**	0.9972	-0.0826	0.0130	**1**
S4m	0.9711	-0.1044	0.0488	2	U2f	0.8990	0.0071	-0.1125	2
U1m	0.9518	-0.1041	-0.0286	2	V4f	0.1154	0.0090	0.0195	2
S3m	0.9074	-0.0883	0.0190	1	B4f	0.0736	0.0092	0.0041	1
V2m	0.9721	-0.0851	0.0087	1	B5f	0.0853	0.0118	-0.0038	1
S1m	0.7450	-0.0842	-0.0124	1	V3f	0.2400	0.0130	0.0275	2
S5m	0.9092	-0.0834	-0.0053	1	V2f	0.6662	0.0134	-0.0504	2
S2m	0.9700	-0.0797	-0.0588	2	V1f	0.3915	0.0200	-0.0321	2
U2m	0.9414	-0.0752	-0.0788	2	S3f	0.3230	0.0298	0.0436	2
75-79	0.6737	-0.0382	-0.0253	2	75-79	0.9730	0.0356	-0.0811	2
V3m	0.8321	-0.0235	-0.0438	2	B3f	0.5162	0.0406	-0.0105	1
V4m	0.6606	-0.0206	-0.0187	2	S5f	0.2784	0.0411	-0.0158	1
V5m	0.2330	-0.0158	-0.0127	2	V5f	0.3486	0.0449	-0.0117	1
70-74	0.8136	0.0031	-0.0475	2	B2f	0.9267	0.0455	-0.0165	1
65-69	0.7604	0.0763	-0.0238	2	B1f	0.9230	0.0495	-0.0218	1
B1m	0.9329	0.1490	-0.0084	**1**	S4f	0.3748	0.0515	0.0322	1
60-64	0.9448	0.1705	0.0066	**1**	S1f	0.8399	0.0546	0.0944	2
B2m	0.9634	0.1748	0.0222	**1**	60-64	0.5042	0.0579	0.0404	2
B5m	0.9828	0.2068	-0.0022	**1**	S2f	0.6597	0.0653	0.0468	2
B4m	0.9699	0.2233	0.0081	**1**	45-49	0.4006	0.0694	0.0702	2
B3m	0.9871	0.2422	0.0171	**1**	50-54	0.4943	0.0878	0.1091	2
55-59	0.9660	0.2437	0.0051	**1**	55-59	0.3970	0.0887	0.0719	2
50-54	0.9879	0.3775	0.0271	**1**	70-74	0.7690	0.0904	0.0289	1
40-44	0.9796	0.4529	0.0855	**1**	40-44	0.2346	0.0942	0.0224	1
45-49	0.9776	0.4553	0.0686	**1**	65-69	0.6813	0.1045	0.0346	1
Percent of Chi-Square		90.73%	5.12%				55.82%	21.89%	

Sorted according to the 1st dimension

The plot (Figure 10) shows that the first dimension correctly orders the age groups (but not for females: see plot 11). The correct order of ages and the contrast of basic to university education reflect ***the shift over time of the Czech male mortality pattern characterized by a faster mortality decline of the elderly and university graduates compared***

with a slower decrease of mortality in adults with basic education. However, referring to Table 4 to the columns labeled Quality and Best, it is seen that only categories indicated in bold black - basic education for each time period, university education for years 1997-2000, and ages 45-64 - are reproduced well on the plot for the first dimension.

Figure 10 ***MALES*** ***Plot of Simple Correspondence Analysis of Mortality change by education and age through five time periods***



The results for females are different. The contributions to the total chi-square (Table 3b) increase with age and are significant for females with university education (60%). The plot (Figure 11) of the association between rows and columns for females contrasts mortality of university graduates and the age group of 80-84 to the remaining age groups and education categories (Table 4). The result of age order is unclear and reflects unspecific relative change by age through the five time periods. Points labeled university are farther from the origin than all other points in the first dimension. The second axis accounts for 22% of data association and the quality of most points is poor (Table 4). Additionally, in the second dimension, ordering by age or education or time period cannot be observed. In summary, relative change in mortality was disproportional by age for males and specific for women with a university education. Mortality of males with basic education primarily resisted significant improvement. The results of correspondence analysis (relative mortality change) do not show

a clear time delineation between periods 1 and 2 compared with periods 3,4 and 5 but, more distinct mortality according to education for females and primarily according to age (with weak impact of education) for males.

Table 3b **FEMALES** **Contributions to the Total Chi-Square Statistic**

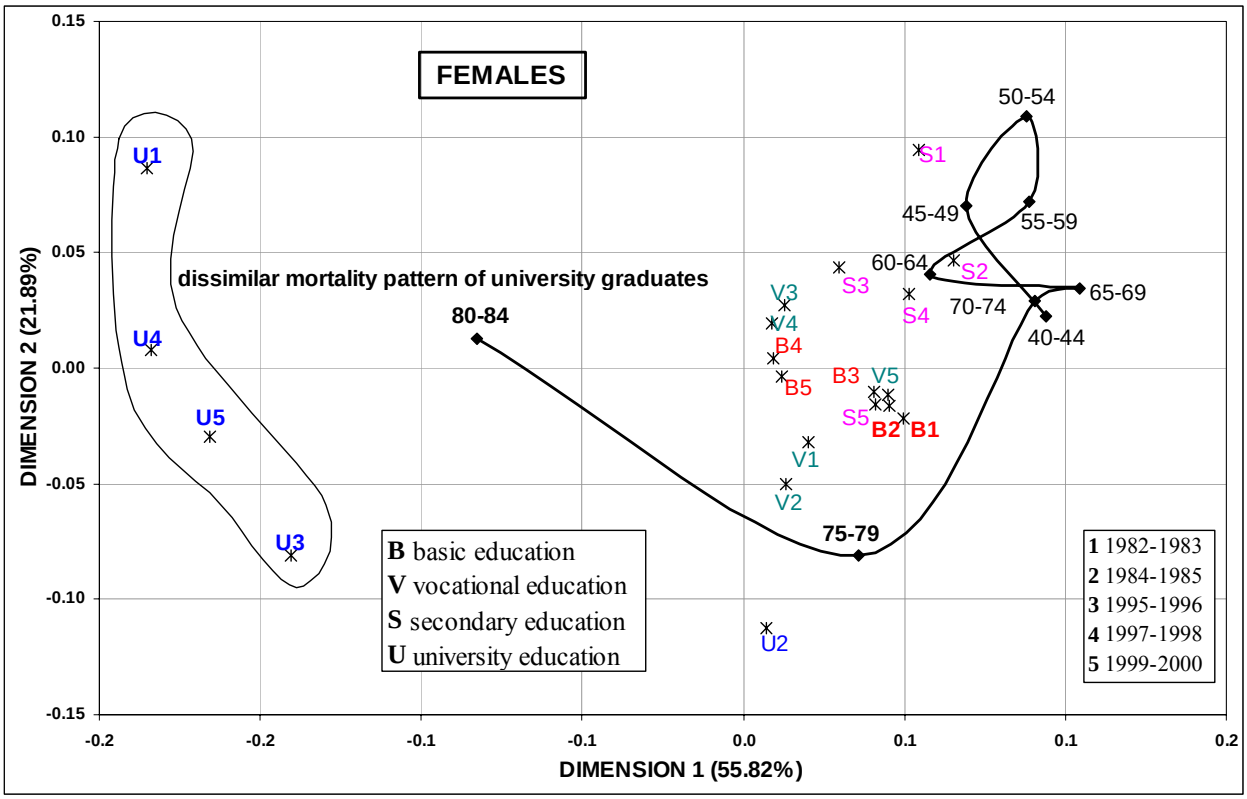
Percents	B1f	V1f	S1f	U1f	B2f	V2f	S2f
40-44	0.027	0.000	0.035	0.013	0.015	0.044	0.136
45-49	0.043	0.062	0.337	0.002	0.023	0.180	0.029
50-54	0.003	0.654	2.295	0.137	0.005	0.446	0.503
55-59	0.018	0.228	1.316	0.707	0.030	0.309	2.339
60-64	0.035	0.181	0.286	0.175	0.096	0.000	0.735
65-69	0.307	0.099	0.531	0.555	0.172	0.072	0.138
70-74	0.073	0.396	0.275	1.604	0.027	0.137	0.523
75-79	0.538	0.249	1.459	***7.013***	0.402	0.715	0.176
80-84	1.006	0.146	0.299	***11.392***	0.846	0.154	0.964
Sum	2.051	2.015	6.834	**21.598**	1.614	2.058	5.543

Percents	U2f	B3f	V3f	S3f	U3f	B4f	V4f
40-44	0.147	0.404	0.011	0.000	0.488	0.264	0.081
45-49	0.351	0.430	0.007	0.019	0.188	0.228	0.007
50-54	0.260	0.029	0.572	0.200	0.338	0.045	0.097
55-59	0.274	0.000	0.084	0.120	0.335	0.037	1.006
60-64	0.001	0.064	0.428	0.176	0.679	0.055	0.280
65-69	0.023	0.098	0.440	***2.319***	1.992	0.006	0.385
70-74	0.759	0.049	0.156	0.208	***2.791***	0.007	0.001
75-79	***4.032***	0.186	0.087	0.768	0.607	0.000	0.021
80-84	0.308	0.485	0.035	0.034	2.626	0.015	0.024
Sum	6.154	1.745	1.820	3.844	**10.045**	0.656	1.902

Percents	S4f	U4f	B5f	V5f	S5f	U5f	Sum
40-44	0.003	0.174	0.225	0.031	0.079	0.215	2.392
45-49	0.029	0.124	0.030	0.176	0.007	0.194	2.467
50-54	0.056	0.493	0.231	0.122	0.160	0.036	6.682
55-59	0.213	0.181	0.176	1.194	0.121	0.080	8.771
60-64	0.053	0.097	0.004	0.035	0.455	0.484	4.319
65-69	1.787	***2.830***	0.025	0.039	0.068	1.180	13.065
70-74	1.345	1.291	0.038	0.188	1.648	***3.375***	14.891
75-79	0.344	0.804	0.023	0.427	0.063	0.010	17.924
80-84	0.248	***5.918***	0.042	0.657	0.319	***3.971***	29.489
Sum	4.079	**11.913**	0.795	2.868	2.920	9.545	100.000

B basic V vocational S secondary U university f females
1=1982-1983; 2=1984-1985; 3=1995-1996; 4=1997-1998; 5=1999-200

Figure 11 ***FEMALES*** ***Plot of Simple Correspondence Analysis of Mortality change by education and age through five time periods***



Conclusion

In the Czech Republic from the beginning of the 20th century and during the interwar period, mean length of life increased and was close to the levels observed in France. During the post-war period, in particular from the mid-1960s to the mid-1980s, deterioration of the survival rate was observed. Forty-one years of socialist government control placed former Czechoslovakia into the Eastern European block at least from two perspectives - economic and demographic. However, since the collapse of the socialist system at the beginning of the 1990s there has been a reappearance of a new decline in mortality. The recent favourable development has currently brought the Czech Republic a little closer to the European average. There are two sets of factors (medical and social/behavioural) to be considered for explaining the recent favourable turnover of mortality. During the 1990s mortality from circulatory diseases decreased significantly. At the same time the use of cardiovascular drugs and the number of operations of invasive heart-surgery considerably increased. In addition, the structure of treatment shifted from traditional medicines to the new generations of drugs [new beta blockers, long acting Calcium channel blockers, ACE (angiotension converting enzyme) inhibitors, hypolipidemics - statins, etc.]. ACEI, hypolipidemics and antiplatelets have become predominant in the use of cardiovascular drugs. The surgical and invasive procedures such as coronary artery by-pass grafts, valve replacements and angioplastics have also

significantly increased. Regarding lifestyle, smoking and alcohol consumption have slightly increased. However, there has been a positive shift from animal to vegetable fats and increased opportunity to buy a wider variety of healthy fruits and vegetables. The recent decline in mortality is likely to be attributable to technical progress in medical treatment and less affected by the change in lifestyle.

References:

1. 'A decade of transition' (2001), Regional Monitoring Report no 8, UNICEF

2. Bairoch, P. (1981) 'The Main Trends In National Economic Disparities since the Industrial Revolution, in *Disparities in Economic Development since the Industrial Revolution*, eds. P.Bairoch and Lévy-Leboyer. London : MacMillan.

3. 'Central and Eastern Europe in Transition Public Policy and Social Conditions. Crisis in Mortality, Health and Nutrition'. (1994), Economies in Transition Studies. Regional Monitoring Report, UNICEF

4. Kirk D. (1946), 'Europe's population in the interwar years', Office of Population research, Princeton University, League of Nations, 303p.

5. Omram, A.R. (1971), 'The Epidemiologic Transition: A Theory of the Epidemiology of Population Change' Milbank Memorial Fund Quarterly, 49:509-532

6. Pollard, J. (1988), Causes de décès et espérance de vie: quelques comparaisons internationales. in Mesure et analyse de la mortalité: nouvelles approches. Cahier no199. Paris,INED,PUF. P.291-313

7. Pressat, R. (1985). Contribution des écarts de mortalité par âge à la différence des vies moyennes. Population 4-5: p.766-770

8. Rychtaříková, J. Vallin J., and F.Meslé (1989) ,Comparative study of mortality trends in France and the Czech Republic since 1950', *Population English Selection I*, 44, September, p.291-321

9. Rychtaříková J. (1997) ,Reappearance of historical inequalities in health during the Eastern European Transition',1997, Proceedings of the XXIIIrd General Population Conference, Beijing, China, p.509-528

10. Rychtaříková J (1998) 'La république tchèque va-t-elle sortir de la crise de santé de l'Europe de l'Est?' *Espace, Populations, Sociétés*, 3, p. 371-379

11. Rychtaříková J (1998) 'Une tournure favorable de la mortalité tchèque contemporaine'. *Acta Universitatis Carolinae Geographica*, XXXIII, 2, p.43-58

12. Sobotík, Z., J.Rychtaříková (1992): Úmrtnost a vzdělání v České republice, (Mortality and Education in the Czech Republic) *Demografie*, 34, 1992, 2, p.97-105

13. Vallin J., Meslé F., and Valkonen T. (2001), 'Trends in mortality and differential mortality', population studies , no36, 332p. Council of Europe Publishing

Annex

Selected causes of death with their ICD-9 codes and ICD-10 codes

CAUSE OF DEATH	**ICD – 9**	**ICD - 10**
Neoplasms:		
1. Neoplasm of the stomach	151	C16
2. Neoplasm of the colon, rectum, anus	153 – 154	C18-C21
3. Neoplasm of larynx and lung	161 – 162	C32-C34
4. a) Neoplasm of breast (females)	174 – 175	C50
b) Neoplasm of prostate (males)	185	C61
5. Remaining malignant neoplasms	Remainder of 140 – 208	C00-C97
Circulatory diseases:		
6. Ischemic heart disease	410 – 414	I20-I25
7. Other heart diseases	420 – 423, 425 – 429	I30-I52,
8. Cerebrovascular diseases	430 – 438	I60-I69
9. Other circulatory diseases	Remainder of 390 – 459	I00-I99
Diseases of the respiratory system:		
10. Influenza and pneumonia	487, 480 – 486	J10-J11, J12-J18
11. Chronic lower respiratory diseases	490 – 494, 496	J40-J47
12. Remaining respiratory diseases	Remainder of 460 – 519	J00-J99
Diseases of the digestive system		
13. Chronic liver disease	571.0 – 571.9	K70, K73-K74
14. Remaining digestive diseases	Remainder of 520-579	K00-K93
External causes of death:		
15. Transport accidents	E800 – E848	V01-V99
16. Suicide	E950 – E959	X60-X84
17. Other external	Remainder of E800 – E999	V01-Y89
18. Diabetes mellitus	**250**	**E10-E14**
19. Other causes	**Remainder of 001 – E999**	**A00-Y89**