Socioeconomic Environment and Mortality: A two-level Decomposition by Sex and Cause of Death

by

Martin Gächter
Engelbert Theurl

Working Paper No. 1010

September 2010

Supported by the Austrian Science Funds

FWF

The Austrian Center for Labor Economics and the Analysis of the Welfare State

JKU Linz
Department of Economics
Altenberger Strasse 69
4040 Linz, Austria
www.labornrn.at

Corresponding author: martin.gaechter@uibk.ac.at
phone +43 (0)512-507-7164, -2970 (fax)

Socioeconomic Environment and Mortality: A two-level Decomposition by Sex and Cause of Death

Martin Gächter*† and Engelbert Theurl*

Abstract

Gender inequalities in longevity/mortality are a major area of research since the 1970s. Despite substantial insights, the questions posed and the research strategies used are still in a state of flux. In the present paper we shed some light on the question, to which extent socioeconomic variables determine the gender gap in mortality for important causes of death. Thereby we specifically focus on behavior-related causes of death. We follow an ecological approach based on aggregated mortality data from Austria both at the community and the district level covering the time period 1969 - 2004. By using weighted regression analysis (panel fixed effects, pooled and cross section) we find that higher income levels reduce male mortality in most causes of death (including malignant neoplasms and diseases of the circulatory system), while this indicator appear to be insignificant for female mortality in these causes. This indicates that the decreasing effect of the higher socioeconomic status on mortality might be canceled out by a „gender role equalization" effect for women due to the adoption of unhealthy life styles (e.g. smoking). This finding is also confirmed by the fact that female mortality does not decrease with increasing income levels for smoking-related diseases, ischaemic heart disease and lung cancer. Thus, our results suggest that the decreasing female mortality advantage is mainly caused by increased smoking among women, while in the case of alcohol, violence and accidents the gender equalization seems to work in the opposite direction. In a nutshell, we conclude that the examination of the gender-specific mortality rates and mortality gaps without a disaggregation between different causes of death might mask important patterns of the epidemiological transition and the underlying drivers.

JEL classification: I12, I18, J16
Keywords: mortality, gender differential, causes of death, life expectancy, Austria

*University of Innsbruck, Department of Economics and Statistics; Universitaetsstrasse 15, A-6020 Innsbruck, Austria; Corresponding Author: martin.gaechter@uibk.ac.at.

†University of Linz, Department of Economics; *The Austrian Center for Labor Economics and the Analysis of the Welfare State*; Altenberger Strasse 69, A-4040 Linz, Austria.

1 Introduction

Since the Second World War mortality in Europe underwent substantial transformations. Until the mid of the 1980s a continuous decrease in the mortality level was accompanied by (i) a widening gender gap in life expectancy in favour of women, (ii) the convergence of life expectancy between states and (iii) an epidemiological transition leading to changes in the mortality structure. More recent data show further increases in life expectancy on average, but signs of divergence in life expectancy between states and a decrease in the gender gap in mortality. These changes were accompanied by fundamental changes in life style, social and economic relationships, the educational level, family roles and employment. The observed epidemiological changes and their interaction with socioeconomic variables have attracted the interest of various scientific disciplines. Thereby the female advantage in mortality/life expectancy is one important dimension (for literature reviews and empirical evidence see Kalben 2002, Case/Deaton 2003, Case/Paxson 2004, Cutler/Meara 2001, Cutler et al. 2006, Trovato/Lalu 2005, Trübswetter/Klasen 2007, Waldron 1986, Waldron 2000 or Zielonke 2007). Summing up, we are able to identify three main approaches in the literature dealing with the gender mortality gap, namely (i) *biological-genetic*, (ii) *environmental-behavioral* and (iii) *economic*.

Biological-genetic differences can influence the gender gap in mortality either directly or indirectly. There exist various biological-genetic theories to explain the mortality gap such as the role of the X-chromosomes, androgens, estrogens and progestins, iron overload, natural selection etc. (for an overview see Kalben 2002 or Luy 2002). To isolate the biological-genetic effect from the behavioral-environmental factors different empirical approaches have been used, such as empirical evidence from animals (see Kalben 2002), examinations of differences in prenatal and neonatal mortality between female and male foetus and babies (see Sahn/Stifel 2002 and Siow/Zhu 2002) or studies of groups of the population with similar behavioral-environmental determinants, such as nuns and monks (see, for instance, Luy 2003). Overall, it seems clear that biological variables explain the gender mortality gap to some extent; however, the observed changes in the life expectancy gap can hardly be substantiated by biological factors alone.

Behavioral-environmental approaches focus on the role of working conditions, social roles, environmental behavior, political and civil rights a. s. o. A wide array of studies try to explain mortality differences by consumption behavior, in particular by highlighting the role of smoking (see Pampel 2002, Boback 2003, Valkonen/Poppel 1997, Preston/Wang 2005 among others), alcohol and accidents (Pampel 2001).

There are only a few papers which apply economic approaches to explain the gender gap in mortality/longevity. Within these approaches longevity basically is the result of the

(optimal) amount of investment in life extension (for the basic model see Galor/Weil 1996). To account for differences in the embedment of the optimization different models are used. In this line of research, Klasen (1998) developed an intra-household resource allocation model to explain the excess female mortality during the Early German Development 1740 - 1860. Felder (2006) studied the gender longevity gap in Switzerland by applying different utility functions for singles and couples.

Previous research on the gender gap in mortality predominantly focused on the relationship between socioeconomic variables and overall mortality rates. Studies on the effect of these variables on mortality rates broken down by cause of death are rare. As far as overall mortality rates are concerned, previous research based on ecological approaches (for an extended literature review see Gächter et al. 2010) indicated that lower mortality rates correlate directly with (i) a higher socioeconomic status and higher income, (ii) the strength of social (familial) networks, (iii) the share of immigrants in a community/region, and (iv) the homogeneity of the population in a community/region. Moreover, (v) men show a stronger sensitivity than women to changes/differences in the socioeconomic environment (implying that the male mortality disadvantage decreases with improving living conditions), and finally, (vi) the influence of socioeconomic variables on the gender mortality gap also depends on the corresponding 'gender gaps' in these variables.

Koskinen and Martelin (1994) argue that the socioeconomic mortality gradient varies by causes of death, and thus, that the differences in the sensitivity of mortality rates by gender could be restrained to specific death causes. Their results are confirmed by the study of Mackenbach et al. (1999). They analyzed mortality data from the US, Finland, Norway, Italy, the Czech Republic, Hungary and Estonia and conclude that the larger socioeconomic inequalities in total mortality among men as compared to women is largely due to sex differences in the cause-of-death pattern. Jemal et al. (2008) examined the effect of education on cause-specific and total mortality in the three largest ethnic groups in the US. They find that low educational attainment (as a marker for the socioeconomic status) is strongly correlated with higher death rates. Despite their interesting results on the effect of education on mortality rates (distinguishing between different ethnicities and death causes), no further control variables are included in their estimations. Conti et al. (2003), by examining gender differentials in life expectancy in Italy from 1970 to 1997, conclude that the slight reduction of the gender differential since 1980 seems to be the result of the recent adoption of unhealthy life styles by women together with an opposite process run by young men towards healthier behavior. Similarly, Spijker et al. (2007) conducted an analysis on the gender gap in mortality in the Netherlands, using data from 40 regions with a median size of about 300.000 inhabitants. Following the study by Waldron (2000), the study tries to identify behavioral, socioeconomic and gender specific

factors to explain the gender mortality gap. Their study also offers a disaggregation of death causes, albeit only to a limited extent. By using lung cancer as a proxy for smoking, they show that smoking plays an important role in determining the magnitude of the gender gap in mortality. However, other socioeconomic variables, such as employment, education and gender roles, also appeared significant in the estimations, albeit a consistent pattern of causality between those variables and both male and female mortality rates could not be identified. Strand and Kunst (2006) use data from Norway to show the influence of the socioeconomic status during childhood on adult health, distinguishing both by gender and cause of death. They find that a low childhood socioeconomic position is associated with increased mortality for most causes of death, except for breast cancer. Interestingly, for suicide in women, a low socioeconomic status during childhood was even protective. Moreover, adult socioeconomic position accounted for the associations for total mortality and most causes of death. Wong et al. (2006) investigated the contribution of specific causes of death to the sex difference in premature mortality, measured by years of potential life lost (YPLL). They conclude that YPLL from all causes are greater among men than women, while the largest contributors to the sex difference in YPLL were traumatic deaths due to violence and risk related factors (including homicide, motor vehicle accidents and suicide), cardiovascular disease, and lung cancer, accounting for as much as three-quarters of the excess YPLL among men. Overall, previous research work to some extent lacks in systematically linking cause-specific mortality data to socioeconomic characteristics simultaneously. Thus, it is difficult to derive comprehensive conclusions for the effect of the socioeconomic environment on cause- and gender-specific mortality rates from these studies.

In the following study, we want to reduce some of these shortcoming by offering an analysis, which is mainly explorative. We study the simultaneous influence of various socioeconomic variables on mortality broken down by sex and cause of death. We subsequently compare these results with the findings on overall mortality differentiated by sex. The characterization „explorative“ is valid in several respects. From a conceptual point of view, individual differences in the health status are influenced (i) by individual characteristics (ii) by the level and structure of individual characteristics at an aggregate level (f. e. local community, region, state) and (iii) by contextual factors at an aggregate level (see Diez Roux 1998). This would call for multilevel theories and multilevel data sets for studying gender differences in disease specific mortality rates. Both preconditions are only met to a very limited extend, leaving space for reduced form approaches and one level data sets. We are aware of the objection of Kruger and Nesse (2004) against such approaches. They argue that „more pieces of data would perhaps slightly improve prediction, but no amount of data can substitute for a theoretical framework that can join all the pieces of the puzzle together. Reports of sex differences in mortality rates and factors that influence them

provide only a descriptive explanation. A causal explanation for sex differences in mortality must be based on an understanding of how sex differences were shaped by natural selection, and how those differences interact with environmental factors to create observed patterns and variations“ (Kruger/Nesse 2004, p. 75). The data basis for our dependent and independent variables are aggregated data at the local level from 2377 Austrian communities and 118 districts. Thus, our study stands out both due to its two-level design (by using data at the local community as well as the district level) and the detailed decomposition of mortality rates by gender and main causes of death. Additionally, we particularly focus on the diseases which are assumed to be behavior-related to a high extent (for details see the next section). Moreover, our data set offers a panel structure of four (two) periods at the district (community) level, giving more comprehensive insights into the linkages between socioeconomic variables and mortality than earlier studies by being able to control for unobserved variables. We are aware of the diverse problems of aggregated data in this context. The regional entities for our data sets are not homogenous as their borderlines are not drawn by research related criteria. In addition, there might exist spatial autocorrelation. While our results cannot be assigned to mortality risks for individuals, the considerable variations between communities both in mortality rates and socioeconomic conditions, however, can nevertheless be helpful to identify important determinants of disease specific mortality rates, both for males and females. Furthermore, we are aware of the possibly raised problems caused by the disconnection between the level of analysis and the level of inference (see, for instance, Sheppard 2003, Diez-Roux 1998 or Greenland/Morgenstern 1989). However, we take account of this „ecological bias“ problem by applying a two-level approach. By doing so, we basically follow the suggestion by Robert (1999) who proposed to „include information about self-defined communities or at least purposefully delineate community boundaries to more closely match the theoretical constructs being tested“ (p. 509).

The remainder of the paper is organized as follows. Section two explains the data set. The main findings are presented in section three. Finally, section four draws some conclusions.

2 Data

2.1 Dependent Variables

We extracted sex-specific Standardized Mortality Rates (SMR) for the 2377 communities and 118 districts[1] using information from the *Atlas of Mortality in Austria by Causes of*

[1]Following the NUTS-classification the local community level is LAU2. There were minor changes in the number of the local communities within the observation period due to unification movements. We

Death (Statistik Austria 2007). Official death records include information on the place of residence, age, sex and cause of death. This information is combined with the results of the population census (1971, 1981, 1991 and 2001) to calculate the corresponding SMR.[2] To minimize the problems of small numbers, mortality cases sorted by age, gender and cause of death are aggregated for longer time periods. At the district level seven-year periods around the population census years 2001(1998-2004), 1991 (1988-94), 1981 (1978-84) as well as a five-year period for the 1971 census (1969-73) were used. At the community level, due to their smaller size, even longer periods were used, namely 16 years for the first period (1969-84) and 17 years for the second period (1988-2004). For the interpretation of our data this approach means, that we rely on „trend-information", which is planished from short-run effects. The difference in the age structure between regions and between different time periods is accounted for by age-standardization.[3]

To investigate the effect of socioeconomic variables on cause-specific mortality rates, we use the five main causes of death for our regression analysis, namely

adjusted for these changes in our data. Vienna is counted as 23 local communities mirrowing the districts in Vienna. In the Austrian political system local communities act as agents in the administration of public functions of the central state and the provinces and fulfill several task self-governed. The mean population of the communities is 3373, the median is 1575 (in period two).

Districts are geographically separated jurisdictions below the NUTS3-level and above the LAU1-level. Their only purpose is to act as agents of the central state and the provinces within the administration of public policy, they are without any legislative authority.

Local communities and districts are traditional units of the official statistics in Austria in various fields, nowadays at least partially substituted and complemented by the NUTS-classification. On both levels of aggregation we are confronted and aware of the different „boundary problems" of regional epidemiologic analysis. See Diez Roux 1998, Flowerdey et al. 2008.

[2]For each death case the registrar must formulate a death certificate which is to be filled in by the coroner stating the cause of death. This death certificate must then be forwarded to Statistics Austria, where these data are centrally processed and codified. The data files on deaths cover all those persons listed in the resident population who have died in Austria. From an international perspective the documentation of deaths and also of death causes in Austria is pretty good.

[3]In the case of our data set, the method of direct standardization was used. More precisely, the age-specific death rates were broken down into five-year age group intervals for each gender and region. Subsequently, they were applied to the corresponding age group of the standard population, providing the expected number of deaths for the standard population. By summing these expected numbers of death by age group and dividing them by the total standard population, we obtain the SMR, which allow comparisons of mortality rates across regions as well as between periods. The same standard population (WHO-European standard) was employed for all analyzed periods. In the case of communities, the method of indirect standardization was applied. This method weights the age-specific reference rates with the age structure of the investigated population (instead of the WHO-European standard population) and calculates the expected number of deaths within a community. Subsequently, the SMR is then calculated by the ratio of observed to expected death incidences, as explained above. However, as the study population at the community level was chosen gender-specific (the gender-specific SMR in the community relative to the gender-specific average of the whole population), these SMR are not appropriate to compare mortality rates of males and females. Thus, we calculated ratios of the SMR to the gender-specific average by dividing the SMR by the national average by gender. Thereby we get comparable mortality rates for males and females and are able to calculate the gender mortality gap at the community level as well. For details about the method of direct standardization of SMR see Statistik Austria (2007).

- malignant neoplasms (contributing 26.53% to overall mortality),
- diseases of the circulatory system (45.78%),
- diseases of the respiratory system (5.09%),
- diseases of the digestive system (5.04%), and
- injury and poisoning (6.97%).

These main causes add up to 89.42% of total mortality, leaving 10.58% to all other causes (values are given for an average of the two last periods, namely 1988-94 and 1998-2004). In addition to the main causes mentioned above, we separate the mortality by important underlying risk factors in order to get an idea about the influence of behavioral factors on the gender mortality gap, namely

- transport accidents,
- ischaemic heart diseases,
- alcohol related diseases,
- lung cancer, and
- smoking related diseases.

The classification of these risk factors (ICD-10-Codes are reported in *Tables 1 and 2*) is included in the official mortality data in Austria, based on information from death certificates reported by physicians.

Table 1 gives an overview of the shares of the (main) causes contributing to overall mortality and the differences of death causes by gender (country-wide average of the mortality data of the two last periods, namely 1988-94 and 1998-2004). While the shares of malignant neoplasms on total mortality only differ slightly between genders, the higher share of diseases of the circulatory system (48.38%) on female mortality compared to male mortality (43.56%) is remarkable. However, this higher share must not be mixed up with mortality rates, as the male/female mortality ratios for the same cause of death amounts to 1.51. Thus, although more females die due to diseases of the circulatory system, mortality is still higher for men (because men die younger on average). The second interesting difference can be observed for deaths due to injury and poisoning, which is a death cause with strong behavioral dimensions. As expected, the share is higher for male mortality than for female. As shown in *Table 1*, the male/female mortality ratio is always larger than one for all selected causes, indicating that females have a mortality advantage in all

Table 1: Causes of death selected for the study

	ICD-10-Code	Overall	Males	Females	M/F ratio
Malignant neoplasms	C00-C97	26.53	27.13	26.71	1.67
Diseases of the circulatory system	I00-I99	45.78	43.56	48.38	1.51
Diseases of the respiratory system	J00-J99	5.09	5.93	4.59	2.22
Diseases of the digestive system	K00-K93	5.04	5.34	4.32	2.14
Injury and poisoning	V01-Y89	6.97	8.26	4.68	2.79
Other causes	—	10.58	9.79	11.32	1.37
Transport accidents*	V01-V99	1.67	2.00	1.03	3.28
Ischaemic heart diseases*	I20-I25	19.97	21.10	18.75	1.94
Alcohol related diseases*	see notes	11.26	13.70	7.16	3.07
Lung cancer*	C33-C34	5.01	6.47	3.23	3.99
Smoking related diseases*	see notes	39.12	41.80	36.20	1.96

Notes: Causes of death selected for the study as a percentage of total mortality, and the male to female mortality ratio, Austria 1988-2004. Main causes of death are written in **bold** and sum up to 100% in total. Causes selected with * are no main causes, but were selected for the study to obtain results on behavioural aspects of mortality rates. Alcohol-related diseases ecompass the ICD-10-Codes C15, C32, F10, K70, K73,K74, K76, V00-V99, W00-W99, X00-X99, Y00-Y99, while smoking-related diseases include the ICD-10-Codes C00-C14, C32-C34, C15, I20-I25, I60-I69, J40-J47.

observed causes of death. However, the ratios differ quite strongly. While the ratio is moderate for malignant neoplasms (1.67) and diseases of the circulatory system (1.51), injuries and poisoning (2.79) exhibits the highest M/F ratio among the main causes of death. Regarding the remaining death causes, the gender differences are even stronger. More precisely, lung cancer exhibits the highest ratio (3.99), followed by transport accidents (3.28) and the broader category of alcohol related diseases (3.07). Thus, as expected, the gender differences are more distinctive in behavioral-related death causes. At first sight, this confirms the biological-behavioral approach by Carey and Lopreto (1995), who explain the excess male mortality particularly by causes associated with violence (such as accidents), alcohol and smoking.

Table 2: Change of Male/Female Mortality Rates and Ratios by Causes of Death

Period	**1969-1973**			**1978-1984**			**1988-1994**			**1998-2004**		
Variable	Males	Females	M/F Ratio	Males	Females	M/F Ratio	Males	Females	M/F Ratio	Males	Females	M/F Ratio
Malignant neoplasms	288.67	186.33	1.55	281.44	170.61	1.65	266.18	160.43	1.66	232.27	138.90	1.67
Diseases of the circulatory system	674.84	476.45	1.42	644.59	421.83	1.53	498.45	326.83	1.53	372.94	251.63	1.48
Diseases of the respiratory system	118.06	59.62	1.98	77.93	36.67	2.12	56.32	24.32	2.32	50.75	23.89	2.12
Diseases of the digestive system	101.35	50.43	2.01	87.06	39.19	2.22	64.09	28.91	2.22	45.74	22.49	2.03
Injury and poisoning	150.63	60.88	2.47	127.74	49.32	2.59	92.86	34.34	2.70	70.72	24.33	2.91
Other causes	166.74	116.95	1.43	108.67	79.55	1.37	80.83	61.06	1.32	83.81	58.87	1.42
Transport accidents	60.67	16.08	3.77	42.11	11.32	3.72	27.14	8.15	3.33	17.15	5.36	3.20
Ischaemic heart diseases	278.46	159.97	1.74	264.54	125.23	2.11	220.60	109.06	2.02	180.70	97.50	1.85
Alcohol related diseases	212.87	75.92	2.80	191.04	64.95	2.94	149.82	49.75	3.01	117.28	37.23	3.15
Lung cancer	75.41	9.32	8.09	74.44	11.44	6.51	67.03	13.86	4.84	55.42	16.81	3.30
Smoking related diseases	610.96	346.05	1.77	563.27	285.09	1.98	450.70	224.41	2.01	357.89	188.28	1.90

Notes: Male and female mortality rates and corresponding ratios for the causes of death selected for the study.

Table 2 reports the male/female mortality ratios and their development over the four periods and reveals several interesting patterns. While the ratio is continuously decreasing over time for transport accidents and lung cancer, a reversed trend is observable for injury, poisoning and alcohol related diseases. The remaining causes mostly feature a peak in one of the two mid-periods, which fits with the well-known development of the overall gender gap in mortality (in Western countries). There we observe increasing rates until the mid-1980s and decreasing gender gaps since the mid-1990s. At first sight, one could conclude that the increasing equalization of gender roles leads to converging mortality rates for some causes, including lung cancer and transport accidents, while this is not the case for other causes of death. Thus, an analysis considering socioeconomic determinants of cause-specific mortality could reveal interesting insights.

As shown in *Figures 1 and 2* (Appendix), the resulting gender mortality gap (overall mortality) is almost normally distributed. Moreover, we observe a negative gender gap (and thus, a male mortality advantage) in only 22 out of 2377 communities. Interestingly, the standard deviations for the gender mortality gap in malignant neoplasms and diseases of the circulatory system is much higher than for the remaining main causes of death (as shown in the „wider“ distributions in Figure 2).

2.2 Independent Variables

Subsequently, we give an overview of our explanatory variables and how they are calculated. Due to the explorative character of our study we do not present theory based hypotheses and previous empirical findings on the shape of these relationships.

- ***Social and familial attachments:*** To investigate the effects of different familial networks, we consider the following variables from the census, namely
  - the average number of people living in a household,
  - the share of one-person households,
  - the share of households comprising a couple with children,
  - the share of households comprising a couple without children, where the woman is 40 or older,
  - the share of single-households with children,
  - the average number of children per family,
  - the average birth rate per woman, age-standardized,
  - the share of divorced women, in percent of the ever married, and

– the share of female singles, age 40-59.

As expected, we observe a high correlation between those dimensions. Thus, a principal component analysis seems to be appropriate to combine the various characteristics into one single variable. As we included nine variables in our analysis, and the eigenvalue of the first factor amounts to 6.29, the resulting factor explains approximately 70% of the total variance. Factor loadings are reported in *Table 10* (Appendix). Average household size, couple with children, the average number of children per family and the age-standardized number of births per woman are negatively correlated with the factor, while the remaining variables mentioned above influence the factor in the reverse direction, namely one-person households, couples without children, singles with children, the share of divorced women and the share female singles in the age between 40 and 59. To sum up, traditional family structures including a couple with children or more people living in a household exercise a negative influence on the factor. On the contrary, one-person households, couples without children, singles with children and a higher share of divorced or single women increase the resulting factor. By reversing the factor (multiplying it by -1) we are able to interpret the resulting variable as „Social and familial attachments“, with increasing values of the factor indicating a higher level of social attachments and familial solidarity (for a similar approach see Anson 2003).

At the districts level, we apply the same method to calculate our measure for social and familial attachments within a region. While the factor analysis yield qualitatively the same result compared to the community level (not shown), we only used eight variables, as the average birth rate per woman was not available for the first period at the district level (1971). Despite of that minor difference between the two geographical levels in terms of calculation of the variable we do not expect any difference in terms of interpretation, as we try to measure a single dimension of social and familial attachments in both cases.

- ***Level of education:*** To measure the impact of education on mortality, we consider five groups of educational levels. To calculate an average education level, we multiplied the numbers of persons in each group with the corresponding level of education, and divided the sum of the subgroups by the population above 15 years, as indicated in equation (1),

$$Edu = \frac{\sum_{L=1}^{5} POP_L * L}{POP_{15}} \tag{1}$$

where L corresponds to the level of education, POP_L is the population in each

subgroup, and POP_{15} is the overall population above 15 years. The factors used for the education level were (1) compulsory school, (2) apprenticeship or secondary education, (3) higher school certificate (general qualification for university entrance), (4) an additional education after this school-leaving certificate (e.g. a polytechnic education or a college) excluding university education, and finally (5) a university degree or equivalent.[4] Thus, we get an index measuring the average educational level, (theoretically) ranging from 1 to 5 within regions where increasing values indicate a higher level of education, respectively. Subsequently, the same method was applied to gender-specific educational levels.

- ***Education heterogeneity:*** To measure inequality in socioeconomic variables within a community or district, we calculated the standard deviation of the educational level, corrected for the average level of education in each region. More precisely, we calculated the education heterogeneity variable by

$$H_{edu} = \frac{\sqrt{\sum_{L=1}^{5}(L-\mu)^2 * s_L}}{\mu} \tag{2}$$

  where L corresponds to the educational level (ranging from 1 to 5), μ is the average educational level within the community, and s_L is the share of the subgroup (by educational level) in the population older than 15. At the district level we use a slightly different methodology, as we use the mean of the above calculated education heterogeneity across communities as an explanatory variable (as we think that districts are too heterogeneous to apply the same methodology as used for the community level).

- ***Work participation rate:*** Depending on the estimation, we use overall, gender-specific and/or the gap in the participation rate as explanatory variables.

- ***Population origins:*** As we are able to distinguish between the share of immigrants from Turkey or former Yugoslavia, and other foreigners, we have to differentiate. While we expect that mortality will be lower the higher the overall share of foreigners, the effect of immigrants from Turkey and Yugoslavia is not clear. This is mainly due to their traditional employment status, as most of them (or their ancestors) came into the country because there was a lack of unskilled workers in the fast growing economy of the 1960s and 1970s.

[4] As the Austrian education system differs quite strongly from other countries, we also included in this „highest“ level of education the degrees for primary and secondary school teachers and similar educations which formally do not belong to university degrees in Austria, but would yield a bachelor's degree according to international standards.

- ***Average net income:*** On the district level, we include the gross regional product (GRP) as an explanatory variable.[5] Unfortunately, net income is only available for the second period at the community level (average net income data from tax authorities from 2004). Thus, in the case of communities, we are not able to include it in our pooled regression model as we would loose the observations of the first period.

Table 3: Summary statistics (community level)

	Mean		**Std. Dev.**		**Min.**		**Max.**	
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2
Gender mortality gap	528.638	384.225	162.067	98.544	-1023.08	-199.938	1814.170	1204.319
Standardized mortality, males	1398.147	954.757	185.770	131.533	501.927	288.993	2875.495	2158.581
Standardized mortality, females	869.508	570.532	137.555	94.030	402.022	71.325	2508.721	1576.902
Net income	—	18043.227	—	2060.918	—	6981.000	—	28236.000
Social & familial attachments	0.366	-0.344	0.978	0.893	-1.583	-2.130	3.340	2.439
Foreigners, others	1.398	3.253	1.489	2.368	0.000	0.000	36.131	45.600
Foreigners, Turkey & Yugoslavia	2.459	5.595	2.881	4.666	0.000	0.000	18.919	25.900
Participation rate, share	44.939	49.512	2.566	1.812	29.800	38.000	57.800	63.300
Male participation rate, share	56.746	56.861	2.142	1.508	30.900	31.700	66.300	69.500
Female participation rate, share	34.244	42.546	4.673	3.074	14.500	21.000	51.400	56.100
Participation rate, gender gap	22.502	14.316	5.262	3.165	4.200	-5.000	44.000	40.400
Education, average level	1.676	2.040	0.228	0.239	1.096	1.329	2.516	2.942
Male education, average level	1.862	2.162	0.276	0.249	1.138	1.324	2.947	3.152
Female education, average level	1.518	1.927	0.202	0.239	1.000	1.311	2.210	2.761
Education, gender gap	0.344	0.235	0.093	0.064	-0.037	-0.337	0.743	0.578
Education, heterogeneity	0.526	0.543	0.042	0.032	0.270	0.329	0.640	0.630

Notes: Means and standard deviations are weighted by population. Gender gap variables were calculated as the difference between the *male share* and the *female share* of the variable. Mortality rates reported are calculated for period one (1969-1984) and two (1988-2004) at the community level and correspond to all death causes. The remaining values correspond to the population census 1981 (period 1) and 2001 (period 2), respectively.

Summary statistics both of our dependent as well as independent variables are reported in *Table 3*. Means and standard deviations are weighted by the community size (population). Overall, a considerable gender gap in mortality is observable, although there are also a few communities with a „negative“ gender gap, indicating a male mortality advantage. As expected, the gender mortality gap decreases from period one to two, as male mortality rates are decreasing more quickly than female mortality rates. Furthermore, we observe a considerable deterioration in terms of social and familial attachments from period one to two, as well as an increasing share of foreigners. The increase in the overall participation rate is (almost only) due to the sharp increase in female participation rates (increasing

[5]Due to statistical changes this variable is only available until 1986. Therefore we used the value of the year 1986 as a proxy for the third period at the district level (mortality data from 1988-94), while we used the corresponding year of the population census for period one (1971) and two (1971). For the fourth period, we used aggregated (individual) net income data at the community level to calculate a corresponding GRP index at the district level. Subsequently, we calculated a (relative) index for each district and each period that is equal to 100 on average. In order to make the values comparable, we then calculated a consistent index based on the fourth period (where it is equal to 100 on average) and multiplied the indices of earlier periods by the Austrian average GDP (as a percentage of 2004 GDP).

from 34.2% to 42.5%). Accordingly, the gender gap in participation rates decreases from 22.5% to 14.3% in period two. In terms of education, we observe an increasing level of education on average, while female education is increasing more quickly, and thus, the gender gap in education decreases. Interestingly, the heterogeneity in terms of education (as a measure of social status) increases (slightly) over time. In total, as the variables differ considerably between communities, our investigation of socioeconomic determinants of mortality rates by using aggregated data should give interesting results.

3 Findings

3.1 Overall Mortality

We start our empirical analysis with an analysis of the influence of socioeconomic variables on overall mortality rates and the corresponding gender gap. As we use these results as a benchmark for the remaining findings of cause- and gender-specific mortality rates, we focus on the most important findings for overall mortality. For a more detailed discussion of the results see Gächter et al. (2010).

Weighted regression results of male and female mortality rates as well as the resulting gender gap are shown in *Table 4*, including estimation results both at the community (pooled model) and district level (panel fixed effects). Both for males and females, mortality is ceteris paribus lower with stronger social and familial attachments, a higher share of foreigners and a higher level of education. As indicated by the standardized beta coefficients, the influence is much higher on male mortality rates as compared to females. These results are basically confirmed at the district level, where male and female mortality is negatively influenced by social and familial attachments and foreigners (except for foreigners from Turkey and Yugoslavia). Interestingly, the negative influence of higher income levels and education is only confirmed for males, but not for females, confirming once again the suggestion that male mortality rates are more sensitive to socioeconomic influences than females, and the (at least partly) negative effect of the change in the socioeconomic status for women (because of unhealthy life styles and risky behavior due to the equalization of gender roles). The influence of participation rates seems quite interesting, as increasing female participation rates are linked to higher mortality rates, both for males and females (while the male participation rate appears negative, but non-significant). The direction of this effect is confirmed at the district level, albeit the coefficients for female participation rates are non-significant. The impact of labor participation is not clear from a theoretical perspective, as higher participation rates, on the one hand, usually correspond to higher income and educational levels, but on the other hand might also lead to less time invest-

Table 4: Empirical Results - Overall Mortality

Dependent variable	**Gender Gap**		**Males**		**Females**	
Regional Level	Community	District	Community	District	Community	District
Method	Pooled	FE	Pooled	FE	Pooled	FE
Income (gross regional product)		-1.451***		-1.111**		0.257
		(-3.640)		(-2.243)		(0.619)
		-0.326***		-0.103**		0.035
Social & familial attachments	-80.864***	17.095	-107.736***	-45.118*	-25.601***	-55.529***
	(-20.473)	(0.867)	(-22.669)	(-1.753)	(-7.175)	(-2.594)
	-0.546***	0.163	-0.399***	-0.178*	-0.137***	-0.322***
Foreigners, others	-2.354**	-27.544***	-9.888***	-10.402*	-3.224***	15.796***
	(-1.981)	(-5.606)	(-7.280)	(-1.767)	(-2.967)	(3.184)
	-0.036**	-0.448***	-0.084***	-0.070*	-0.039***	0.156***
Foreigners, Turkey & Yugoslavia	-2.277***	0.551	-5.202***	8.816**	-2.242***	11.473***
	(-3.526)	(0.199)	(-6.737)	(2.400)	(-3.858)	(4.316)
	-0.067***	0.019	-0.084***	0.126**	-0.052***	0.241***
Participation rate, share	-0.221	12.147***				
	(-0.196)	(3.340)				
	-0.005	0.393***				
Participation rate, gender gap	-0.369	3.000*				
	(-0.490)	(1.706)				
	-0.015	0.162*				
Education, average level	-281.022***	15.094	-287.720***	-241.452**	-75.794***	-45.864
	(-20.465)	(0.170)	(-19.521)	(-2.393)	(-5.954)	(-0.485)
	-0.577***	0.043	-0.324***	-0.287**	-0.127***	-0.079
Education, gender gap	141.733***	-149.941				
	(5.014)	(-1.507)				
	0.083***	-0.112				
Education, heterogeneity	-135.625**	439.324*	-296.232***	-21.999	-256.187***	-327.926
	(-2.026)	(1.847)	(-3.714)	(-0.083)	(-4.243)	(-1.353)
	-0.035**	0.175*	-0.042***	-0.004	-0.052***	-0.079
Period	-84.928***	-74.833**	-422.539***	-157.262***	-293.921***	-135.347***
	(-11.474)	(-2.527)	(-55.398)	(-4.525)	(-45.590)	(-4.351)
	-0.284***	-0.767**	-0.775***	-0.665***	-0.777***	-0.841***
Male participation rate, share			-1.92	1.78	-1.006	-7.317**
			(-1.333)	(0.507)	(-0.903)	(-2.552)
			-0.013	0.012	-0.01	-0.075**
Female participation rate, share			1.856***	3.435	2.396***	1.59
			(2.733)	(1.175)	(4.547)	(0.663)
			0.041***	0.079	0.077***	0.054
Constant	1168.024***	-16.37	2625.989***	1903.622***	1410.374***	1573.201***
	(14.534)	(-0.064)	(27.113)	(5.741)	(18.897)	(6.024)
N	4739	449	4739	449	4739	449
R^2	0.327	0.804	0.707	0.953	0.636	0.932

Notes: The first value reports regression coefficients, t-statistics are reported in parentheses. The third value corresponds to standardized beta coefficients. *, **, *** denote 10%, 5% and 1% significance levels. Regressions are weighted by community/district size (population). The *Pooled* Model includes all observations from both periods (including a dummy variable for period two), while *FE* corresponds to a fixed effects model at the district level. The *Education (average level)* variable corresponds to overall education (gender mortality gap) and male/female educational level (mortality rates), respectively. These notes also apply to the following Tables 5-9.

ments in health. While the conventional explanation proposed that excess male mortality is caused by greater male labor force participation is also not supported by earlier empirical studies, our results rather indicate that higher levels in female participation rates increase male (and female) mortality rates. Overall, the larger beta coefficients in the regressions of male mortality indicate a stronger sensitivity of male mortality to social and economic conditions, and the higher goodness-of-fit values also confirm a higher explanatory power for male mortality rates.

The gender gap in total mortality decreases, as expected, with increasing social and familial attachments, a higher educational level and a higher share of foreigners (including both foreigners from Turkey and Yugoslavia as well as others). Moreover, the gender gap in education shows a significantly positive coefficient, indicating an increasing mortality gap with higher differences in education between men and women, while the influence of work participation rates is not significant. According to this result, the growing gender equality in European societies would actually imply a decrease of the female mortality advantage. Surprisingly, the influence of education heterogeneity appears negative in our estimation, which might be due to the considerable positive correlation with the overall educational level. The time dummy for period two shows a negative coefficient, confirming the result that the gender gap in mortality decreased over time. Most findings are confirmed at the district level (applying panel fixed-effects), where we are also able to show that the gender gap in mortality decreases with increasing income (as measured by the gross regional product). The negative influence of foreigners is also confirmed, while social and familial attachments appear non-significant in this estimation. While the sign of educational heterogeneity is reversed (confirming the impression of non-robust results concerning this variable), the gender gap in education also appears non-signficant in our estimation. However, as the gender gap in participation rates is significantly positive, the results validate the main finding at the community level, namely that increasing gender equalization (as expressed by decreasing gender gaps in education or participation rates, respectively) leads to converging mortality rates among genders.

The next section decomposes total mortality into its main causes and examines the sensitivity of gender-specific mortality rates to socioeconomic variables.

3.2 Decomposition by Main Causes of Death

As most of the above observed patterns also apply to the cause-specific estimations of mortality rates, we will focus on differences of death causes as compared to overall mortality in this section. Empirical results are reported in *Tables 5-7* (gender-specific mortality of the main causes of death) and *Tables 8-9* (behavioral-related causes of death).

Table 5: Empirical Results - Part 1

Cause of Death	**Malignant neoplasms**						**Diseases of the Circulatory System**					
ICD-10-Code	C00-C97						I00-I99					
Dependent variable	**Gender Mortality Gap**		**Males**		**Females**		**Gender Mortality Gap**		**Males**		**Females**	
Regional Level	Community	District	Community	District	Community	District	Community	District	Community	District	Community	District
Method	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE
Income (gross regional product)		-0.203		-0.420***		-0.208**		-0.924***		-1.512***		-0.461
		(-1.401)		(-3.012)		(-2.186)		(-3.557)		(-4.437)		(-1.634)
		-0.213		-0.321***		-0.234**		-0.390***		-0.276***		-0.112
Social & familial attachments	-14.518***	-0.375	-25.631***	5.189	-10.212***	3.218	-41.975***	4.295	-49.306***	-41.996**	-7.530***	-46.748***
	(-9.700)	(-0.052)	(-18.136)	(0.716)	(-12.058)	(0.657)	(-17.433)	(0.334)	(-17.576)	(-2.372)	(-3.249)	(-3.220)
	-0.308***	-0.017	-0.539***	0.169	-0.337***	0.154	-0.512***	0.077	-0.364***	-0.327**	-0.069***	-0.484***
Foreigners, others	-1.772***	-4.173**	-3.022***	-3.490**	-0.443*	0.601	-0.452	-21.855***	-4.110***	-18.968***	-1.342*	4.582
	(-3.933)	(-2.334)	(-7.482)	(-2.106)	(-1.717)	(0.530)	(-0.623)	(-6.827)	(-5.127)	(-4.683)	(-1.902)	(1.362)
	-0.086***	-0.316**	-0.145***	-0.193**	-0.033*	0.049	-0.013	-0.668***	-0.069***	-0.251***	-0.028*	0.081
Foreigners, Turkey & Yugoslavia	-0.262	0.26	-0.358	0.939	0.119	-0.033	0.469	-0.505	-0.920**	4.530*	-1.119***	6.717***
	(-1.070)	(0.258)	(-1.558)	(0.909)	(0.859)	(-0.055)	(1.192)	(-0.280)	(-2.019)	(1.793)	(-2.964)	(3.725)
	-0.024	0.042	-0.033	0.111	0.017	-0.006	0.025	-0.033	-0.029**	0.128*	-0.045***	0.252***
Participation rate, share	-1.108***	2.913**					1.03	8.402***				
	(-2.595)	(2.201)					(1.498)	(3.545)				
	-0.078***	0.439**					0.042	0.511***				
Participation rate, gender gap	-0.378	1.380**					-0.153	1.927*				
	(-1.326)	(2.156)					(-0.333)	(1.682)				
	-0.05	0.348**					-0.012	0.196*				
Education, average level	-58.958***	43.727	-51.474***	99.225***	-3.891	9.345	-94.474***	40.593	-83.253***	-30.852	-27.784***	-30.241
	(-11.331)	(1.350)	(-11.744)	(3.493)	(-1.288)	(0.432)	(-11.286)	(0.700)	(-9.570)	(-0.444)	(-3.360)	(-0.471)
	-0.380***	0.576	-0.329***	0.974***	-0.04	0.134	-0.350***	0.216	-0.187***	-0.073	-0.080***	-0.094
Education, gender gap	36.376***	56.516					116.253***	72.577				
	(3.396)	(1.561)					(6.747)	(1.120)				
	0.067***	0.197					0.122***	0.102				
Education, heterogeneity	41.845*	126.143	52.909**	111.539	-14.595	-48.035	-6.112	281.035*	-209.089***	239.764	-245.668***	-107.496
	(1.650)	(1.457)	(2.231)	(1.488)	(-1.018)	(-0.866)	(-0.150)	(1.813)	(-4.441)	(1.309)	(-6.264)	(-0.654)
	0.034*	0.235	0.043**	0.151	-0.018	-0.096	-0.003	0.211*	-0.059***	0.078	-0.086***	-0.046
Period	15.525***	-6.496	-26.057***	-31.877***	-32.909***	-13.314*	-44.453***	-23.662	-227.811***	-68.918***	-160.616***	-57.188***
	(5.535)	(-0.603)	(-11.488)	(-3.258)	(-21.505)	(-1.871)	(-9.852)	(-1.226)	(-50.600)	(-2.883)	(-38.354)	(-2.710)
	0.163***	-0.31	-0.271***	-1.111***	-0.538***	-0.683*	-0.268***	-0.456	-0.832***	-0.575***	-0.728***	-0.635***
Male participation rate, share			-0.861**	3.853***	0.031	0.78			1.483*	4.938**	1.384*	-0.149
			(-2.009)	(3.899)	(0.116)	(1.189)			(1.744)	(2.045)	(1.912)	(-0.077)
			-0.033**	0.220***	0.002	0.066			0.020*	0.068**	0.023*	-0.003
Female participation rate, share			-0.221	0.098	0.112	-0.326			2.009***	3.634*	1.761***	1.913
			(-1.094)	(0.119)	(0.893)	(-0.594)			(5.009)	(1.808)	(5.145)	(1.177)
			-0.028	0.019	0.022	-0.091			0.089***	0.165*	0.097***	0.115
Constant	219.832***	-179.158*	442.189***	-89.802	218.900***	186.920***	337.813***	-311.759*	1009.415***	377.329*	646.463***	555.519***
	(7.219)	(-1.932)	(15.352)	(-0.962)	(12.356)	(3.129)	(6.895)	(-1.878)	(17.656)	(1.654)	(13.335)	(3.136)
N	4739	449	4739	449	4739	449	4739	449	4739	449	4739	449
R^2	0.046	0.211	0.167	0.632	0.215	0.72	0.184	0.676	0.596	0.911	0.548	0.893

Table 6: Empirical Results - Part 2

Cause of Death	**Diseases of the Respiratory System**						**Diseases of the Digestive System**					
ICD-10-Code	J00-J99						K00-K93					
Dependent variable	**Gender Mortality Gap**		**Males**		**Females**		**Gender Mortality Gap**		**Males**		**Females**	
Regional Level	Community	District	Community	District	Community	District	Community	District	Community	District	Community	District
Method	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE
Income (gross regional product)		-0.182**		0.192*		0.359***		-0.286***		-0.238***		0.02
		(-1.981)		(1.682)		(5.210)		(-3.304)		(-2.877)		(0.485)
		-0.251**		0.145*		0.477***		-0.364***		-0.219***		0.042
Social & familial attachments	-1.066	2.305	0.326	-3.027	1.941***	-4.61	-12.810***	4.776	-17.258***	1.246	-4.170***	-2.51
	(-1.245)	(0.509)	(0.356)	(-0.511)	(3.647)	(-1.301)	(-15.260)	(1.114)	(-20.396)	(0.289)	(-10.791)	(-1.186)
	-0.037	0.136	0.009	-0.098	0.091***	-0.261	-0.445***	0.259	-0.524***	0.049	-0.277***	-0.223
Foreigners, others	-0.176	-0.237	-0.248	3.793***	0.309*	3.920***	-0.675***	-2.583**	-1.725***	-2.010**	-0.165	0.093
	(-0.685)	(-0.210)	(-0.948)	(2.798)	(1.908)	(4.772)	(-2.672)	(-2.418)	(-7.135)	(-2.040)	(-1.398)	(0.190)
	-0.014	-0.024	-0.015	0.208***	0.033*	0.377***	-0.054***	-0.238**	-0.120***	-0.134**	-0.025	0.014
Foreigners, Turkey & Yugoslavia	-0.364***	0.803	-0.965***	1.889**	-0.487***	1.579***	-1.127***	-1.264**	-1.290***	-0.878	-0.022	0.500*
	(-2.600)	(1.262)	(-6.501)	(2.234)	(-5.619)	(3.588)	(-8.211)	(-2.100)	(-9.386)	(-1.428)	(-0.348)	(1.901)
	-0.055***	0.171	-0.114***	0.221**	-0.099***	0.324***	-0.170***	-0.248**	-0.170***	-0.125	-0.006	0.161*
Participation rate, share	-0.06	0.158					0.271	1.607**				
	(-0.246)	(0.189)					(1.133)	(2.032)				
	-0.007	0.031					0.031	0.295**				
Participation rate, gender gap	-0.08	-0.852**					-0.344**	1.428***				
	(-0.489)	(-2.107)					(-2.148)	(3.735)				
	-0.017	-0.284**					-0.074**	0.438***				
Education, average level	-26.983***	-5.959	-31.332***	-52.835**	-8.761***	-17.14	-45.590***	-20.042	-40.202***	-46.286***	-8.196***	-5.808
	(-9.067)	(-0.291)	(-11.056)	(-2.274)	(-4.615)	(-1.094)	(-15.622)	(-1.036)	(-15.320)	(-2.741)	(-5.945)	(-0.621)
	-0.286***	-0.104	-0.258***	-0.515**	-0.129***	-0.29	-0.482***	-0.321	-0.371***	-0.548***	-0.170***	-0.154
Education, gender gap	13.982**	-33.267					45.657***	-46.333**				
	(2.282)	(-1.455)					(7.600)	(-2.142)				
	0.042**	-0.154					0.137***	-0.197**				
Education, heterogeneity	-6.852	-59.715	16.069	-119.732*	9.632	-50.702	-28.469**	108.513**	-30.282**	39.925	-21.661***	-34.472
	(-0.472)	(-1.092)	(1.048)	(-1.953)	(1.070)	(-1.263)	(-2.001)	(2.098)	(-2.133)	(0.896)	(-3.312)	(-1.439)
	-0.009	-0.147	0.017	-0.161*	0.017	-0.12	-0.038**	0.245**	-0.035**	0.065	-0.055***	-0.128
Period	-7.006***	-10.027	-34.073***	-21.365***	-23.141***	-17.600***	-7.944***	-1.691	-34.494***	-1.503	-17.753***	-5.495*
	(-4.367)	(-1.473)	(-23.233)	(-2.670)	(-24.070)	(-3.417)	(-5.050)	(-0.263)	(-25.401)	(-0.259)	(-25.424)	(-1.787)
	-0.121***	-0.633	-0.457***	-0.739***	-0.538***	-1.068***	-0.137***	-0.098	-0.519***	-0.063	-0.584***	-0.523*
Male participation rate, share			-0.940***	-3.790***	-0.719***	-3.170***			-0.930***	1.571***	-0.510***	-0.708**
			(-3.395)	(-4.689)	(-4.326)	(-6.677)			(-3.627)	(2.674)	(-4.222)	(-2.498)
			-0.046***	-0.215***	-0.062***	-0.316***			-0.051***	0.108***	-0.062***	-0.111**
Female participation rate, share			0.449***	1.720**	0.482***	0.833**			0.410***	-1.016**	0.106*	-0.246
			(3.434)	(2.556)	(6.128)	(2.100)			(3.392)	(-2.077)	(1.852)	(-1.039)
			0.073***	0.324**	0.136***	0.275**			0.075***	-0.232**	0.042*	-0.127
Constant	105.836***	137.228**	221.921***	416.755***	104.836***	243.902***	136.972***	-35.591	267.270***	118.207**	111.612***	121.077***
	(6.076)	(2.343)	(11.916)	(5.458)	(9.420)	(5.640)	(8.020)	(-0.642)	(15.499)	(2.130)	(13.807)	(4.689)
N	4739	449	4739	449	4739	449	4739	449	4739	449	4739	449
R^2	0.158	0.528	0.422	0.793	0.374	0.804	0.194	0.574	0.377	0.823	0.338	0.837

Table 7: Empirical Results - Part 3

Cause of Death	**Injury and Poisoning**						**Transport Accidents**					
ICD-10-Code	V01-Y89						V01-V99					
Dependent variable	**Gender Mortality Gap**		**Males**		**Females**		**Gender Mortality Gap**		**Males**		**Females**	
Regional Level	Community	District	Community	District	Community	District	Community	District	Community	District	Community	District
Method	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE
Income (gross regional product)		0.066		0.171*		0.039		0.140**		0.214***		0.065***
		(0.722)		(1.915)		(0.816)		(2.481)		(3.925)		(3.271)
		0.055		0.100*		0.06		0.189**		0.234***		0.302***
Social & familial attachments	-2.629***	6.713	-5.884***	2.644	-2.792***	-2.343	-2.105***	9.591***	-2.175***	7.811***	-0.031	-1.736*
	(-2.597)	(1.474)	(-5.978)	(0.571)	(-6.162)	(-0.947)	(-3.702)	(3.435)	(-3.822)	(2.758)	(-0.134)	(-1.695)
	-0.066***	0.236	-0.124***	0.066	-0.143***	-0.152	-0.092***	0.551***	-0.086***	0.364***	-0.004	-0.343*
Foreigners, others	-0.127	-0.849	-0.059	1.471	-0.221	1.351**	-0.757***	0.708	-0.990***	1.339**	-0.180***	0.542**
	(-0.416)	(-0.748)	(-0.209)	(1.387)	(-1.601)	(2.356)	(-4.421)	(1.017)	(-6.089)	(2.067)	(-2.589)	(2.282)
	-0.007	-0.051	-0.003	0.062	-0.026	0.149**	-0.075***	0.069	-0.089***	0.106**	-0.050***	0.182**
Foreigners, Turkey & Yugoslavia	-0.993***	0.822	-1.004***	0.404	0.003	-0.236	-0.411***	0.663*	-0.408***	0.682*	0.015	-0.068
	(-5.999)	(1.286)	(-6.278)	(0.611)	(0.042)	(-0.768)	(-4.416)	(1.690)	(-4.414)	(1.687)	(0.394)	(-0.533)
	-0.108***	0.105	-0.092***	0.036	0.001	-0.056	-0.078***	0.138*	-0.070***	0.115*	0.008	-0.049
Participation rate, share	-0.106	1.434*					0.445***	-0.74				
	(-0.368)	(1.707)					(2.742)	(-1.436)				
	-0.009	0.171*					0.064***	-0.144				
Participation rate, gender gap	0.851***	1.029**					0.472***	0.133				
	(4.411)	(2.532)					(4.353)	(0.536)				
	0.132***	0.205**					0.128***	0.043				
Education, average level	-36.357***	-40.714**	-46.517***	-97.573***	-4.424***	-18.910*	-15.291***	-15.281	-15.178***	-20.151*	-0.653	-6.254
	(-10.328)	(-1.981)	(-15.239)	(-5.369)	(-2.737)	(-1.730)	(-7.734)	(-1.212)	(-8.601)	(-1.815)	(-0.801)	(-1.381)
	-0.276***	-0.424**	-0.297***	-0.733***	-0.071***	-0.367*	-0.203***	-0.259	-0.181***	-0.283*	-0.025	-0.369
Education, gender gap	-46.996***	-99.704***					-4.244	-20.358				
	(-6.486)	(-4.340)					(-1.043)	(-1.445)				
	-0.102***	-0.275***					-0.016	-0.092				
Education, heterogeneity	-111.784***	65.549	-144.855***	-12.861	-31.813***	-19.011	-60.491***	35.031	-69.703***	28.966	-10.575***	-2.026
	(-6.514)	(1.193)	(-8.770)	(-0.268)	(-4.150)	(-0.679)	(-6.276)	(1.040)	(-7.299)	(0.989)	(-2.734)	(-0.175)
	-0.107***	0.096	-0.117***	-0.013	-0.062***	-0.052	-0.101***	0.084	-0.105***	0.056	-0.050***	-0.017
Period	-18.031***	-19.781***	-42.202***	-17.806***	-26.709***	-7.235**	-16.509***	-16.957***	-23.410***	-17.937***	-6.427***	-0.361
	(-9.503)	(-2.892)	(-26.716)	(-2.845)	(-32.626)	(-2.013)	(-15.490)	(-4.044)	(-25.634)	(-4.690)	(-15.559)	(-0.242)
	-0.223***	-0.746***	-0.440***	-0.475***	-0.675***	-0.504**	-0.357***	-1.044***	-0.456***	-0.895***	-0.390***	-0.076
Male participation rate, share			0.530*	2.031***	-0.344**	-0.04			0.678***	-0.584	-0.035	-0.421***
			(1.777)	(3.213)	(-2.431)	(-0.122)			(3.928)	(-1.513)	(-0.486)	(-3.068)
			0.020*	0.089***	-0.032**	-0.005			0.049***	-0.048	-0.008	-0.146***
Female participation rate, share			-0.830***	-0.771	0.013	-0.345			-0.274***	-0.951***	-0.024	-0.498***
			(-5.899)	(-1.466)	(0.199)	(-1.246)			(-3.373)	(-2.957)	(-0.716)	(-4.344)
			-0.105***	-0.112	0.004	-0.131			-0.065***	-0.258***	-0.018	-0.573***
Constant	232.356***	96.876	353.772***	249.147***	126.928***	110.829***	88.396***	102.934***	117.286***	153.691***	30.156***	58.351***
	(11.278)	(1.646)	(17.637)	(4.172)	(13.393)	(3.673)	(7.639)	(2.852)	(10.114)	(4.212)	(6.306)	(4.668)
N	4739	449	4739	449	4739	449	4739	449	4739	449	4739	449
R^2	0.394	0.819	0.595	0.924	0.463	0.883	0.418	0.85	0.527	0.898	0.212	0.776

A higher income reduces male mortality in malignant neoplasms, diseases of the circulatory system and the digestive system, while it appears to be positively significant for diseases of the respiratory system. The same variable appears insignificant for female mortality in the case of diseases of the circulatory system and the digestive system, while it also appears positively significant for diseases of the respiratory system (with a much larger impact than for males). This might indicate that a higher income (and thus, higher labor participation rates and education) lead to smoking behavior among women, and thus, to higher mortality rates in these death causes. Interestingly, the income variable does not appear significant for deaths due to injury and poisoning for females, while it appears (weakly) positively significant for males. At first glance, it seems that higher income levels have an overall decreasing impact on mortality, while it affects mortality caused by diseases of the respiratory system positively (where the effect is much stronger for females). For men, higher income levels also seem to be linked with higher mortality rates due to injury and poisoning, while this is not the case for females. While the observed influences of social and familial attachments on overall mortality hold in most of the cases (although it is sometimes insignificant at the district level which is likely due to the heterogeneity at this regional level), we find mixed results for the impact of education heterogeneity. As indicated by the negative values of the variable „Period“, mortality rates decrease over time, for both genders and all observed main death causes.

The negative influence of higher educational levels is basically confirmed for most death causes (except for malignant neoplasms), while the influence is stronger for men than for women. The above mentioned increasing effect of female work participation rates in the labor market is mostly due to higher mortality rates in diseases of the circulatory and respiratory system. Remarkably, these causes of death are widely known as diseases of affluence, where people with higher socioeconomic status typically have jobs with less physical activities (office etc.), leading to a higher blood cholesterol level and other related diseases. With respect to gender-specific participation rates, the pattern observed in the case of diseases of the respiratory system seems highly interesting. At both geographical levels, male participation rates have a decreasing effect on mortality rates for both genders, while female participation rates exercise an influence in the reversed direction. As mentioned above, these effects might be the result of unhealthy life styles adapted by women in the labor force, and also due to decreasing time investment in health due to time restrictions.

Similarly, we observe some interesting patterns for the resulting cause-specific gender mortality gaps. Not surprisingly, in most of the cases the gender mortality gap is negatively associated with higher income levels, a higher level of social and familial attachments (albeit not always significant), higher educational levels (sometimes insignificant at the

district levels due to heterogeneity) and a higher share of immigrants. The decreasing effect of converging gender roles (as indicated by positive coefficients for the gender gaps in education and the participation rate) is confirmed for malignant neoplasms and diseases of the circulatory system (which constitute more than 70% of all death incidences), while the results are rather mixed for diseases of the respiratory and digestive system. Interestingly, this effect is reversed for deaths due to injury and poisoning in the case of the gender gap in education, where a higher gender gap *reduces* the gender mortality gap. Thus, in this death cause, the converging gender roles (as measured by education) are likely to *increase* the female mortality advantage. However, in the case of labor participation rates, this effect is not confirmed, as a higher gender gap in labor force participation - once again - increases the gender mortality gap. The interesting pattern in deaths due to injury and poisoning might indicate some further socioeconomic influences on behavioral-related death causes, which are examined in the following section.

3.3 Decomposition by selected behavioral-related Causes of Death

Based on the analyses of the influence of various socioeconomic determinants on gender-specific (overall) mortality and the corresponding gender gap for main death causes, we want to focus on the question whether these patterns are also observable in behavioral-related death causes. The influence of a higher income on cause-specific mortality rates seems particularly interesting. Concerning male mortality, higher income lowers mortality for men in the case of ischaemic heart disease, lung cancer and smoking-related diseases. While it is not significant for alcohol-related diseases, a higher income increases mortality due to transport accidents both for males and females. Contrary to males, female mortality does not significantly decrease with increasing income levels in the case of smoking-related and alcohol-related diseases. The same applies to mortality due to ischaemic heart disease and lung cancer. Moreover, increasing income levels lead to an increasing gender mortality gap for transport accidents, as the increasing effect is stronger for males than for females. On the contrary, higher educational levels do not decrease female mortality in this death cause. In the case of lung cancer, the educational level even exercises a positive effect on female mortality (at the community level). In most of the remaining cases, a higher educational level lowers mortality for the observed death causes (or appears insignificant in our estimations).

Table 8: Empirical Results - Part 4

Cause of Death	**Ischaemic Heart Disease**						**Lung Cancer**					
ICD-10-Code	I20-I25						C33-C34					
Dependent variable	**Gender Mortality Gap**		**Males**		**Females**		**Gender Mortality Gap**		**Males**		**Females**	
Regional Level	Community	District	Community	District	Community	District	Community	District	Community	District	Community	District
Method	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE
Income (gross regional product)		-0.633***		-0.689***		0.041		-0.173**		-0.200***		0.005
		(-4.321)		(-3.637)		(0.308)		(-2.582)		(-3.178)		(0.272)
		-0.450***		-0.317***		0.036		-0.308**		-0.371***		0.021
Social & familial attachments	-19.087***	-16.539**	-28.319***	-8.508	-10.887***	3.501	-7.804***	0.11	-11.908***	3.417	-3.584***	2.361**
	(-14.244)	(-2.284)	(-17.370)	(-0.864)	(-9.725)	(0.511)	(-12.225)	(0.033)	(-18.877)	(1.047)	(-18.909)	(2.495)
	-0.422***	-0.501**	-0.478***	-0.167	-0.283***	0.13	-0.361***	0.008	-0.565***	0.271	-0.472***	0.429**
Foreigners, others	0.389	-11.282***	-2.173***	-7.419***	-1.592***	5.162***	-0.781***	-2.123**	-0.829***	-2.427***	0.139**	0.144
	(0.964)	(-6.251)	(-4.665)	(-3.292)	(-4.669)	(3.253)	(-4.066)	(-2.567)	(-4.598)	(-3.252)	(2.407)	(0.658)
	0.02	-0.581***	-0.084***	-0.247***	-0.094***	0.325***	-0.082***	-0.273**	-0.090***	-0.327***	0.042**	0.045
Foreigners, Turkey & Yugoslavia	1.100***	-1.67	1.619***	-1.716	0.436**	-0.864	0.260**	0.57	0.319***	0.752	0.145***	0.374***
	(5.019)	(-1.642)	(6.112)	(-1.221)	(2.389)	(-1.016)	(2.491)	(1.223)	(3.117)	(1.616)	(4.704)	(3.185)
	0.106***	-0.183	0.119***	-0.122	0.049**	-0.116	0.052**	0.156	0.066***	0.216	0.083***	0.246***
Participation rate, share	0.206	2.128					-0.968***	1.570**				
	(0.539)	(1.593)					(-5.315)	(2.564)				
	0.015	0.218					-0.148***	0.402**				
Participation rate, gender gap	0.104	1.564**					0.027	0.915***				
	(0.409)	(2.421)					(0.222)	(3.091)				
	0.014	0.268**					0.008	0.391***				
Education, average level	-28.280***	0.958	-16.026***	52.696	-10.197**	-35.948	-24.829***	11.37	-20.722***	15.82	2.051***	-0.588
	(-6.070)	(0.029)	(-3.170)	(1.364)	(-2.553)	(-1.188)	(-11.187)	(0.759)	(-10.592)	(1.237)	(3.033)	(-0.140)
	-0.190***	0.009	-0.082***	0.312	-0.083**	-0.397	-0.349***	0.254	-0.298***	0.378	0.084***	-0.032
Education, gender gap	39.210***	61.029*					6.147	33.783**				
	(4.089)	(1.670)					(1.346)	(2.017)				
	0.075***	0.145*					0.025	0.200**				
Education, heterogeneity	26.261	12.972	-4.233	354.110***	-30.804	233.292***	7.645	79.241**	7.452	110.667***	-9.419***	-0.492
	(1.156)	(0.148)	(-0.155)	(3.474)	(-1.626)	(3.010)	(0.707)	(1.978)	(0.704)	(3.278)	(-2.937)	(-0.046)
	0.022	0.016	-0.003	0.290***	-0.031	0.361***	0.014	0.250**	0.014	0.366***	-0.048***	-0.004
Period	-27.076***	17.495	-72.962***	-22.869*	-36.532***	-18.194*	-6.767***	-7.563	-7.045***	-9.568**	2.047***	-0.209
	(-10.782)	(1.609)	(-27.885)	(-1.719)	(-18.062)	(-1.829)	(-5.657)	(-1.517)	(-6.959)	(-2.172)	(5.978)	(-0.152)
	-0.296***	0.568	-0.610***	-0.480*	-0.470***	-0.722*	-0.155***	-0.613	-0.165***	-0.813**	0.133***	-0.041
Male participation rate, share			0.974**	0.952	0.647*	-1.362			-0.17	1.812***	0.239***	0.202
			(1.971)	(0.709)	(1.851)	(-1.485)			(-0.889)	(4.071)	(4.033)	(1.597)
			0.030**	0.033	0.031*	-0.089			-0.015	0.252***	0.057***	0.065
Female participation rate, share			0.576**	0.817	0.718***	0.817			-0.653***	0.152	-0.100***	0.221**
			(2.474)	(0.730)	(4.340)	(1.065)			(-7.239)	(0.411)	(-3.570)	(2.081)
			0.058**	0.093	0.112***	0.176			-0.186***	0.07	-0.079***	0.233**
Constant	158.836***	-13.786	287.978***	-10.888	141.528***	136.269	150.149***	-73.172*	149.095***	-87.290**	-0.315	-7.229
	(5.825)	(-0.147)	(8.667)	(-0.086)	(6.044)	(1.631)	(11.559)	(-1.706)	(11.597)	(-2.076)	(-0.080)	(-0.626)
N	4739	449	4739	449	4739	449	4739	449	4739	449	4739	449
R^2	0.17	0.658	0.284	0.72	0.152	0.561	0.176	0.679	0.155	0.534	0.375	0.687

Table 9: Empirical Results - Part 5

Cause of Death	**Alcohol-related Diseases**						**Smoking-related Diseases**					
ICD-10-Code	see Tables 1/2						see Tables 1/2					
Dependent variable	**Gender Mortality Gap**		**Males**		**Females**		**Gender Mortality Gap**		**Males**		**Females**	
Regional Level	Community	District	Community	District	Community	District	Community	District	Community	District	Community	District
Method	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE	Pooled	FE
Income (gross regional product)		-0.195		-0.174		-0.021		-1.109***		-1.487***		-0.126
		(-1.507)		(-1.369)		(-0.373)		(-4.854)		(-4.807)		(-0.565)
		-0.119		-0.082		-0.029		-0.486***		-0.353***		-0.049
Social & familial attachments	-11.997***	6.842	-19.477***	2.145	-6.717***	-3.341	-40.979***	-6.765	-49.544***	-12.591	-8.753***	-11.518
	(-9.051)	(1.067)	(-14.470)	(0.325)	(-12.991)	(-1.162)	(-19.181)	(-0.599)	(-19.578)	(-0.783)	(-4.878)	(-1.005)
	-0.231***	0.178	-0.325***	0.043	-0.311***	-0.199	-0.546***	-0.126	-0.450***	-0.127	-0.118***	-0.19
Foreigners, others	-0.875**	-0.795	-1.441***	1.167	-0.071	1.313**	-1.877***	-16.224***	-6.143***	-13.972***	-2.100***	5.939**
	(-2.192)	(-0.498)	(-3.747)	(0.774)	(-0.453)	(1.970)	(-2.920)	(-5.762)	(-8.495)	(-3.799)	(-3.843)	(2.235)
	-0.038**	-0.035	-0.055***	0.04	-0.008	0.133**	-0.057***	-0.515***	-0.127***	-0.240***	-0.064***	0.167**
Foreigners, Turkey & Yugoslavia	-1.752***	0.272	-1.790***	0.068	0.103	0.056	0.581*	-0.782	0.625	1.058	0.285	3.019**
	(-8.084)	(0.303)	(-8.186)	(0.072)	(1.221)	(0.158)	(1.663)	(-0.493)	(1.521)	(0.461)	(0.975)	(2.121)
	-0.147***	0.026	-0.130***	0.005	0.021	0.012	0.034*	-0.053	0.025	0.039	0.017	0.181**
Participation rate, share	-0.39	2.555**					-1.080*	7.697***				
	(-1.031)	(2.161)					(-1.772)	(3.692)				
	-0.025	0.225**					-0.048*	0.487***				
Participation rate, gender gap	0.378	2.341***					0.107	2.598**				
	(1.495)	(4.094)					(0.262)	(2.578)				
	0.045	0.345***					0.009	0.274**				
Education, average level	-80.298***	-76.431***	-82.769***	-131.745***	-8.794***	-20.623	-105.820***	-6.056	-88.650***	-42.366	-20.690***	-82.314
	(-17.425)	(-2.642)	(-19.827)	(-5.095)	(-4.767)	(-1.622)	(-14.247)	(-0.119)	(-11.296)	(-0.672)	(-3.232)	(-1.624)
	-0.470***	-0.588***	-0.419***	-0.802***	-0.127***	-0.366	-0.429***	-0.033	-0.244***	-0.129	-0.087***	-0.406
Education, gender gap	-5.826	-106.595***					99.324***	119.325**				
	(-0.614)	(-3.296)					(6.497)	(2.093)				
	-0.01	-0.218***					0.114***	0.175**				
Education, heterogeneity	-139.939***	67.505	-170.284***	-19.922	-46.954***	-40.773	61.818*	294.440**	-46.707	543.297***	-147.691***	36.202
	(-6.229)	(0.873)	(-7.538)	(-0.292)	(-5.366)	(-1.252)	(1.707)	(2.160)	(-1.100)	(3.266)	(-4.864)	(0.279)
	-0.103***	0.073	-0.109***	-0.017	-0.083***	-0.101	0.032*	0.230**	-0.016	0.230***	-0.076***	0.025
Period	-15.317***	-10.779	-50.866***	-7.115	-30.131***	-5.081	-34.022***	-6.496	-152.782***	-57.239***	-96.792***	-38.491**
	(-6.166)	(-1.120)	(-23.546)	(-0.799)	(-32.250)	(-1.216)	(-8.498)	(-0.383)	(-37.619)	(-2.637)	(-29.852)	(-2.310)
	-0.146***	-0.301	-0.420***	-0.154	-0.690***	-0.324	-0.224***	-0.13	-0.687***	-0.621***	-0.643***	-0.681**
Male participation rate, share			-0.695*	3.976***	-0.739***	0.239			-0.862	5.053**	-0.289	-0.05
			(-1.704)	(4.421)	(-4.574)	(0.620)			(-1.124)	(2.304)	(-0.515)	(-0.032)
			-0.021*	0.141***	-0.062***	0.025			-0.014	0.090**	-0.007	-0.001
Female participation rate, share			-0.607***	-1.837**	0.067	-0.640**			-0.294	3.344*	0.753***	1.943
			(-3.154)	(-2.453)	(0.879)	(-1.986)			(-0.813)	(1.832)	(2.843)	(1.514)
			-0.061***	-0.216**	0.019	-0.222**			-0.016	0.197*	0.061***	0.187
Constant	383.237***	123.747	577.694***	304.412***	181.428***	132.184***	462.867***	-218.252	982.092***	159.341	503.592***	385.202***
	(14.210)	(1.494)	(21.059)	(3.583)	(16.774)	(3.767)	(10.648)	(-1.495)	(19.043)	(0.769)	(13.416)	(2.754)
N	4739	449	4739	449	4739	449	4739	449	4739	449	4739	449
R^2	0.384	0.778	0.525	0.891	0.426	0.864	0.233	0.757	0.502	0.872	0.41	0.828

While the explanation of all results would clearly go beyond the scope of this paper, some observed influences on the gender gap in mortality nevertheless seem interesting. Particularly the role of gender equalization in society exhibit different results across causes of death. While a higher gender gap in education leads to higher gender mortality gaps in the case of ischaemic heart disease, lung cancer and smoking-related diseases, the opposite is true for alcohol-related diseases, and to a less extent, for transport accidents (where the coefficient also appears negative, but non-significant). Thus, our results suggest that the decreasing female mortality advantage is mainly caused by increased smoking among women, while in the case of alcohol, violence and accidents the gender equalization seems to work in the different direction. According to these death causes, the gender mortality gap would be even wider if the gender roles in society converge. This impression is also confirmed by the variable „Period“ for female mortality in lung cancer, where female mortality *increases* over time (as opposed to all other death causes, both for men and women).

In the case of the gender gap in labor participation rates, the picture seems more consistent. In all cases (albeit not always significant) a higher gender gap in labor participation rates leads to a higher female mortality advantage. Thus, with equalizing gender roles - at least in the labor market - mortality rates of males and females seem to converge. While the decreasing influence of immigrants on overall mortality was quite consistent in our estimations about overall mortality rates, the results are rather mixed when distinguishing different death causes (particularly in the case of immigrants from Turkey and Yugoslavia).

4 Discussion & Conclusion

This study investigated the socioeconomic determinants of cause- and gender-specific mortality rates and the corresponding gender mortality gap in an explorative manner. Earlier research on this topic showed that the socioeconomic mortality gradient might vary by causes of death (Koskinen and Martelin 1994, Mackenbach et al. 1999). Thus, the differences in the sensitivity of mortality rates by gender might be restrained to specific death causes, leading to an overall higher male mortality sensitivity to socioeconomic factors. While studies on cause-specific mortality rates are rare in general (using cross-sectional country data), our study investigates the socioeconomic determinants of mortality by explicitly decomposing mortality by gender and causes of death using regional data.

Our estimations indicate that higher income levels reduce male mortality in most of the cases (including malignant neoplasms, diseases of the circulatory system, diseases of the digestive system etc.), while it appears insignificant for female mortality in those cases. This might indicate that a higher income (and thus, higher labor participation rates and

education) also leads to unhealthy life styles among women (particularly smoking). Thus, the decreasing effect of the higher socioeconomic status might be canceled out by the „gender role equalization“ effect in these cases. The decreasing effect of converging gender roles on the female mortality advantage is confirmed for most of the main causes of death, while the effect is reversed for deaths due to injury and poisoning (similarly to alcohol-related diseases) in the case of the gender gap in education, where a higher gender gap reduces the gender mortality gap. Thus, in these death causes, the converging gender roles are likely to increase the female mortality advantage.

Moreover, we distinguished further by investigating mortality rates for behavioral-related causes of death. Interestingly, a higher income increases mortality due to transport accidents both for males and females, while the increasing effect is stronger for males (and thus, a higher income level increases the gender mortality gap in transport accidents). Remarkably, contrary to male mortality, female mortality does not decrease with increasing income levels in the case of smoking-related diseases, ischaemic heart disease and lung cancer. Similarly, while a higher gender gap in education leads to higher gender mortality gaps in the case of ischaemic heart disease, lung cancer and smoking-related diseases, the opposite is true for alcohol-related diseases, and to a less extent, for transport accidents. Thus, our results suggest that the decreasing female mortality advantage due to converging gender roles is mainly a result of increased smoking among women, while in the case of alcohol, violence and accidents the gender equalization seems to work in the different direction. According to these death causes, the gender mortality gap would be even wider if the gender roles in society converge.

Although we are well aware of the limitations of this study due to regional heterogeneity, the borderline problem of aggregated data which possibly feature an „ecological bias“ problem, and the possible existence of spatial autocorrelation (as explained in detail in the introduction), we nevertheless aimed to offer an explorative study to examine the linkages between socioeconomic factors and cause-specific mortality rates at a local and regional level, respectively. The considerable variation across regions in terms of mortality as well as socioeconomic factors allows to give some insights in this underexplored topic in the literature. In particular, the two-level approach by considering data both at the local community as well as the district level takes to some extent account of the ecological bias problem, where the level of inference and the level of analysis are disconnected. In a nutshell, we have to conclude that the examination of the gender mortality gap as well as gender-specific mortality rates without distinguishing between different causes of death might mask important patterns in the underlying factors. It is up to future research to broaden this insights in several respects: f. e. by the use of SMR-data for different age cohorts, by using simultaneous multi-level approaches, or by accounting for the relationship

between different causes of death using epidemiological knowledge.

5 References

Anson, J., 2003, Sex Differences in Mortality at the Local Level: An Analysis of Belgian Municipalities, *European Journal of Population*, 19, 1-28.

Boback, M., 2003, Relative and Absolute Gender Gap in all-cause Mortality in Europe and the Contribution of Smoking, *European Journal of Epidemiology*, 18, 15-18.

Case, A. and Deaton, A., 2003, Broken Down by Work and Sex: How Our Health Declines, in: Wise, D. (eds.): *Analyses in the Economics of Aging*, Chicago, US, The University Chicago Press, 185-219.

Carey, A. and Lopreto, J., 1995, The Evolutionary Demography of the Fertility-Mortality Quasi-Equilibrium, *Population and Development Review*, 21, 3, 613-630.

Case, A., and Paxson, C., 2004, Sex Differences in Morbidity and Mortality, *Demography*, 42, 189-214.

Conti, S., Farchi, G., Masocco, M., Minelli, G., Toccaceli, V. and Vichi, M., 2003, Gender Differentials in Life Expectancy in Italy, *European Journal of Epidemology*, 18, 107-112.

Cutler, D. and Meara, E., 2001, Changes in the Age Distribution of Mortality over the 20th Century, NBER Working Paper 8556, http://nber.org/papers/w8556.

Cutler, D., Deaton, A. and Lleras-Muney, A., 2006, The Determinants of Mortality, *Journal of Economic Perspectives*, 20, 3, 97-120.

Diez-Roux, A.V., 1998, Bringing Context back into Epidemiology: Variables and Fallacies in Multilevel Analysis, *American Journal of Public Health*, 88, 2, 216–222.

Felder, S., 2006, The Gender Longevity Gap: Explaining the Difference between Singles and Couples, *Journal of Population Economics*, 19, 543-557.

Flowerdew, R. and Manley, D. and Sobel, C., 2008, Neighborhood effects on health: Does it matter where you draw the boundaries?, *Social Science and Medicine*, 6, 1241-1255.

Gächter, M. and Schwazer, P. and Theurl, E., 2010, Stronger sex but earlier death: A multi-level socioeconomic analysis of gender differences in mortality in Austria, Working Papers, Faculty of Economics and Statistics, No. 2010-16, University of Innsbruck.

Galor, O. and Weil, D.N., 1996, The Gender Gap, Fertility, and Growth, *American Economic Review*, 86, 3, 374-387.

Greenland, S. and Morgenstern, H., 1989, Ecological Bias, Confounding, and Effect Modification, *International Journal of Epidemiology*, 18, 1, 269-274.

Jemal, A. and Thun, M.J. and Ward, E.E. and Henley, S.J. and Cokkinides, V.E. and Murray, T.E., 2008, Mortality from Leading Causes by Education and Race in the United States, 2001, *American Journal of Preventive Medicine*, 34, 1, 1-8.

Kalben, B.B., 2002, Why Men Die Younger: Causes of Mortality Differences by Sex, *SOA Monograph*.

Klasen, S., 1998, Marriage, Bargaining, and Intrahousehold Resource Allocation: Excess Female Mortality among Adults during Early german Development 1740-1860, *The Journal of Economic History*, 58, 2, 432-467.

Koskinen, S. and Martelin, T., 1994, Why are Socioeconomic Mortality Differences smaller among Women than among Men?, *Social Science & Medicine*, 38, 10, 1385-1396.

Kruger, D.J. and Nesse, R.M., 2006, An Evolutionary Life-History Framework for Understanding Sex Differences in Human Mortality Rates, *Human Nature*, 17, 1, 74-97.

Luy, M., 2002, Die geschlechtsspezifischen Sterblichkeitsunterschiede - Zeit für eine Zwischenbilanz, *Zeitschrift für Gerontologie und Geriatrie*, 35, 412-429.

Luy, M., 2003, Causes of Male Excess Mortality: Insights from Clustered Populations, *Population and Development Review*, 29, 4, 647-676.

Mackenbach, J.P. and Kunst, A.E. and Groenhof, F. and Borgan, J.K. and Costa, G. and Faggiano, F. and Józan, P. and Leinsalu, M. and Martikainen, P. and Rychtarikova, J. and Valkonen, T., 1999, Socioeconomic Inequalities in Mortality among Women and among Men: An international Study, *American Journal of Public Health*, 89, 12, 1800-1806.

Pampel, F.C., 2001, Gender Equality and the Sex Differential in Mortality from Accidents in High Income Nations, *Population Research and Policy Review*, 20, 5, 397-421.

Pampel, F.C., 2002, Cigarette Use and the narrowing Sex Differential in Mortality, *Population and Development Review*, 28, 1, 77-104.

Preston, S.H. and Wang, H., 2005, Sex Mortality Differentials in the United States: The Role of Cohort Smoking Patterns, *Demography*, 43, 4, 631-646.

Robert, S.A., 1999, Socioeconomic Position and Health: The Independent Contribution of Community Socioeconomic Context, *Annual Review of Sociology*, 24, 489-516.

Sahn, D.E. and Stifel, C.D., 2002, Parental Preferences for Nutrition of Boys and Girls: Evidence from Africa, *The Journal of Development Studies*, 39, 1, 21-45.

Sheppard, L., 2003, Insights on Bias and Information in Group-Level Studies, *Biostatistics*, 4, 265-278.

Siow, A. and Zhu, X., 2002, Differential Fecundity and Gender-Biased Parental Investments in Health, *Review of Economic Dynamics*, 5, 999-1024.

Spijker, J. and van Poppel, F. and van Wissen, L., 2007, Explaining new Trends in the Gender Gap of Mortality: Insights from a Regional Trend-Analysis of the Netherlands, *Vienna Yearbook of Population Research 2007*, 61-92.

Statistik Austria, 2007, Oesterreichischer Todesursachen Atlas [Atlas of Mortality in Austria by Causes of Death], Vienna: Statistik Austria.

Strand, B.H. and Kunst, A., 2006, Childhood Socioeconomic Position and Cause-specific Mortality in Early Adulthood, *American Journal of Epidemiology*, 165, 1, 85-93.

Trovato, F. and Lalu, N.M., 2005, From Divergence to Convergence: The Sex Differential in Life Expectancy in Canada, 1971–2000, *Canadian Review of Sociology*, 44, 1, 101-122.

Trübswetter, P. and Klasen, S., 2007, Gender bias in Mortality in Ireland around 1870-1930, Working Paper.

Valkonen, T. and van Poppel, F., 1997, The Contribution of Smoking to Sex Differences in Life Expectancy, *European Journal of Public Health*, 7, 3, 302-310.

Waldron, I., 1986, The Contribution of Smoking to Sex Differences in Mortality, *Public Health Rep.*, 101, 2, 163–173.

Waldron, I., 2000, Trends in Gender Differences in Mortality: Relationships to Changing Gender Differences in Behaviour and other Causal Factors, in: Annandale, E. and Hunt, K. (eds.): Gender Inequalitites in Health, Open University Press, Berkshire-New York, 150-181.

Wong, M.D. and Chung, A.K. and Boscardin, W.J. and Li, M. and Hsieh, H. and Ettner, S.L. and Shapiro, M.F., 2006, The Contribution of Specific Causes of Death to Sex Differences in Mortality, *Public Health Reports*, 121, 6, 746–754.

Zielonke, N., 2007, Revealing Patterns - A Cross-Country Analysis of the Gender Gap in Mortality, Paper prepared for the session 93 „Aging and Health in Developing Countries: Comparative Aspects“ of the Populatoin Association of America.

6 Appendix

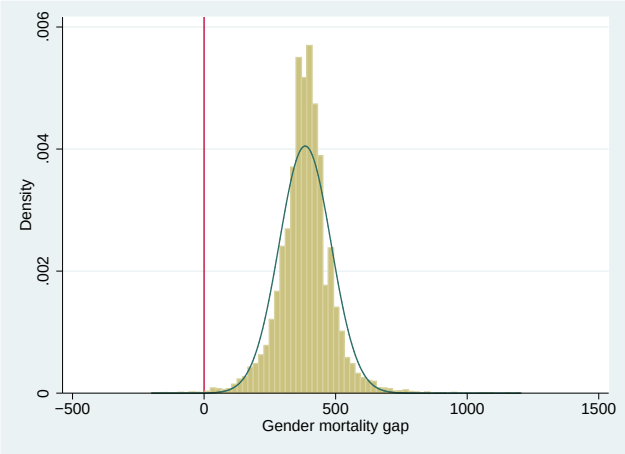

Figure 1: Distribution of the gender mortality gap, overall mortality (community level for period two). Values are weighted by community size (population).

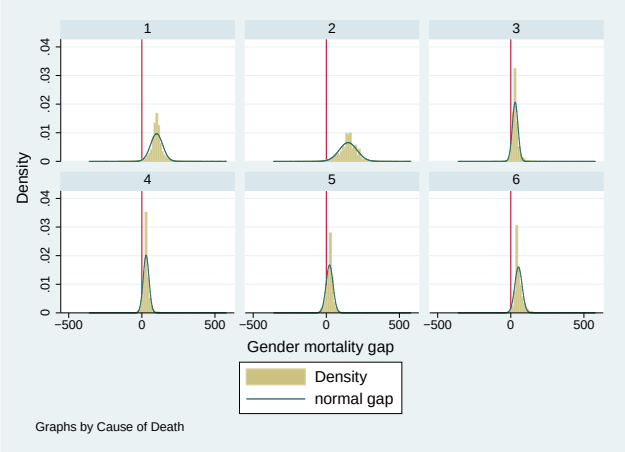

Figure 2: Distribution of the gender mortality gaps, cause-specific mortality (community level for period two). The distributions correspond to the main causes of death, namely *Malignant neoplasms* (1), *Diseases of the Circulatory System* (2), *Diseases of the Respiratory System* (3), *Diseases of the Digestive System* (4), *Other Death Causes* (5) and *Injuries and Poisoning* (6). Values are weighted by community size (population).

Table 10: Principal Component Factor - Social Attachments: Factor loadings

Variable	Factor	Uniqueness
Average household size	-0.9338	0.1280
One-person households, share	0.9614	0.0757
Couple with children	-0.9751	0.0491
Couple without children, woman 40+	0.8088	0.3459
Single with children	0.7127	0.4920
Average number of children per family	-0.3865	0.8506
Birth per woman, age-standardized	-0.8954	0.1983
Share of divorced women	0.9327	0.1301
Share of female singles, age 40-59	0.7460	0.4435

Notes: The eigenvalue of the factor amounts to 6.29, explaining approximately 70% of the variance in the variables.