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Article — Published Version

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Fiscal Studies

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Suggested Citation: Redler, Peter; Wuppermann, Amelie; Winter, Joachim; Schwandt, Hannes; Currie, Janet (2021) : Geographic Inequality in Income and Mortality in Germany, Fiscal Studies, ISSN 1475-5890, Wiley, Hoboken, NJ, Vol. 42, Iss. 1, pp. 147-170, <https://doi.org/10.1111/1475-5890.12259>

This Version is available at:

<https://hdl.handle.net/10419/242004>

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Geographic Inequality in Income and Mortality in Germany*

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Abstract

We use data from the German Federal Statistical Office on population counts, births, deaths and income to study the development of socio-economic inequality in mortality rates from 1990 to 2015 for different age groups and both genders. Ranking the 401 German districts by average disposable income per capita, we observe large inequalities in district-level mortality rates in 1990, which had almost disappeared, or at least been flattened considerably, by 2015 particularly for infants, children and the very old. The most important driver of this reduction in inequality is German reunification in 1990. As indicated by more detailed analyses comparing districts in the former East and the former West, even five years after reunification there was a large gap in disposable income, with all Eastern districts considerably poorer than the

*Submitted November 2020.

P. Redler gratefully acknowledges support from the Elite Network of Bavaria within the Evidence-Based Economics programme. Daniel Saggau provided excellent research assistance.

Keywords: Germany, health inequality, income, inequality, mortality, SES.

JEL classification numbers: I12, I14, I18, J10.

poorest district in the West. At the same time, mortality rates were higher for all age groups and both genders in the East. Income has caught up, to the extent that there are equally poor districts in the East and West in most recent years (although the West is still much richer on average). Mortality rates in the East have improved considerably and are even below mortality rates for similarly poor districts in the West in the most recent data.

I. Introduction

Inequalities in mortality provide a stark measure of unequal life chances and hence are of fundamental interest and importance. Yet, they can be difficult to measure. Currie and Schwandt (2016a, 2016b) proposed an alternative method of examining inequalities in mortality, which allowed all of the deaths for the entire population to be included. As described in the introduction to this special issue, they first ranked areas from richest to poorest and then grouped them into 20 ‘bins’ of approximately equal size. Age-specific mortality rates were then examined by age and gender groups for each bin in census years. This way of examining inequality in mortality has the advantage that it is able to include all deaths in a consistent way over time.

In this paper, we apply these methods to data from Germany for 1990, 2003 and 2015. This time period is of special interest in German history because it follows reunification. As of 3 October 1990, the German Democratic Republic (GDR, East Germany) no longer existed and the Federal Republic of Germany absorbed five new states from the East. East and West Berlin were also reunited and the unified city became the capital of the newly united country. However, as we show below, stark differences in income and mortality still divided the East and the West, though the East began to catch up. Hence, Germany over these 25 years offers a unique setting for examining the relationship between income and mortality.

We find that inequality in mortality rates has decreased considerably since 1990, driven mainly by rapid reductions in mortality in the East. Our most striking finding is that although the East remains poorer, for many age and gender groups, the East has overtaken the West in terms of lowering mortality. Conditional on income, the East has lower infant mortality, and lower mortality for adult women aged 20–79. Men in the East now largely match men in the West in terms of mortality, conditional on income.

These results suggest once again that although higher income tends to be linked to better health, the two do not move in lock step. It was possible for the East to close large gaps in mortality rates even though gaps in income remained. A better understanding of how the East has been able to lower mortality, especially for adult women and infants, could shed light on how to eliminate the link between socio-economic status and health more generally.

The rest of the paper proceeds as follows. Section II offers a discussion of the evolution of inequality in mortality for men and women across six broad age groups. Section III probes these results in greater detail. In Section IV, we offer an analysis of the evolution of mortality between the German East and West. We end with a summary and conclusions.

II. Evolution of inequality in mortality in six broad age groups

Part A

1. Data

We use data on population counts, deaths, births and income by the German Federal Statistical Office on a district (*Kreise und kreisfreie Städte*) level from 1990 to 2016. There were 401 districts in Germany in 2016 with an average of around 200,000 inhabitants each. The district level is suitable for our analysis as this is the lowest level at which data on mortality and income are easily available for the full population.

The official population counts are based on national census data and yearly large-scale survey data (*Mikrozensus*). The population counts represent the population at the beginning of the respective year.¹ These data contain population totals by five-year age groups with the exception of the youngest age groups (0–2, 3–5 and 6–9). Before 2012, these categories are broader for older ages (65–74 and 75 and older). Because the number of deaths is published for infants below one year of age and mortality in young children is highest in the first year, we supplement these population data with the number of births in a district in a given year to estimate the number of infants.

Mortality data include the number of deaths by age group at the time of death in a given year. Age groups span five years, with the exception of the 0–4 age group, which is split into infant mortality (age 0) and mortality from age 1 to 4.²

To construct mortality rates within age groups, we divide the number of deaths in a given year by the total population at the beginning of the year.

¹The census in 2011 revealed that population estimates for most areas were too high (Scholz and Kreyenfeld, 2016). The downward correction amounted to a drop of around 1.8 per cent of the national population from 2010 to 2011. Crucially, the Federal Statistical Office did not retrospectively adjust population estimates. Klüsener et al. (2018) estimate population counts by state and age for the entire intercensal period from 1987 to 2010. We use their data to adjust population estimates on a district/year/age group level.

²For some years and age groups, the age groups for population counts and for the number of deaths do not match perfectly. In this case, we estimate the population of finer age groups using the state-level estimates of Klüsener et al. (2018). We conduct the same procedure to create larger age groups where necessary. The resulting measurement error at the district level is mitigated by binning districts in the subsequent analysis. We proceed in a similar way for the number of deaths for a few states in which they are aggregated at 75 years and older.

When we aggregate five-year age groups, we ensure comparability over time by age-adjusting mortality rates to the German population in 2015. The reason for age adjustment is that in a relatively wide age category such as individuals aged 20–49, a sample that had more individuals aged 49 would be expected to have higher mortality rates only because they were older. Therefore, changes in the age distribution within age categories could complicate the interpretation of changes over time. Note that, due to data limitations, no age adjustment is available beyond age 85.

As a measure of socio-economic status (SES), we use the per capita disposable income in a district. This measure captures post-transfer income (i.e. after government benefits and income taxes). This measure is available from 1995 to 2017. For the three states of Niedersachsen, Mecklenburg-Vorpommern and Schleswig-Holstein, the measure is only available at the state level before 2000. For these states, we extrapolate the pre-2000 state trend to the district level and impute the missing values. We also impute recent district data (2014–17) for one state (Sachsen) in an identical way.

The SES data are available for districts in their current geographical configuration. Over the last 30 years, five states in the East that were part of the former GDR performed major district reforms, mostly consolidating smaller districts into larger ones. We map the districts that no longer exist to their current districts in order to link the SES measures.

2. Income inequality in Germany

Individual income inequality in Germany rose to some extent in the 1990s and more strongly in the early 2000s.³ This increase was stronger for the East, which was less unequal after the reunification in 1990. The increase for disposable income per capita (our SES variable) was lower than the increase of market income inequality due to the tax and transfer system.⁴ The increase in inequality was mainly driven by an increase in wage inequality conditional on employment. This trend stopped around 2005.⁵

Geographic inequality in our SES variable, measured by a standard Gini coefficient, declined over time in our analysis period. This decline is driven by a catch-up of Eastern districts while inequality across districts in the West was stable over time. Inequality across districts in the East also declined (detailed results available upon request).

³Fuchs-Schündeln, Krueger and Sommer, 2010; Dustmann, Ludsteck and Schönberg, 2009.

⁴Fuchs-Schündeln, Krueger and Sommer, 2010.

⁵Biewen, Ungerer and Löffler, 2017.

3. Health care provision in Germany

Health care in Germany is provided in a multi-payer system with universal mandatory health insurance. There are two health insurance systems that exist side by side. The public health insurance system (statutory health insurance) covered around 85 per cent of individuals during our study period.⁶ In this system, insurance premiums are based on individuals' income and are not risk-rated. Dependents are covered at no charge. Low co-payments for drugs and some treatments were introduced in the mid-1990s. High earners, civil servants and the self-employed can opt out of the public system and buy private health insurance with risk-rated insurance premiums. Health care provision is mostly private, but prices are heavily regulated. Choice of health care provider is not restricted. Health care spending per capita increased from 8 per cent of GDP in 1990 to around 11 per cent of GDP in 2015.⁷

4. Results

Figure 1 displays the distribution of poverty across Germany in the years 1995, 2003 and 2015. As described above, we first rank all German districts by average disposable income per capita in each year and then group districts into 'bins' that each contain roughly 5 per cent of the population. Due to large districts (e.g. the big cities of Hamburg, Berlin and Munich), the exact population represented by a single bin varies between 2.93 and 4.96 million in 1990, 3.67 and 4.38 million in 2003, and 2.56 and 5.23 million in 2015.

As Figure 1 indicates, in 1995 (i.e. five years after German reunification), the poorest districts in Germany were all exclusively in the East of Germany (the former GDR). Berlin, which belonged in part to the former GDR and in part to the Federal Republic of Germany (FRG) before reunification, is an exception, with much higher income on average than the rest of the former East in 1995. The ranking of districts changed considerably over time, as shown in Figure 1, though even by 2015 the East is still relatively poor compared with the West. However, in 2015, there are equally poor districts in the West, such as in the Ruhr valley where deindustrialisation has had a large impact.⁸

Figure 2 displays the association between a district's poverty rank and mortality rates (per 1,000 inhabitants) for men (top panel) and women (bottom panel). There is a separate figure for each age group (0–4, 5–19, 20–49, 50–64, 65–79 and 80+). Each figure has a line for each of the three years: 1990, 2003 and 2015. Because of the lack of other data, we use disposable income in 1995 to rank districts in 1990. The rankings in 2003 and 2015 are

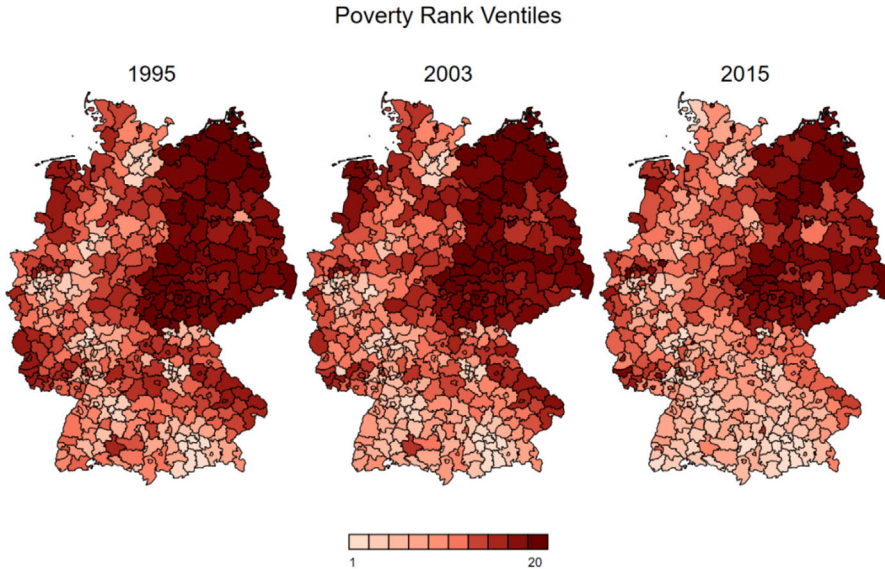
⁶Busse and Blümel, 2014.

⁷Papanicolas, Woskie and Jha, 2018.

⁸Oei, Brauers and Herpich, 2020.

FIGURE 1

Regional distribution of poverty ranks by year, where darker colours represent lower socio-economic status



based on income data for those years. Mortality rates in 2003 and 2015 are based on three-year averages (2002–04 and 2014–16, respectively), while data restrictions force us to use data from 1990 only to construct the 1990 mortality rate, possibly leading to higher variability in the 1990 rates. Table 1 displays average mortality rates (per 1,000 inhabitants) for the most extreme poverty bins for 1990, 2003 and 2015, separately by age and gender, as well as the slopes of the regression lines depicted in Figure 2. Furthermore, it reports p -values for tests of equality of the slopes across years.

The graphs in Figure 2 and the results in Table 1 show that mortality rates dropped considerably between 1990 and 2003, for both genders and across all age groups and all districts. For most age groups and districts, there are further but smaller reductions in mortality between 2003 and 2015. As the overall decline in mortality rates between 1990 and 2015 is particularly large for the poorer districts, inequality in mortality has dropped considerably in Germany, with no inequality remaining for children (5–19) and girls (0–4), for whom the gradient in mortality across districts is not significant in 2015 (Table 1), and older women (65+), for whom the gradient is still significantly different from zero in 2015 but comparably small.

It is striking that in many of the graphs the three points representing regions at the 85th percentile of poverty or higher showed much higher mortality

FIGURE 2
Yearly mortality per 1,000 by age group, gender and poverty rank

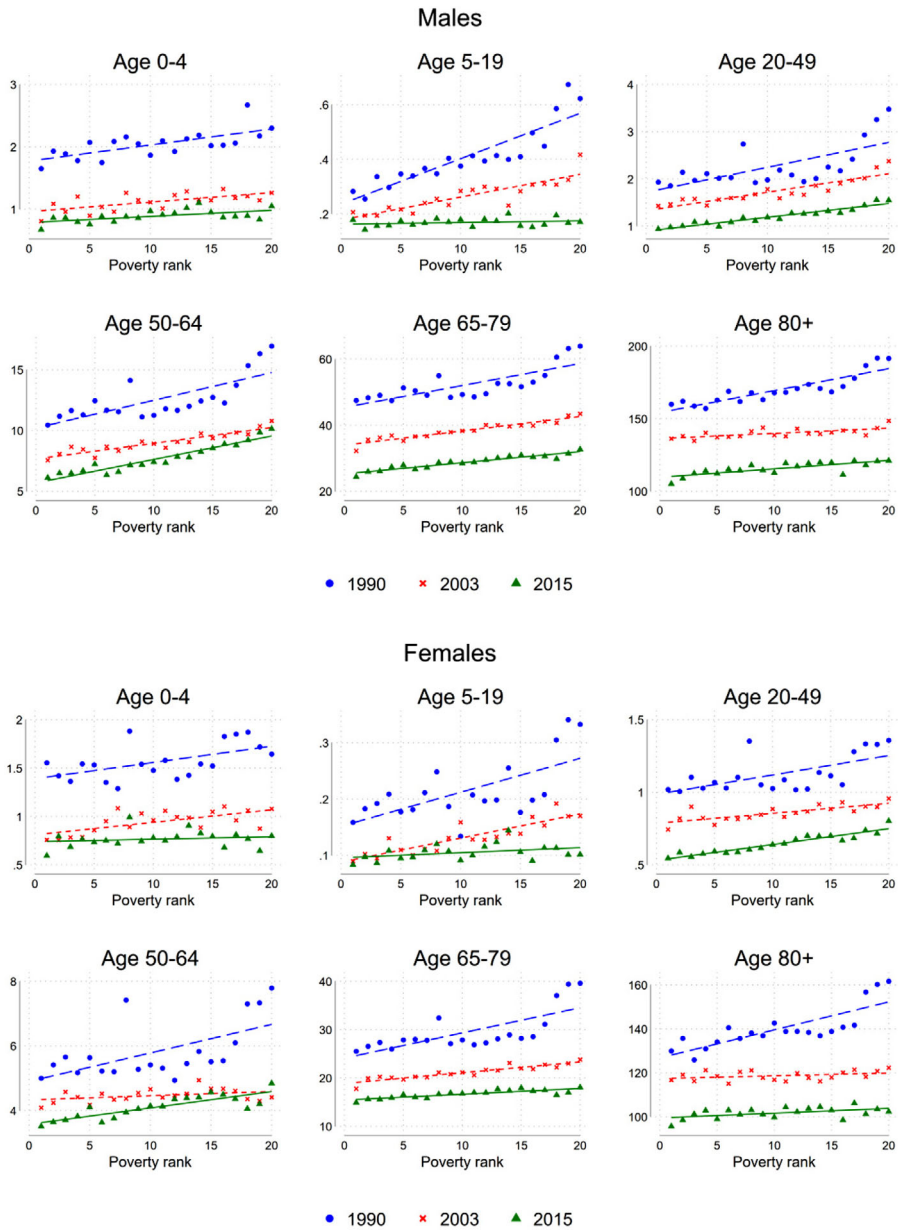


TABLE 1
Age-specific one-year mortality in lowest and highest poverty bins and change in inequality

	Lowest poverty bin		Highest poverty bin		Slope of regression line			p-value	
	1990 (1)	2003 (2)	1990 (4)	2003 (5)	1990 (7)	2003 (8)	2015 (9)	Δ_{1990}^{2003} (10)	Δ_{2003}^{2015} (11)
<i>Men</i>									
0–4	1.651	0.809	2.301	1.263	0.026*** (0.006)	0.015*** (0.004)	0.010*** (0.003)	0.176	0.309
5–19	0.283	0.206	0.623	0.417	0.017*** (0.002)	0.008*** (0.001)	0.001 (0.001)	0.001	0.000
20–49	1.931	1.429	3.478	2.379	0.053*** (0.014)	0.039*** (0.005)	0.029** (0.002)	0.374	0.077
50–64	10.452	7.556	16.951	10.795	0.228*** (0.047)	0.129*** (0.013)	0.193*** (0.014)	0.045	0.001
65–79	47.495	32.243	63.940	43.453	0.664*** (0.122)	0.435*** (0.034)	0.338*** (0.027)	0.084	0.068
80+	159.938	136.255	191.549	148.533	1.513*** (0.187)	0.359*** (0.093)	0.583*** (0.110)	0.000	0.130

(Continued)

TABLE 1
(Continued)

	Lowest poverty bin		Highest poverty bin		Slope of regression line			p-value Δ_{1990}^{2003} (10)	Δ_{2003}^{2015} (11)		
	1990 (1)	2003 (2)	2015 (3)	1990 (4)	2003 (5)	2015 (6)	1990 (7)			2003 (8)	2015 (9)
Women											
0–4	1.555	0.759	0.593	1.645	1.079	0.798	0.017** (0.006)	0.013*** (0.003)	0.003 (0.003)	0.511	0.028
5–19	0.159	0.090	0.083	0.333	0.170	0.102	0.006*** (0.002)	0.004*** (0.001)	0.001 (0.001)	0.320	0.000
20–49	1.019	0.744	0.545	1.357	0.957	0.802	0.013*** (0.004)	0.007*** (0.001)	0.011*** (0.001)	0.065	0.033
50–64	4.998	4.088	3.510	7.791	4.412	4.842	0.088*** (0.028)	0.013* (0.007)	0.051*** (0.008)	0.005	0.001
65–79	25.522	17.783	14.926	39.598	23.822	18.052	0.521*** (0.116)	0.222*** (0.022)	0.120*** (0.018)	0.019	0.002
80+	129.974	116.712	95.624	161.674	122.341	102.352	1.272*** (0.220)	0.127 (0.080)	0.217*** (0.086)	0.000	0.440

Note: Columns 1–6 report one-year mortality rates for each gender and age group in 1990, 2003 and 2015, in the bin of districts with the lowest and highest poverty rank. Rates for 2003 and 2015 are smoothed across three years. The rates are age-adjusted to the 2015 population. Columns 7–9 report the coefficient of the fitted regression line in each year. Columns 10 and 11 report the *p*-value for the null hypothesis that the slopes are equal in the given years. ***, ** and * denote significance at the 1, 5 and 10 per cent levels, respectively.

rates than other districts in 1990. From Figure 1, we know that these districts were all in the East. Hence, higher mortality rates in the poorest parts of the East were a significant driver of overall inequality in mortality in Germany. By 2003, these points are no longer such extreme outliers, suggesting that reductions in mortality in these particular districts helped to equalise mortality rates.

While inequality in mortality rates decreased across the board between 1990 and 2015, the picture is more nuanced for the subperiod 2003–15. During this subperiod, inequality decreased for children (girls 0–4, and both genders 5–19) but increased for the 50–64 age group. The results suggest that, for children, mortality rates declined more for poorer districts than for richer districts between 2003 and 2015, leading to a reduction in inequality. At the same time, there were either no improvements (for women aged 50–64) or smaller improvements (for women aged 20–49 and men aged 50–64) in mortality rates for poorer districts compared with richer districts for other age groups, leading to increases in inequality. For some age groups, mortality gradients remained constant (men aged 0–4 and 20–49, and men and women aged 80+; see Table 1).

III. Robustness and additional results

Part B

Figure 2 shows inequality in mortality rates obtained by re-ranking districts in each year using the average disposable income per capita for that year. Hence, the poverty rank is for a specific year. This re-ranking means that changes in mortality gradients over time could result from districts changing ranks, or from changes in mortality within districts with a fixed rank. In order to investigate what is behind these changes, we re-estimate our gradients using a fixed ranking based on the 2015 income data for all three years. The results are shown in Figure 3. Overall, the relationships look very similar whether based on re-ranking or using a fixed rank.

An interesting observation is that mortality rates for 1990 are more linear based on the 2015 ranking (Figure 3) compared with the re-ranked results in Figure 2. One reason is that Berlin, which is an outlier in terms of income in 1990 (high income compared with the East), had relatively high mortality rates that were similar to those of other Eastern districts. Based on the 2015 ranking, Berlin sticks out less. Another reason is that, as Figure 1 indicated, many poor regions in the East moved to a higher SES in relative terms over time. Thus, the poorest bins in 2015 consist of both Western and Eastern regions. As results in Section IV underline further, mortality was much higher in the East in 1990 across all age groups, so that combining mortality rates for Eastern and Western districts for 1990 (by using the fixed 2015 rankings) reduces extreme mortality rate outliers.

FIGURE 3
Yearly mortality per 1,000 (fixed 2015 poverty rank)

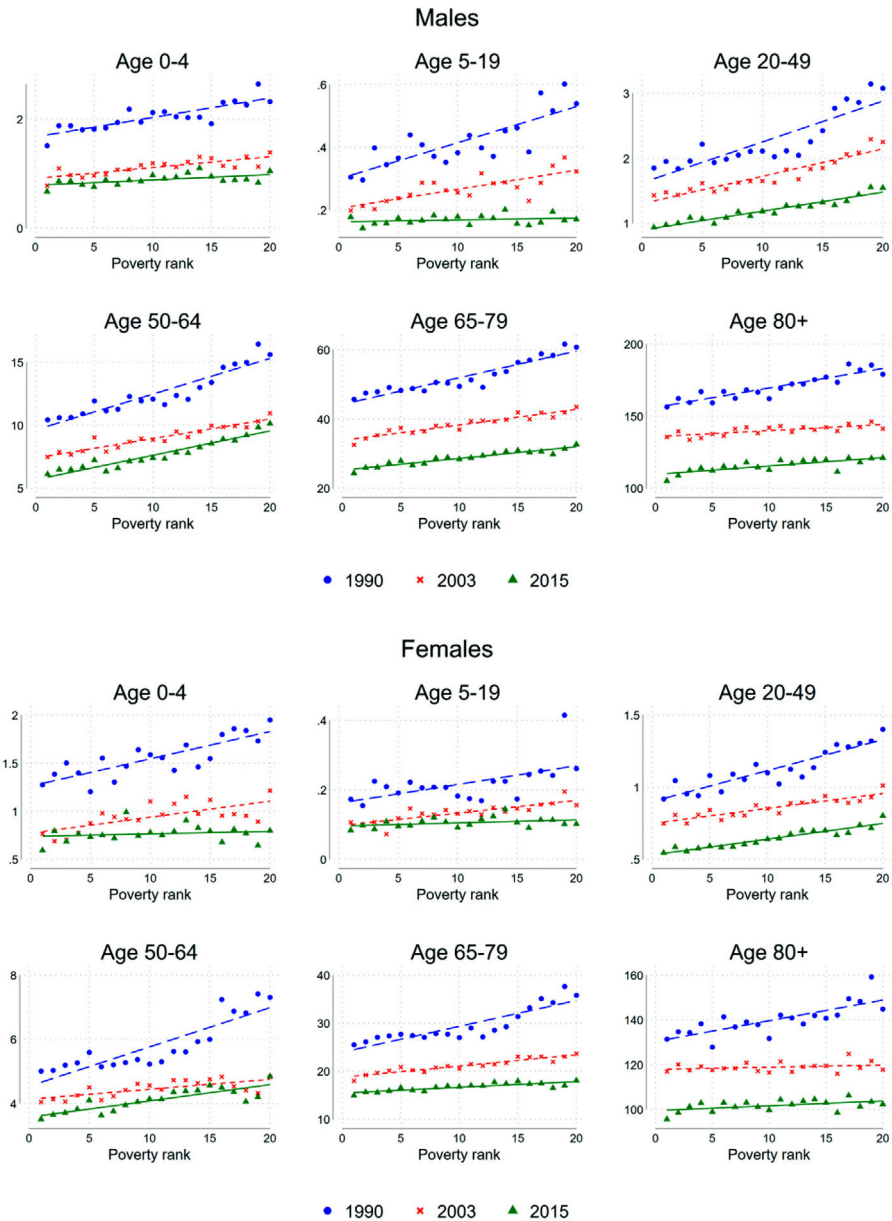
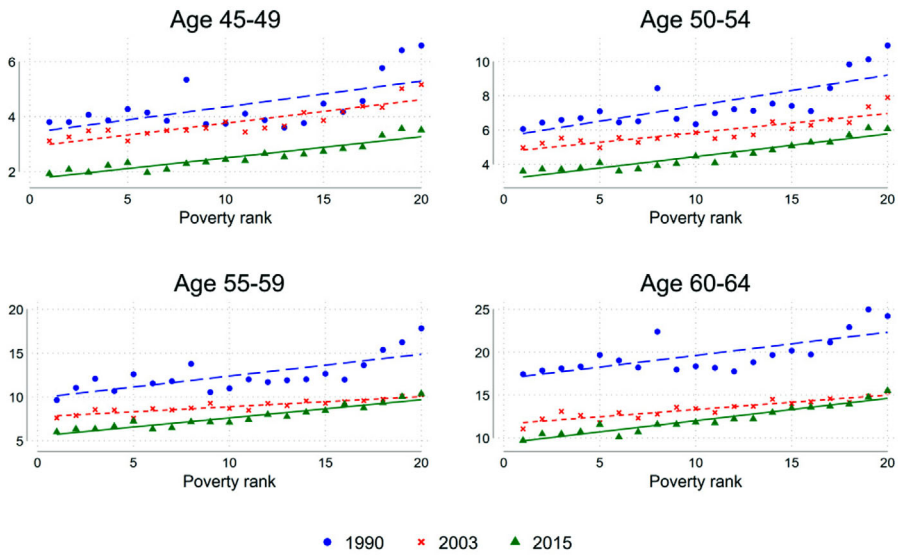


FIGURE 4
Mid-age yearly mortality per 1,000

Males



Females

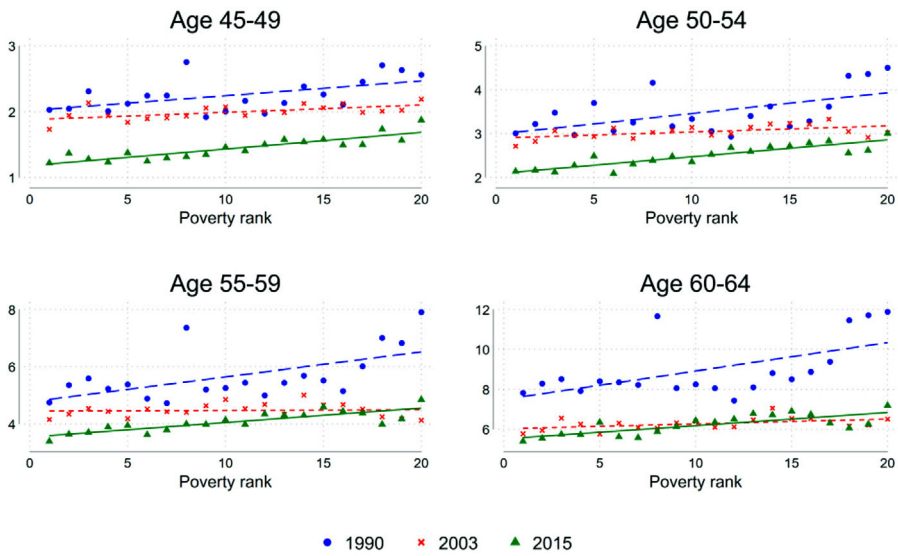


Figure A.1 displays the same results as Figure 2 without adjusting for age. The results in Figure 2 were age-adjusted to the 2015 population using the population counts in the finer five-year age groups discussed above. However, Figure A.1 suggests that age adjustment is not a major concern here – the general trends are similar in Figures 2 and A.1. The one difference is that in Figure A.1 the mortality gradient for young children in 1990 is almost flat. The underlying reason for the discrepancy in this case is the low number of births in the East in 1990 (because, within the 0–4-year-old group, infants have much higher mortality). This example shows that it is necessary to adjust for lower fertility in the low-SES areas (i.e. mostly East German districts) in 1990 in order to draw valid conclusions about the youngest age group.

Figure 4 explores mortality rates in middle age in more detail. It displays mortality rates for the smallest available age groups (45–49, 50–54, 55–59 and 60–64) and re-ranks districts over time, as in Figure 2. The trends by age group differ over time. Mortality rates fell for both genders and all age groups from 1990 to 2015. For the age groups between 55 and 64, this decrease was largest in the period 1990–2003, while for the age groups between 45 and 54, the decrease was largest from 2003 to 2015. Here, underlying cohort effects might be playing a role as the cohorts born during and shortly after World War II (i.e. ages 40–49 in 1990 or 55–64 in 2003) faced difficult conditions in early childhood.⁹ However, this should not influence the SES gradient in mortality rates, which is trending similarly for men and women. There was no improvement in mortality rates from 2003 to 2015 for lower-SES districts in the age groups between 55 and 64. For women aged 60–64, we even see the linear fit lines for 2003 and 2015 crossing (albeit narrowly): lower SES groups are worse off while higher SES groups are improving. In contrast, mortality rates have been decreasing for age groups between 45 and 54 across the board.

IV. Discussion: East–West differences and trends

1. Background and previous literature

Differences between the former Communist GDR and the West are widely studied in economics and other fields. While GDP per capita had been consistently higher in the West since the 1950s, life expectancy only started diverging in the 1970s.¹⁰ The East caught up in life expectancy rather quickly after reunification. In this section, we explore these differences further by examining age-specific mortality rates over time.

Various studies in the fields of epidemiology, sociology and demography have analysed mortality differences in Germany. Van Raalte et al. (2020) find

⁹Kesternich et al., 2014.

¹⁰Becker, Mergele and Woessmann, 2020.

that regional inequality in mortality, particularly among women, is low for Germany in an international comparison in absolute terms. Von Gaudecker and Scholz (2007) compare male pensioners' life expectancy at age 65 by lifetime earnings and find a positive association between income and longevity for both East and West German men. Kibele, Jasilionis and Shkolnikov (2013) also analyse male pensioners and find an increase in the income–mortality gradient from the 1990s to the 2000s that was more pronounced in East Germany. Rau and Schmertmann (2020) estimate life expectancy in 2015–17 at the district level. They find that life expectancy correlates with various local economic indicators while it does not correlate strongly with physician density and population density.

2. Health care in the East

The health care system in the former GDR was centralised and mostly state-operated. It was split up into ambulatory and hospital services. Up until the 1960s, it was considered a model health care system within the socialist countries. Since the 1970s, shortages of equipment and medical personnel had played a larger role.¹¹ While this was not disclosed to the public, internal documents later showed the lack of equipment, hospital beds and personnel, as well as the bad shape of the hospitals in the 1970s and 1980s. Medical technology in the 1980s was described as '10 years behind Western technology' in internal documents in the 1980s.¹²

As summarised by Busse and Blümel (2014), after the reunification in 1990, the East quickly and fully adopted the health care system of the West. An aid package of several billion euros directed at Eastern hospitals and nursing homes helped to modernise health care facilities in the East. Over time, the densities of hospital beds and medical personnel in the East have risen to levels that are comparable with the West. The net migration of 1.45 million people from the East to the West also played a role in this adaptation process. Today, there are marginal differences in health care provision between the East and the West in general. Differences are much more pronounced between rural and urban areas.

3. Trends within the East and the West by age group

Figure 5 explores differences in the evolution of inequality in mortality between the East and the West. Districts are binned according to their disposable income per capita (in prices of 2015). West German districts are grouped into 20 bins while former GDR districts (excluding Berlin) make up

¹¹Busse and Blümel, 2014.

¹²Erices and Gumz, 2014.

FIGURE 5A
 East versus West: trends in income and mortality rates, age 0–4

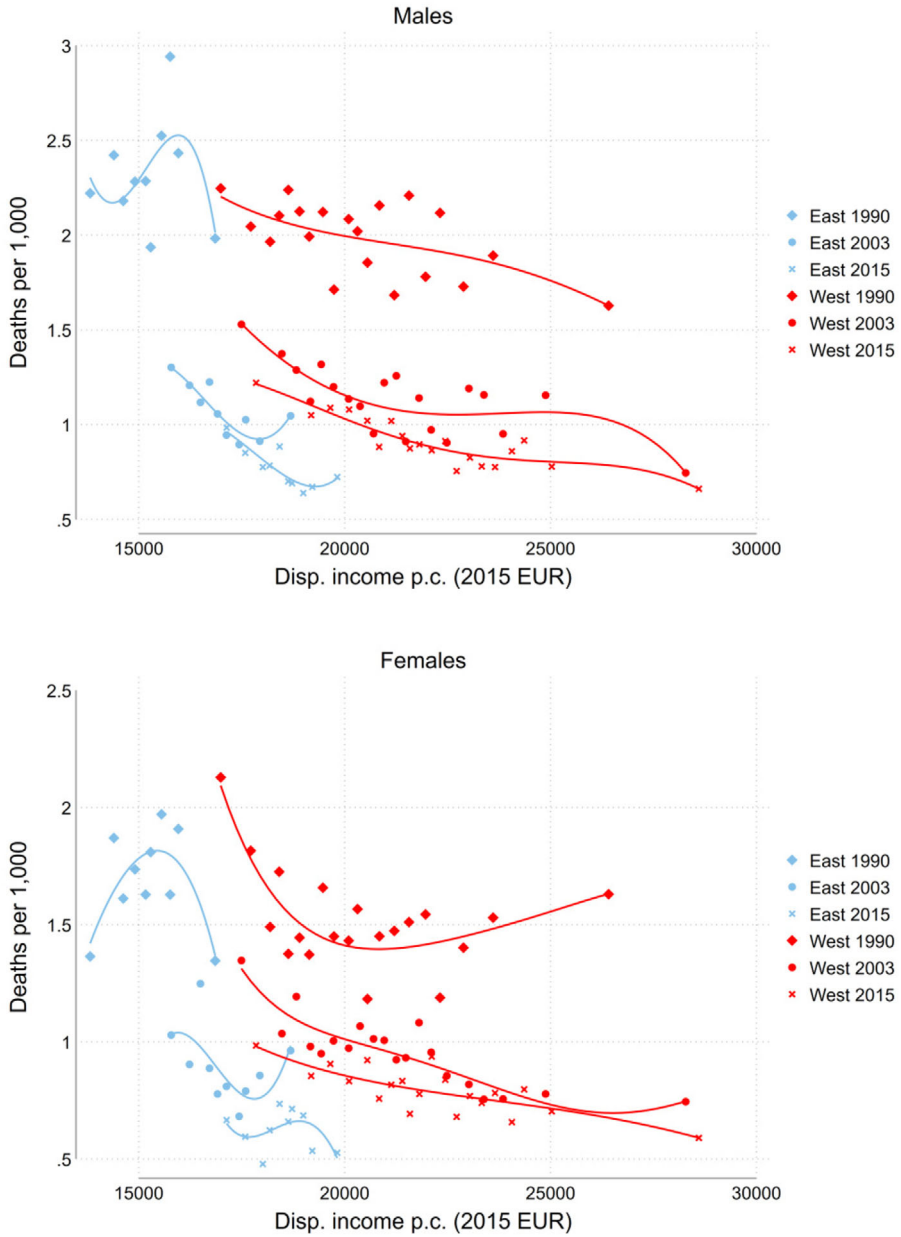


FIGURE 5B

East versus West: trends in income and mortality rates, age 5–19

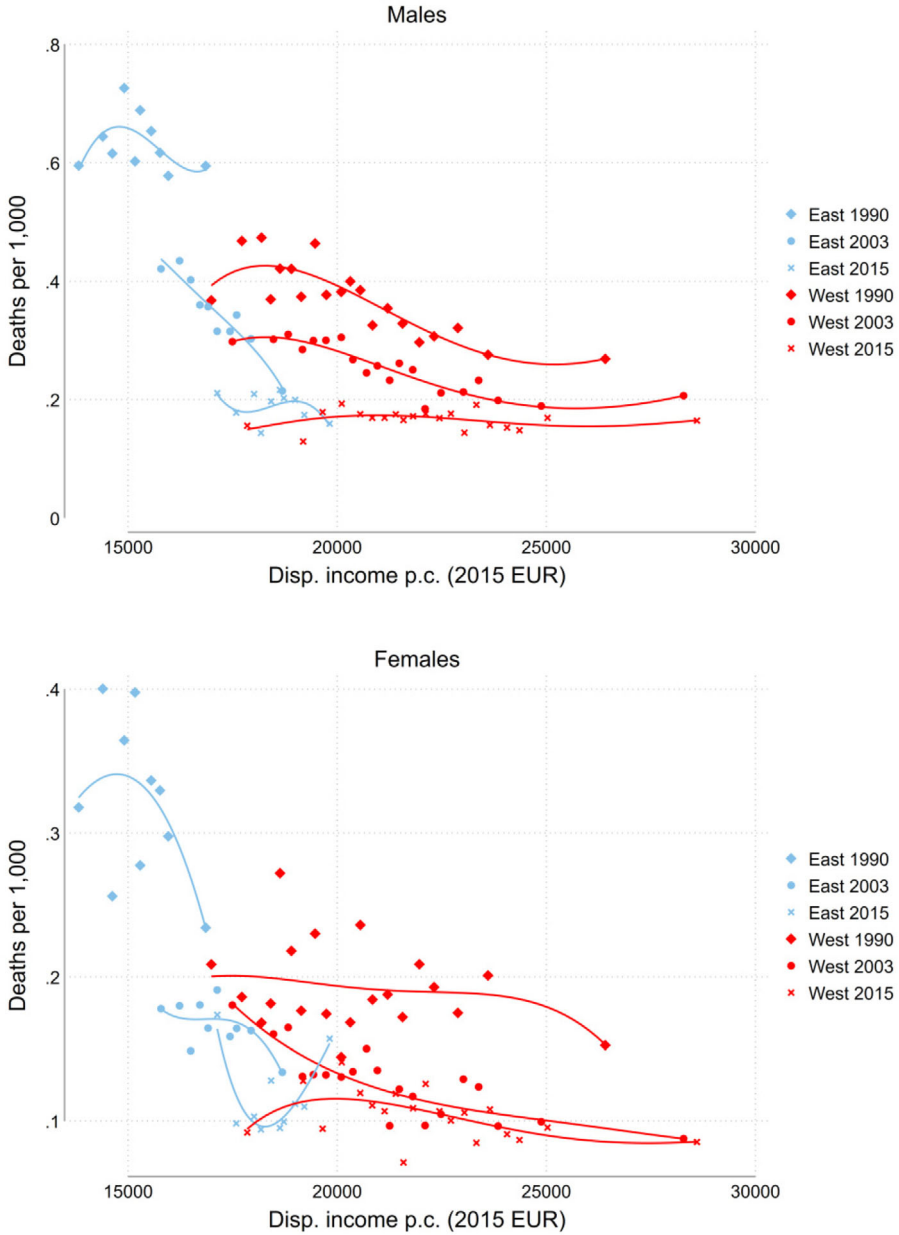


FIGURE 5C

East versus West: trends in income and mortality rates, age 20–49

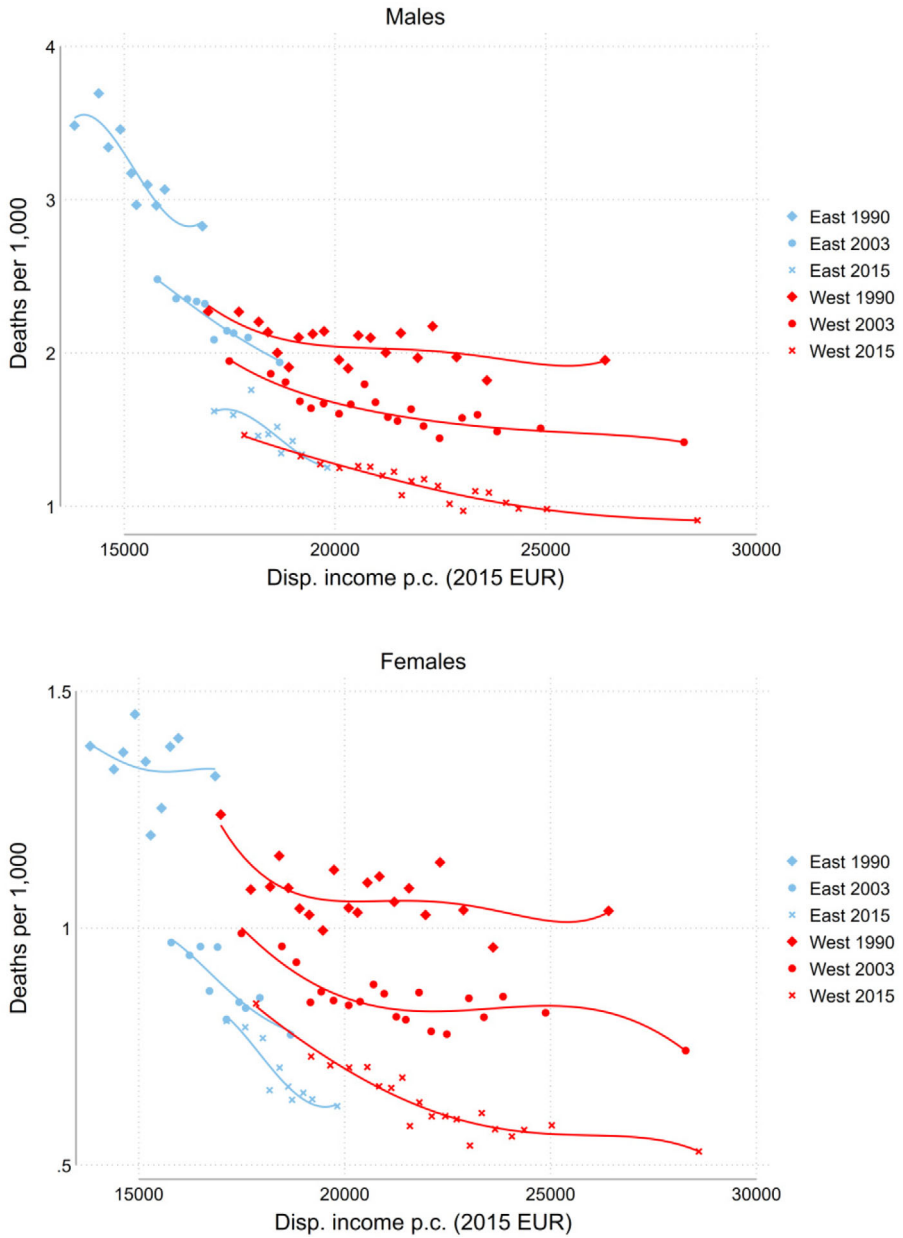


FIGURE 5D

East versus West: trends in income and mortality rates, age 50–64

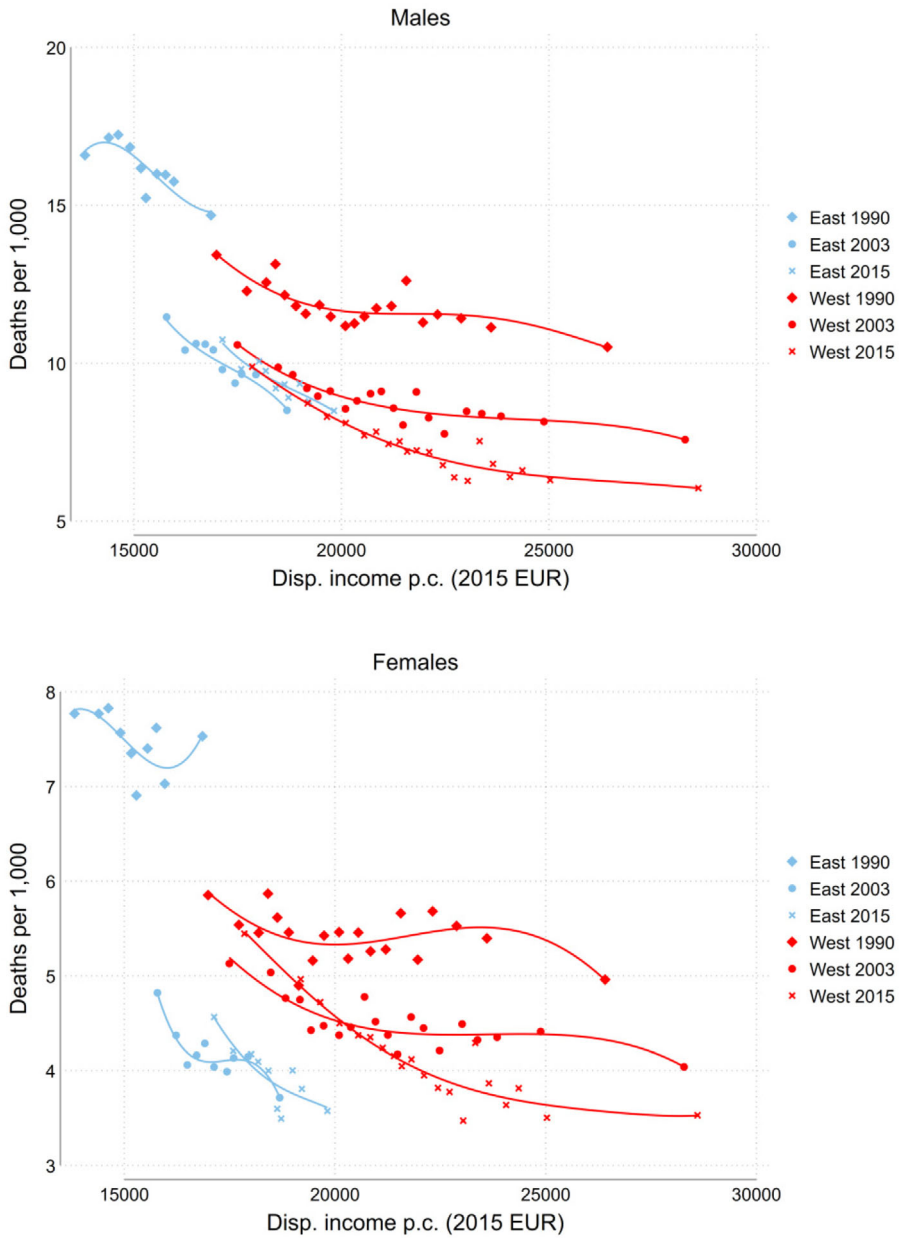


FIGURE 5E

East versus West: trends in income and mortality rates, age 65–79

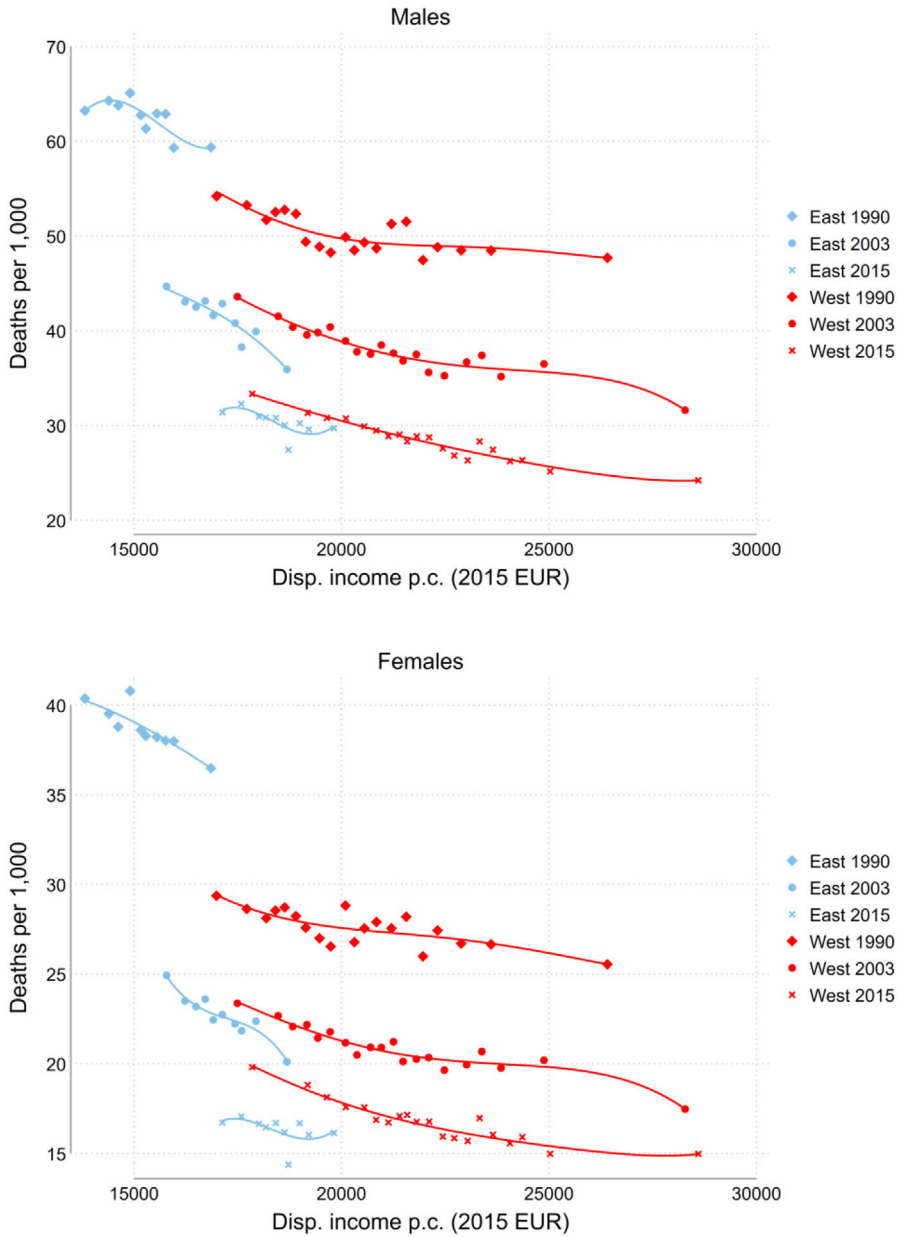
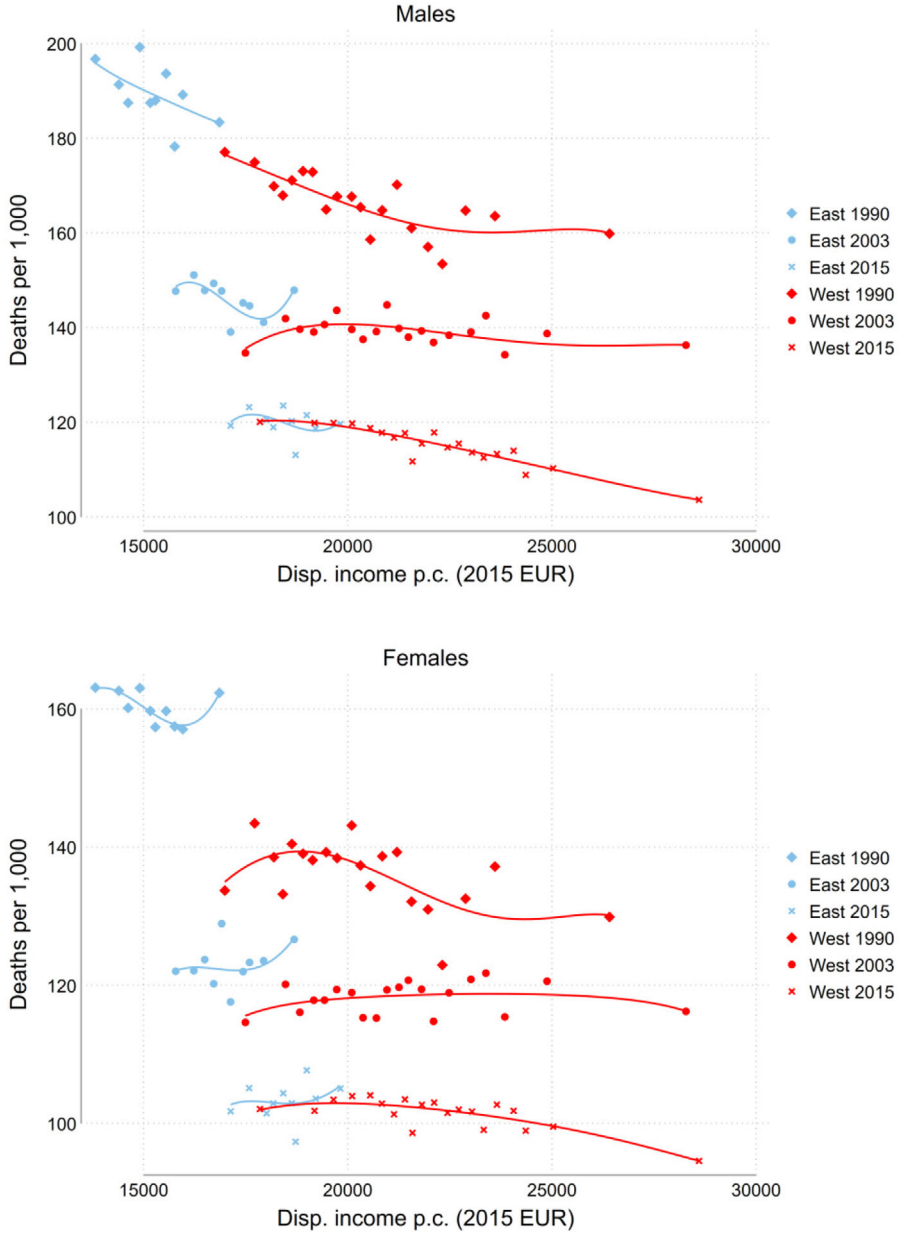


FIGURE 5F

East versus West: trends in income and mortality rates, age 80+



10 bins. Over time, movement to the right indicates improvements in income while a downward shift represents a lower mortality rate. Trend fit lines are polynomial to account for possibly non-linear trends.

Figure 5 indicates that there was no overlap in 1995 income between the East and the West (our SES measure for 1990). The richest decile in the East had lower disposable income on average than the poorest ventile in the West. This is not the case in 2003 and 2015 where we see some convergence in income. However, strong inequality persists as the highest decile in the East is still only at the level of the 16th ventile of the West in 2015. Income inequality within the West and the East also shows differing trends. While the range of incomes in the East is decreasing over time, the top and bottom income bins in the West diverge as a sign of widening regional economic inequality.

The most striking thing about Figure 5 may be that in many age and gender groups, mortality rates in the East and the West do not appear to be on the same line in 1990. That is, in 1990 the higher mortality in the East could not be explained simply by the fact that these districts had lower income. The discontinuity in the relationship between income and mortality is seen most strongly for men aged 5–49, and for women aged over 50. Looking over time, across all age groups, the reduction of inequality in mortality in Germany since 1990 is most strongly driven by improvements in mortality rates in Eastern districts. By 2015, mortality rates in the East are largely what one would expect given their lower income levels.

Kibele, Klüsener and Scholz (2015) argue that excess mortality in the East after reunification was attributable to traffic-related mortality among younger men and to excess cardiovascular mortality among people aged 60 and older; deaths from both of these causes were greatly reduced during the 1990s.

For young children (Figure 5A), the East–West gap was low in 1990, with slightly lower mortality rates in the West. As discussed above, mortality rates in this age group are mainly driven by infant mortality, which was 7.1 deaths per 1,000 live births in the West and 7.3 deaths per 1,000 live births in the East in 1990, according to the German Federal Institute for Population Research. In the late 1990s, the infant mortality rate in the East dropped below the rate in the West and remains lower in the East today (2.5 in the East compared to 3.3 in the West in 2019). This is especially remarkable as the SES disadvantage persists. In this age group, mortality has also dropped most in relative terms. It is possible that the difference in infant mortality rates may reflect a difference in which women select into child birth.

For those aged 5–19, Figure 5B shows the flattening of the SES mortality gradient in more detail. Because of the low number of deaths, the graphs are relatively noisy. By 2015, the West and the East had similar mortality rates and there was almost no gradient with respect to disposable income, which represented a remarkable improvement since 1990, especially in the East.

For adults aged 20–49, the mortality disadvantage in the East was particularly pronounced for men in 1990, while for women, the biggest mortality disadvantage in the East opened up after age 50. These large gaps had largely closed by 2003 for men in both age groups whereas by 2003 women aged 50–79 in the East have lower mortality rates than their Western counterparts with similar income. In 2015, the picture is similar: men in the East die at comparable rates to similar income groups in the West while women in the East have a lower mortality rate conditional on income category. Among men aged 65–79, the clear 1990 East–West mortality rate gap had mostly closed by 2003 and fully closed by 2015.

Figure A.2 compares the development of SES gradients in the West and the East from 1990 to 2015 for more years (in five-year intervals). Here, districts in the West and in the East are grouped into five bins each. One-year mortality rates are shown. As districts are ranked within East and West, we can compare, for example, mortality in the poorest places in the West with mortality in the poorest places in the East. Conducting this type of comparison reveals a puzzle – although mortality rates for men are largely similar conditional on poverty rank, women aged 5–19 (Panel B2) and 50–64 (Panel D2) in the poorest places in the West have higher mortality than those in the poorest places in the East. Hence, pockets of high poverty and high mortality appear to be emerging in the West. Kibele et al. (2015) also observe that many economically disadvantaged regions in the West have become high-mortality hot spots.

A potential limitation of our analysis is that there is undoubtedly a good deal of inequality in income and mortality rates within districts as well as across districts. Rau and Schmertmann (2020) find that deprivation indicators correlate most strongly with life expectancy at the district level and more so than GDP per capita. This suggests that individual-level associations between income and mortality rates, which have been demonstrated for subgroups,¹³ are likely to be larger in magnitude than our district-level gradients.

V. Summary and conclusions

Income-related inequality in mortality rates across German districts has decreased considerably since 1990, for all age groups and both genders. This decrease is mainly driven by the fact that the East has caught up. The East remains considerably poorer, on average, than the West 25 years after reunification, but the large gap in disposable income that existed five years after reunification has closed and there are now equally poor districts in the East and West.

¹³See, for example, Von Gaudecker and Scholz (2007).

In contrast to the slow progress in terms of closing the income gap, the East has largely caught up and even overtaken the West in terms of reducing mortality. In 2015, mortality rates for many demographic groups (particularly for infants, but also for women aged 20–79) are below those of comparably poor districts in the West. For men, mortality rates conditional on district income are now quite similar in East and West.

Our results align with findings in the literature¹⁴ that life expectancy does not differ significantly between the East and West, while GDP in the East is still significantly lower than in the West. Our results provide further detail about where the catch-up in life expectancy is coming from: the main driver for males is lower mortality rates among children aged 0–4 in the East compared with similarly poor districts in the West. For females, mortality in the East is also lower for age groups 20–49, 50–64 and 65–79.

These results speak to the larger literature about the relationship between inequality in income and inequalities in health. Germany offers a case study in which gaps in mortality were closed and even reversed, even while gaps in income proved stubbornly resistant to change. Understanding the drivers of this tremendous progress in the East, coupled with the reasons for the emergence of mortality hot spots in the West, is an important topic for future research.

Article Funding

Open access funding enabled and organized by Projekt DEAL.

Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

- Appendix

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¹⁴Becker, Mergele and Woessmann, 2020.

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