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## ABSTRACT

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### **Forced Migration and Mortality\***

We examine the long-run effects of forced migration from Eastern Europe into post-war Germany. Existing evidence suggests that displaced individuals are worse off economically, facing a considerably lower income and a higher unemployment risk than comparable natives even twenty years after being expelled. We extend this literature by investigating the relative performance of forced migrants across the entire life cycle. Using social security records that document the exact date of death and a proxy for pre-retirement lifetime earnings, we estimate a significantly and considerably higher mortality risk among forced migrants compared to native West-Germans. The adverse displacement effect persists throughout the earnings distribution except for the top quintile. Although forced migrants are generally worse off regarding mortality outcomes, those with successful labor market histories seem to overcome the long-lasting negative consequences of flight and expulsion.

**JEL Classification:** I12, J61, O15, R23

**Keywords:** forced migration, differential mortality, lifetime earnings, economic history

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# 1 Introduction

In the aftermath of World War II, about eight million Germans were forcibly displaced from Eastern Europe to West Germany. This mass expulsion is one of the largest population movements in history, leaving the bulk of forced migrants to arrive in a country that suffered from major destruction. Against this background and the fact that displaced individuals had to restart with little or no possessions, the integration of the large population inflow was a challenging task. Empirical research has shown that these migrants exhibit considerably lower incomes and a higher unemployment risk even 20 years after the mass exodus (Lüttinger, 1986; Bauer et al., 2013). Emphasizing the role of the local environment, recent evidence further indicates that counties with high industrialization and low refugee inflows were much more successful in integrating forced migrants within two decades after the war (Braun and Dwenger, 2017). An open question that remains is whether flight and expulsion have long-run consequences across the entire life-cycle.

This article aims to fill this gap by investigating lifetime outcomes of forced migrants. In particular, we analyze the effect of displacement on mortality, comparing displaced persons predominantly from the former Eastern territories of the German Reich to native West-Germans. We further examine effect heterogeneity across completed labor market biographies, i.e. pre-retirement lifetime earnings, to learn more about mechanisms that transmit the negative consequences of displacement over the life course.

The identification of the displacement effect is based on exogenous variation from the large-scale inflow of forced migrants into post-war Germany between 1944 - 1950. This natural experiment involves several features that allow us to isolate the effect of flight and expulsion on the mortality of forced migrants relative to native West-Germans. First, the population of displaced persons under consideration had no choice to stay whatsoever and migrated in a short period of time, which refrains our analysis to suffer from self-selection

problems and cohort effects inherent to many empirical studies on the integration of migrants (Borjas, 1985, 1987, 1999). Second, selective return migration (see Lubotsky, 2007, for a discussion) was virtually impossible due to the iron curtain until 1989. Even after the fall of the wall it remains unlikely that the elderly population under study remigrated after settling in West Germany for more than 40 years and when taking into account that resentments towards Germans in Eastern Europe exist until today. Third, language abilities and transferability of skills should not play a role for the group of migrants analyzed in this study, since most of the displaced persons were German speakers and received their education at German schools. Finally, pre-war characteristics of natives and displaced persons were largely similar. While this has been shown to hold for several socio-economic characteristics (see Bauer et al., 2013, based on census data), we use information on regional disparities in mortality rates as an important control variable in our analysis.

Studying the elderly population at risk from age 68 onwards, we find that displaced individuals exhibit a considerably and significantly higher mortality risk than comparable natives. Our estimates of the differential in mortality hazards between displaced and native men range from 0.73 to 1.27 percentage points, meaning that the mortality risk of displaced men is about 12% to 21% higher than the average mortality rate in the sample of elderly males (6.0% per year). Similarly, for women the estimated differential in the mortality hazard ranges between 0.18 and 0.48 percentage points, translating into a 3% to 9% higher mortality risk of displaced women compared to average mortality in the sample of elderly females (5.3% per year). Using a measure of pre-retirement lifetime earnings, we further show that the adverse displacement effect persists through large parts of the earnings distribution. Within the top quintile, the adverse effect not only disappears. Our estimates even indicate a slightly lower mortality risk among forced migrants. This suggests that displaced individuals with exceptionally successful labor market biographies are able to overcome the long-lasting negative consequences of flight and expulsion.

Although more than 65 million people were forcibly displaced worldwide in 2015 UNHCR (2016), only little is known yet about the consequences of forced migration.<sup>1</sup> A growing literature examines the effects of forced migration on host countries' labor markets (Ruiz and Vargas-Silva, 2015) or its impact on economic outcomes and integration of displaced persons (e.g. Sarvimäki et al., 2009; Falck et al., 2012; Bauer et al., 2013; Fiala, 2015; Braun and Dwenger, 2017), finding predominantly negative effects<sup>2</sup> of forced migration in the short- and medium-term. Our contribution to this literature is to examine the effects of forced migration across the entire life-cycle, focusing on mortality as an objective health outcome. This novel feature adds to the general understanding of the long-run consequences of forced migration as a global and prevailing phenomenon.

Our study also relates to the economic mortality literature that largely agrees upon conditions and experiences early in life to have profound consequences later in life.<sup>3</sup> Since the population that we study here is predominantly aged 18 - 45 by the time of expulsion, our results closely reflect what has recently been termed the *cumulative disadvantage* over life (Case and Deaton, 2015, 2017). Although Case and Deaton refer to a different study group<sup>4</sup> the mechanisms behind the cumulative disadvantage are strikingly close to what we find with respect to mortality outcomes of forced migrants in Germany: adverse conditions at the outset of their living in West Germany accumulated to disadvantages over the entire

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<sup>1</sup>An extensive literature has examined voluntary migration. However, the process behind forced migration differs in many respects from voluntary migration decisions such that many of the policy implications and conclusions from studies on voluntary migrants may not be applicable to forced migrants (see Ruiz and Vargas-Silva, 2013, for an overview on the forced migration literature).

<sup>2</sup>Positive effects on long-term income of males in Finland have been argued to be due to an accelerated transition from traditional to modern occupations (Sarvimäki et al., 2009). A similar result is documented for those forced migrants in Germany who worked in the agricultural sector before migrating to West Germany (Bauer et al., 2013).

<sup>3</sup>Individuals born in a recession live fewer years than individuals born in times of economic prosperity (van den Berg et al., 2006). Recent evidence further suggests that entering the labor market in a recession (“unlucky start”) increases mortality later in life even if initial losses in earnings have faded (Schwandt and von Wachter, 2017).

<sup>4</sup>The term *cumulative disadvantage* is used by Case and Deaton (2017) to describe recently increasing mid-age mortality rates among non-hispanic whites without college degree in the U.S. (1998 - 2015), triggered by increasingly poor labor market conditions at the time of labor market entry.

life-cycle. Estimating higher mortality rates in the elderly displaced population on average indicates that the incisive and dramatic experience of expulsion has negative effects that are largely irreversible.

Finally, the vanishing displacement effect at the upper margin of the earnings distribution indicates an inverse relationship between lifetime earnings on the one hand and the mortality risk *differential* between displaced persons and natives on the other hand. This insight is not only in line with the inverse relationship between income and health (or mortality) as one of the most robust empirical findings in economics and medical science.<sup>5</sup> It is also highly policy relevant because it highlights the importance of successful economic integration.

The remainder of this article is organized as follows. Section 2 outlines the historical background of the paper. Section 3 describes the data, introduces the empirical strategy and discusses selection issues. Section 4 presents the estimation results and several sensitivity checks. Section 5 concludes.

## 2 Historical Background

West Germany experienced a major population inflow in the aftermath of World War II. Between 1944 and 1950, about 7.9 million displaced persons or more than 16% of the total West German population at that time entered the country.<sup>6</sup> Figure 1 shows the region of origin of the forced migrants. Among them were 4.4 million 'National Germans' (*Reichsdeutsche*) that used to live in areas that were located east of the Oder-Neisse rivers such as Silesia, East Prussia or Pomerania. Additionally, individuals of ethnic German origin (*Volksdeutsche*)

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<sup>5</sup>For recent empirical evidence on the link between income and health, see Chetty et al. (2016). What remains controversial until today is measuring the causal impact of income on health (or mortality) and vice versa. Low income could explain poor access to health care or less healthy nutrition but one could also think of poor health to reduce the ability for gainful employment or even to prevent people from investing in human capital. See Smith (1999) and Deaton (2003) for discussions.

<sup>6</sup>Douglas (2012) provides a detailed overview about the historical background of the mass migration while Connor (2007) focuses on the integration of expellees into post-war Germany. Lüttinger (1986) and Reichling (1958) summarize the most important data on the forced migrants that arrived in Germany.

that lived as minorities in foreign countries made up 3.5 million refugees. The majority of these ethnic Germans came from Sudetenland, which was located in Czechoslovakia in close proximity to the German border (Connor, 2007).

Expulsion of Germans from their homelands took place in three phases starting in October 1944 when advancing Soviet troops entered through the eastern border of the German Reich. The cruelty of the approaching Red Army caused Germans to flee westwards. These so-called 'treks' were very risky as refugees were exposed to extreme weather conditions (e.g. strong winter), malnutrition, as well as air strikes by the allied troops. Many did not survive this exhausting flight. By the end of the war in May 1945 and the unconditional surrender of Nazi Germany, the second phase of displacement, so-called 'wild' expulsions conducted by Polish and Czechoslovakian authorities, started. Those affected by these 'wild' expulsions were forced to leave their homes and personal belongings behind and were put into internment camps where they stayed before being transferred to Germany. The Potsdam Treaty from August 1945 marked the third phase of expulsion. As a result of this treaty, the eastern border of Germany was shifted westwards to the Oder-Neisse rivers and Germany was divided into four zones of occupation. Furthermore, the treaty legalized resettlement of the remaining German population in Poland and Czechoslovakia, which lasted until 1950. Overall, the displacement of Germans from the Eastern European countries was almost universal and individuals had no other choice than to leave their home regions.

Displaced persons who finally arrived in West Germany had to start their new lives without any financial means and often without any social network, since larger groups of refugees from the same home region were often distributed geographically to prevent the formation of 'a state in a state' (Connor, 2007). They entered into a country that was earmarked by vast destruction of the war accompanied by severe food and housing shortage. Tensions between natives and newcomers arose quickly, especially in more rural areas, where natives were less open to outsiders, experienced fewer damage by the war and possessed fewer



knowledge on the actual circumstances of the expulsion. In contrast, expellees in larger cities were soon recognized as precious economic resource for war reconstruction. For expellees who had to build up their life from scratch this often meant working as unskilled laborer rather than as self-employed farmers, which many did before the displacement. Further tensions appeared from different religions of natives and newcomers<sup>7</sup>, fear of foreign influence by the natives and local politicians that did little to foster integration (Connor, 2007).

Post-war West Germany, however, implemented several measures to foster economic integration of newly arrived Germans from the former Eastern territories of the German Reich and other Eastern European countries. The 'Law of Equalization of Burden' (*Lastenausgleichsgesetz*) from 1952 compensated forced migrants as well as the indigenous German population for the loss of property or savings. The idea behind this law was that the ones with high losses from the war were compensated by those who had to handle fewer losses. Another important law was the 'Law for Foreign Pensions' which acknowledges specific periods of work for the pension claims of forced migrants and therewith reduces the burden for forced migrants. This law is crucial for the following empirical analysis, since it allows us to identify expellees in our data.

## 3 Data and Empirical Strategy

### 3.1 Data and Variables

The empirical analysis is based on large-scale administrative data from German pension insurance accounts. Specifically, we use individual records that document the termination of individual pensions due to death (*Rentenwegfall*). The pension shortfall is available for the

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<sup>7</sup>For example, some catholic Sudeten were placed in protestant North Hesse and Franconia, while many protestant migrants were settled to catholic areas in Lower Bavaria (Connor, 2007).

entire German population covering the years 1994 - 2013<sup>8</sup>, accessible via remote-computing provided by the German federal pension insurance (*Deutsche Rentenversicherung*).<sup>9</sup>

Using these social security records is advantageous in many respects for answering the questions at hand. First, all data points are generated within the administrative process and document the exact date of birth and death without measurement error. Second, pension shortfall records provide an universal picture on mortality in Germany because they include everyone who has ever been registered for an insurance account and received a pension at some point in time. Since we study a sample of the elderly population (from age 68 onwards) it is almost certain that eligible individuals receive pension benefits. In fact, the data source covers 82% of the total number of death cases according to official mortality statistics (Federal Statistical Office, 2016), including 96% among men and 75% among women.<sup>10</sup> Finally, the insurance accounts include information to identify forced migrants and to distinguish them from the native West-German population.

To account for differences in regional birth and death rates we supplement the analysis with historical mortality data from statistical yearbooks of the German Reich.<sup>11</sup> Systematic differences in mortality rates between the country of origin (former Eastern Territories of the German Reich) and the destination country (West-Germany) would compromise our results. Variation in regional life expectancy is possible, for example, due to the effects of

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<sup>8</sup>Precisely, the covered period is from December 1993 to November 2013. Due to the nature of the administrative process, each annual wave of pension shortfall records samples all cases of death from January to November of a given calendar year adding those cases documented for December of the preceding year. For example, the wave of 2012, includes all deaths that were documented from December 2011 - November 2012.

<sup>9</sup>A detailed description of the sampling design (in German) and a code book is available in the data documentation (Forschungsdatenzentrum FDZ-RV, 2017).

<sup>10</sup>People who never became actively registered within the German public pension system do not have a pension insurance account and thus do not appear in the data. Men exhibit high labor force participation rates. Consequently, the vast majority of them do have pension insurance accounts. Among women, the coverage rate is smaller because some of them never worked. In this case they obtain pension benefits (and a corresponding account) only from periods of pregnancy and child raising.

<sup>11</sup>We use an electronically preprocessed version of the original print by Besser (2008), using information only for those birth cohorts that are sampled in our primary data from pension shortfall records, i.e. 1885-1925.

maternal nutrition and health status on mortality (see Barker, 1990, 1995). Health and mortality outcomes could also be influenced by general living standards and regional-specific industries that may involve physically demanding work. In fact, while Silesia and Bavaria had quite low life expectancies, regions in the North-West of Germany reported higher life expectancies (Kibele et al., 2015). To encounter this challenge, we use birth and death rates for each region of the German Reich (measured by year of birth for each individual), allowing us to control for ex ante differentials in mortality across regions.

### 3.1.1 Separating Forced Migrants from Natives

We identify forced migrants based on the legal framework of the 'Law for Foreign Pensions' (LFP) (*Fremdrentengesetz*) enacted in 1960<sup>12</sup>. The goal of the LFP was to acknowledge periods of work or work-related periods (e.g. unemployment, illness, pregnancy and child-raising) accumulated previous to expulsion from Eastern Europe for the pension claims of forced migrants in the West-German public pension system. The value of an acknowledged period was based on the level of education and the occupational group of the displaced person, referring to average earnings of these groups in Germany.<sup>13</sup> For each person with LFP-related pension claims, the data document the country of origin, the amount of acknowledged earnings and the length of the acknowledged period in months.

Based on this information, we define forced migrants as those persons who entered West-Germany between 1944 and 1950, encompassing the period of mass expulsion, who obtained pension claims referring to the LFP and who were expelled from the former Eastern Territories or one of the Eastern European countries that were affected by the mass expulsion (see Figure 1). Unique identification of forced migrants via LFP pension claims requires

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<sup>12</sup>The LFP was enacted on February 25, 1960 (BGBl. I 1960, S. 93).

<sup>13</sup>This was necessary to account for the nature of the German pay-as-you-go pension system, where contributions and corresponding claims are relative to annual labor earnings. A specific type of worker thus received pension claims as if she had contributed to the public pension system just as a comparable West-German worker.

the existence of such claims. The LFP provided a generous program that aimed at making forced migrants similar to the West German population in terms of pension claims. Since the LFP accounted not only for working times but also for other labor market related periods, it is unlikely that displaced persons were not covered or did not call on these claims, because otherwise their old age incomes would deteriorate.

Natives are defined to be individuals with German citizenship without recent migration history, restricted to former West-Germany. We drop all observations that neither satisfy the definition of forced migrants nor the one for natives.

### **3.1.2 Birth Cohort Composition**

To identify forced migrants according to their pre-migration pension claims, we need to ensure that individuals have reached working age once they migrated. Taking into account the beginning of mass expulsion in 1944, we set the minimum age at migration to 18 by restricting the sample to birth cohorts that were born in 1925 or earlier. Choosing younger cohorts (born after 1925), while principally possible, would increase the likelihood that forced migrants are mistakenly sampled as natives because they did not have the chance to collect creditable pension claims previous to migration. Our baseline cohort choice (1925 and older) reasonably balances the sample at two margins: it allows to cover a large number of birth years and ensures to uniquely distinguish forced migrants from natives. Later-on, we relax this restriction by also including younger cohorts to show the sensitivity of our baseline estimates against this choice.

Our final sample consists of birth cohorts from 1885 - 1925 (see Figure 2). The upper margin of the cohort distribution is limited by the age restriction imposed to identify displaced persons. The lower margin is unrestricted and thus only limited to people who reach the observation period (starting in 1994) in terms of survival. Older cohorts are thus represented to a lesser extent. Figure 2 also illustrates that fewer individuals who were born

during World War I (1914 - 1918) are sampled due to lower birth rates at that time.

### 3.1.3 Definition of Mortality

We define mortality as the instantaneous probability of dying conditional on having survived until the respective point in time. For each individual in the data, we observe the exact date of birth and death on a monthly level, allowing us to determine the exact age at death. Speaking of the displacement effect thus refers to estimating the mortality hazard based on the event of death as dependent variable.

### 3.1.4 Approximating Lifetime Earnings

To investigate the relative performance of displaced vs. natives, we also examine mortality differentials across the entire earnings distribution. We approximate pre-retirement lifetime earnings using a variable that includes the individual sum of so-called earnings points (EP), documenting pension claims that predominantly consist of plain labor earnings. One EP from labor earnings of individual  $i$  in year  $t$  is defined as  $EP_{it} = \frac{y_{it}}{\bar{y}_t}$ , where  $y_{it}$  are labor earnings of individual  $i$  in year  $t$  and  $\bar{y}_t$  are the average labor earnings of all contributors of the public pension system in that year. Intuitively, one EP reflects the relative earnings position of each individual in a given year, i.e., an employee receives exactly one EP per year if she contributes at average earnings, two EP if she contributes at twice the average earnings, and so on. For each individual, our data include the sum of annual earnings points that are given by  $EP_i = \sum_{t=1}^T EP_{it}$ , where  $T$  is the last year of gainful employment before an individual retires. Although EP are not a perfect measure of earnings because they also include creditable periods, e.g., from education or child-raising (see appendix A for a detailed description of its limitations), we argue that they are a fairly reasonable proxy of pre-retirement lifetime earnings.

The actual distribution of earnings is depicted in Figure 3, reflecting the typical labor

force patterns of men and women within the observed birth cohorts: while men overwhelmingly work in full-time jobs and often have working biographies of 40 years or more (sample mean: 44 EP), women either work in part-time jobs or not at all (sample mean: 20 EP). The patterns in Figure 3 summarize these labor market histories by showing a remarkable spike for women at low EP-values (between 8-12), that are due to creditable periods of child-raising (max. 2 EP per child until 1992) and another spike between 20 - 30 EP, reflecting gainful employment that is dominated by part-time work. Among men, the patterns are much more homogenous with the highest densities between 40 - 60 EP, reflecting typical full-time work biographies. Table 1 further documents substantial gender differences in mortality patterns and labor market histories. Women strongly outlive their male counterparts and were less active in the labor market, having collected a lower number of earnings points and obtained fewer contribution months to the pension insurance (insurance months predominantly consist of contributions from gainful employment).

### **3.1.5 Estimation Sample**

The final sample documents cases of death between 1994 and 2013 covering the West-German population. After imposing these restrictions for persons born between 1885 and 1925 and following the definition of forced migrants and natives, our final estimation sample consists of a total number of 4.98 million observations that split into sub-samples of 2,985,403 million women and 1,992,963 men (Table 1). The share of forced migrants of about 0.7% seems low when having in mind that, just after World War II, forced migrants represented no less than 16% of the West-German population. However, due to the birth cohort restriction, the predominant part of forced migrants in our sample is between age 25 to 45 at the time of entering the country (see Figure 2). Only 30% of the total expellee inflow in West Germany belonged to this age group (Reichling, 1958). Moreover, our sample only contains those migrants that have at least celebrated their 68th birthday, i.e. have not died before 1994.

Finally, having collected any earnings points that count for pension claims is a prerequisite to enter the sample. Despite these requirements and the age restriction, our final sample still includes more than 33,000 displaced persons (12,072 men and 21,031 women).

## 3.2 Empirical Strategy

In recognition of the timing structure of our outcome variable, we model the mortality hazard as it is common in the mortality literature (see, for example, van den Berg et al., 2006; Palme and Sandgren, 2008; Kalwij et al., 2013). We use a discrete time version of the Cox proportional hazards model since age is measured in years and thus the event death can only occur at the level of age in years. Integrating the continuous time hazard function  $\lambda_{1i}(t) = \lambda_0(t) \exp(\alpha D_i + \beta' x_{it})$  over the interval  $[t, t + 1)$  yields the discrete time hazard function

$$\gamma(t) = 1 - \exp(-\exp(\alpha D_i + \beta' x_i + \delta_t)) \quad (1)$$

with extreme-value distributed survival spells (complementary log-log model) for  $i$  individuals and survival time  $t$  measured as age in years. The indicator  $D_i$  takes the value one for displaced individuals from the former Eastern territories and is zero for native West-German individuals. Hence, our primary interest is in the displacement effect, measured by the parameter  $\alpha$ . We control for time-invariant observable characteristics in the vector  $x_i$  that may affect the mortality hazard, including earnings points (EP) as a proxy of lifetime earnings and birth cohort dummies to balance out differences in birth cohort representation between displaced persons and natives. Furthermore,  $x_i$  includes regional-specific birth and death rates, measured at the time of birth for each individual, to account for pre-war differences regarding mortality outcomes among displaced and native individuals.

The sampling structure implies that individuals are at risk beginning at age 68. All

estimates are thus conditional on having celebrated the 68th birthday. For any subsequent age, we include a duration dummy into the model, estimating the parameters  $\delta_t$ .<sup>14</sup> This is possible due to the large data set and is particularly advantageous because it leaves the baseline hazard in its most flexible version without any functional form assumptions. All parameters in equation (1) are estimated separately for men and women, since both earnings biographies and mortality outcomes differ substantially between the two sexes.

As outlined in more detail in the introduction, the identification of  $\alpha$  is based on a natural experiment. The historical setting involves several features that allow us to isolate the relative performance of forced migrants compared to natives in terms of mortality outcomes through corresponding transmission channels over life. In summary, the identification of this displacement effect relies on the fact that migration was involuntary and non-selective, that the possibility of return migration did not exist, and that the group of expellees was very similar to West-German natives in terms of language and cultural background. To strengthen the identification of differential mortality between forced migrants and natives in particular, we use regional birth and death rates to account for ex ante disparities in mortality across regions.

An important question regarding the influx of forced migrants is who eventually arrived in West Germany after experiencing the dramatic and exhausting event of expulsion. This comprises concerns not only about the prevalence of death during the flight but also about self-selection into East and West Germany. The crucial point about all of these sources of selection is that they potentially induce a (positively) selected pool of displaced persons. Some of the selection mechanisms and pathways are not well documented<sup>15</sup> or even unobservable.

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<sup>14</sup>Due to the small number of observations at the upper margin of the age-at-death distribution, we use 40 duration dummies for age  $t = 68, \dots, 107$ . Estimating  $\delta_t$  above age 107 is difficult because we observe only very few persons to survive this age.

<sup>15</sup>One exception is the crossing of the inner-German border before the iron curtain (i.e. the wall) was built. Many Germans moved from the Eastern to the Western part of Germany, which is a pattern that can also be observed for the displaced. From 1950 - 1955 over half a million expellees migrated from Berlin or the Soviet sector to West Germany (Reichling, 1958).



However, this is not a drawback for our analysis. The present study focuses on analyzing the *relative performance of forced migrants compared to the native West-German population* only after their arrival in West Germany. These comparisons are not biased by potential selection mechanisms previous to arrival. This would only be problematic if we were to estimate a treatment effect on the treated. This parameter is not identifiable simply due to the lack of a valid control group. First, since virtually all Germans in the Eastern Territories were forced to leave, there exists no group of comparable stayers in their former home regions to whom the long-run outcomes of expellees could be compared to. Second, West-German natives cannot serve as a control group to identify a causal effect of treatment on the treated because the large population inflow probably induced general equilibrium effects that may have impacted the entire German economy. In particular, we do not preclude that the mortality of natives is also affected by the huge inflow of forced migrants. Our interpretation of the relative performance regarding the mortality outcomes of expellees vs. natives is not only consistent with these limitations. It is also interesting from a policy perspective, because it is informative about the integration of forced migrants over an exceptionally long period under identical economic circumstances and trends.

One remaining issue is positive selection in age. Qua construction, our sample only includes individuals who have at least reached age 68. The lower end of the mortality age distribution remains unobserved, which means that those who die early are not sampled. Self-evidently, this is a missing piece of information. However, studying only the elderly population that is predominantly retired (more than 99% have claimed a pension by the age of 68) offers the opportunity to observe the entire pre-retirement earnings history in terms of completed labor market biographies. This allows us to estimate the mortality effect of displacement also across the lifetime earnings distribution to reveal heterogeneity in connection to economic integration.

## 4 Results

### 4.1 Basic Results

Comparing the age at death distribution at the sample mean yields a first indication that West-German natives outlive their displaced counterparts considerably (Table 1). The gap is statistically significant and amounts to 0.9 years among men and 1.6 years among women.

Figures 4 and 5 provide graphical evidence on differences in the mortality distribution between displaced persons and natives. Two things are noteworthy in these cumulative distributions: First, natives live considerably longer than displaced persons and second, the mortality differential is much larger among women.

For example, observing individuals at risk beginning at age 68, we document an 11 percentage point gap between displaced and native women at age 88, i.e., at this age 73% of displaced women have deceased in contrast to only 62% of native women. Among men, the difference in the mortality distribution is smaller but still considerable in size. At age 88, we measure a 6 percentage point difference in mortality, based on 80% male displaced and 74% male natives who have deceased by that age.

The descriptive evidence on differential mortality is further strengthened by estimating the corresponding mortality hazard. Our estimates of the differential in mortality hazards between displaced and native men range from 0.73 to 1.27 percentage points (Table 2), meaning that the mortality risk of displaced men is 12% to 21% higher than the average mortality rate in the sample of elderly males (6.0% per year). Similarly, for women the estimated differential in the mortality hazard ranges between 0.18 and 0.48 percentage points, translating into a 3% to 9% higher mortality risk of displaced women compared to average mortality in the sample of elderly females (5.3% per year).

The estimates of the lower boundaries of the effect of displacement on the mortality risk in columns (1) and (4) of Table (2) are obtained from specifications that only include the

displacement dummy, a set of duration dummies and birth cohort dummies. The estimates at the upper bound (columns (3) and (6)) are obtained from specifications that aim at making the two populations under consideration, i.e. displaced vs. natives, as homogeneous as possible by controlling for lifetime earnings and pre-war disparities in regional birth and death rates. While including lifetime earnings changes the results only very little (columns (2) and (5)), the difference between lower and upper bound estimates of the effect of displacement on mortality risk is predominantly driven by regional birth and death rates. Both of these variables covary positively with the mortality rate and the displacement indicator, since pre-war birth and death rates were considerably higher in Eastern Europe than in West Germany (see Figures 6 and 7). This suggests that the mortality differential between forced migrants and natives is underestimated as long as regional disparities in birth and death rates are not taken into account.

## 4.2 Differential Mortality Across the Earnings Distribution

The baseline estimates suggest that pre-retirement lifetime earnings (EP) do not influence differential mortality risks between displaced persons and natives. So far, however, these estimates are measured at the mean of the earnings distribution.

Estimating the displacement effect separately by earnings quintile (Figures 8 (men) and 9 (women)) reveals effect heterogeneity across different margins of the distribution (corresponding coefficients are reported in Table 3). While the displacement effect is large and positive within the lower regions (quintile one and two) it declines when moving towards the upper margin of the distribution. Within the fourth quintile, the measured effect is significantly smaller compared to the third quintile (95% confidence bands do not overlap). In the top quintile, the displacement effect is negative and yet differs significantly from zero. These principal patterns hold for both men and women and are robust across different specifications.

Hence, the adverse displacement effect, as previously measured at the sample mean appears to be driven by individuals in the lower regions of the earnings distribution, while displaced individuals with exceptionally successful labor market biographies (reaching the top quintile of the earnings distribution) manage to overcome the long-lasting negative consequences of flight and expulsion.

### 4.3 Sensitivity Analysis

The first sensitivity check narrows the native population to the federal state of Bavaria to make the native population more comparable to forced migrants for two reasons. First, regional-specific birth and mortality rates in Bavaria, measured at time of birth, are much more similar to those of the former Eastern Territories than for overall West-Germany (Figures 6 and 7). Second, Bavaria exhibited by far the largest inflow of expellees in the aftermath of World-War II due to its geographical location in the south-east of Germany.<sup>16</sup> The spatial distribution of displaced persons also did not change much over time, a fact that has been documented by Schumann (2014) who finds that population shocks in the aftermath of World War II are highly persistent. Table 3 shows that our main results change only very little for the full earnings point distribution and different quintiles if we compare only Bavarian natives to forced migrants rather than using the full West German sample of natives.

To identify expellees in the data, our core estimates are based on a strong age restriction that only allows individuals to enter the sample if they were born until 1925. We now relax this rather conservative cohort restriction by extending the sample also to younger cohorts. The corresponding estimates in column (2)-(3) and (6)-(7) of Table 4 show that the adverse displacement effect slightly increases when relaxing the baseline restriction (born until 1925) by further including the cohorts up to 1927 or 1929.<sup>17</sup> As discussed above, adding younger

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<sup>16</sup>A total of 1,937,297 displaced persons were registered in Bavaria by 1950. In relative terms, this amounted to 21% of the Bavarian population at that time (Reichling, 1958).

<sup>17</sup>We also conducted sensitivity checks by moving the cohort restriction into the opposite direction, thus

cohorts to our sample increases the likelihood of misclassifying forced migrants as natives. Although one would expect the estimated mortality differential to become smaller as an increasing number of forced migrants with worse mortality expectations erroneously moves to the comparison group of natives, this is not entirely clear due to changes of the relative representation of expellees across birth cohorts. What we can say, however, is that the overall changes are fairly small and that our baseline estimates seem to produce the most conservative result in terms of a smaller displacement effect both for men and women.

A final concern is that heterogeneity between displaced and natives may arise from the length of individual working biographies. For example, individuals who start their working careers early may work in manual jobs rather than obtaining a university degree and following an academic track. Since this type of selection may correlate to health impairments accumulated over time, we take a sub-sample of individuals that have contributed to the German public pension system at least 40 years and thus must have started their working biography at young ages. While the results for men stay unchanged, among women the displacement effect strongly changes and becomes negative (column (4) and (8) in Table 4). It must be noted that contributing to the pension scheme for at least 40 years is a tough restriction that is only fulfilled by 60% of men and by 10% of women indicating that in particular the female sample is specifically selected in terms of labor force participation. In contrast, results for the restricted male sample (40+ years of contribution) are relatively unchanged if compared to the baseline estimates. This is not surprising as for men it is much more common to contribute 40 years or longer and thus the sample composition remains very similar. The results for long contribution periods are strongly in line with the findings for the top earnings quintile (Table 3), indicating that, for individuals that are positively selected with regard to their working biographies, the adverse displacement effect disappears

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shrinking the sample to older cohorts (youngest cohort is 1923 or 1921). Again, the results only change little and are available from the authors upon request.

or even becomes positive.

## 5 Conclusion

This paper analyzes long-run consequences of non-voluntary migration on mortality. In the aftermath of World War II, almost 8 million Germans that were expelled from the former Eastern territories of the German Reich and other Eastern European countries arrived in West-Germany. Since these individuals did not choose to migrate there is no self-selection and thus we use this historical example of forced migration as a natural experiment to identify the displacement effect and how it transmits over the entire life-cycle. Using large-scale administrative data, we specifically focus on differential mortality between displaced persons and comparable natives in the elderly population.

Our results show that the mortality risk of forced migrants is substantially higher than among comparable natives. These estimates are robust across several specifications and account for regional disparities in pre-war birth and mortality patterns between the former Eastern territories and West Germany. While controlling for pre-retirement lifetime earnings at the mean seems to have only little influence, estimating the displacement effect within each quintile of the earnings distribution reveals that the adverse displacement effect (higher mortality risk among expellees) is driven by individuals in the lower regions of the earnings distribution. At the upper margin of the distribution, however, the displacement effect not only becomes smaller in magnitude but even reverts within the top quintile. This effect heterogeneity, equally measurable among men and women, provides evidence that displaced individuals with exceptionally successful labor market biographies manage to overcome the long-lasting negative consequences of flight and expulsion.

The mortality gap between displaced persons and West German natives that we document may operate through two distinct channels. The first one refers to the direct and long-lasting

link of the traumatizing event of displacement on health outcomes later in life and its strong correlation to mortality. Forced migrants faced horrific conditions during their flight and were exposed to enormous physical and psychological distress (Connor, 2007; Douglas, 2012).

The second channel reflects indirect effects of poor integration of forced migrants into the labor market and the society. Although the German legislation adopted a number of different laws that aimed at reducing the burden of war related financial losses (e.g. *Lastenausgleichsgesetz*), the integration of expellees remained a societal challenge. Despite an enormous labor demand in post-war Germany, unemployment rates among the displaced remained higher than among comparable natives even in the long-run (Reichling, 1958; Lüttinger, 1986; Bauer et al., 2013). Resentments of the native population towards the newcomers, which already started arising during the post-war period that was characterized by severe food and housing shortages due to major destruction, also impeded their integration. Even though the relations between the native and immigrant population improved over time, forced migrants often remained aliens (Connor, 2007).

The *cumulative disadvantage* over life plausibly describes that the consequences of expulsion reached far beyond a local displacement and the loss of material possessions. The atrocities experienced by expellees during flight and expulsion seem to have caused long-lasting wounds that did not heal by the end of the war. For some, this was the beginning of poor integration into society and the labor market that cumulatively contributed to long-run disadvantages. The cumulative disadvantage represents a meaningful explanation for the transmission mechanism over life, thus allowing to attribute differential mortality to forced migration even decades after the expulsion took place.

## References

- Barker, D. J. (1990). The Fetal and Infant Origins of Adult Disease. *British Medical Journal* 301(6761), 1111–1111.
- Barker, D. J. (1995). Fetal Origins of Coronary Heart Disease. *British Medical Journal* 311(6998), 171–174.
- Bauer, T. K., S. Braun, and M. Kvasnicka (2013). The Economic Integration of Forced Migrants: Evidence for Post-War Germany. *The Economic Journal* 123(571), 998–1024.
- Besser, C. (2008). Grunddaten zur Bevölkerungsstatistik Deutschlands von 1871 bis 1939. *GESIS: Köln. ZA8295 Datenfile Version 1(0)*.
- Borjas, G. J. (1985). Assimilation, Changes in Cohort Quality, and the Earnings of Immigrants. *Journal of Labor Economics* 3(4), 463–489.
- Borjas, G. J. (1987). Self-Selection and the Earnings of Immigrants. *American Economic Review* 77(4), 531–553.
- Borjas, G. J. (1999). The Economic Analysis of Immigration. *Handbook of Labor Economics* 3, 1697–1760.
- Braun, S. T. and N. Dwenger (2017). The Local Environment Shapes Refugee Integration: Evidence from Post-war Germany. *School of Economics and Finance Discussion Paper No. 1711, University of St. Andrews*.
- Case, A. and A. Deaton (2015). Rising Morbidity and Mortality in Midlife among White Non-Hispanic Americans in the 21st Century. *Proceedings of the National Academy of Sciences* 112(49), 15078–15083.



- Case, A. and A. Deaton (2017). Mortality and Morbidity in the 21st Century. *Brookings Papers on Economic Activity, Spring 2017*.
- Chetty, R., M. Stepner, S. Abraham, S. Lin, B. Scuderi, N. Turner, A. Bergeron, and D. Cutler (2016). The Association Between Income and Life Expectancy in the United States, 2001-2014. *JAMA* 315(16), 1750–1766.
- Connor, I. (2007). *Refugees and Expellees in Post-War Germany*. Manchester University Press.
- Deaton, A. (2003). Health, Inequality, and Economic Development. *Journal of Economic Literature* 41(1), 113–158.
- Douglas, R. M. (2012). *Orderly and Humane: The Expulsion of the Germans after the Second World War*. New Haven: Yale University Press.
- Falck, O., S. Heblich, and S. Link (2012). Forced Migration and the Effects of an Integration Policy in Post-WWII Germany. *The BE Journal of Economic Analysis & Policy* 12(1), 1–29.
- Federal Statistical Office (2016). Statistik der Sterbefälle, Deutschland 1970 - 2014. Technical report, Statistisches Bundesamt, Wiesbaden.
- Fiala, N. (2015). Economic Consequences of Forced Displacement. *The Journal of Development Studies* 51(10), 1275–1293.
- Forschungsdatenzentrum FDZ-RV (2017). Codeplan SUFDemografie Rentenbestand & Rentenwegfall 1993 – 2014. Technical report, Deutsche Rentenversicherung Bund, Berlin/Würzburg.

- Kalwij, A. S., R. J. M. Alessie, and M. G. Knoef (2013). The Association Between Individual Income and Remaining Life Expectancy at the Age of 65 in the Netherlands. *Demography* 50(1), 181–206.
- Kibebe, E., S. Klüsener, and R. Scholz (2015). Drastic Changes in Regional Life Expectancy Disparities in Germany: in Search of the Determinants. Technical report, Max Planck Institute for Demographic Research.
- Lubotsky, D. (2007). Chutes or Ladders? A Longitudinal Analysis of Immigrant Earnings. *Journal of Political Economy* 115(5), 820–867.
- Lüttinger, P. (1986). Der Mythos der schnellen Integration: Eine empirische Untersuchung zur Integration der Vertriebenen und Flüchtlinge in der Bundesrepublik Deutschland bis 1971. *Zeitschrift für Soziologie* 15(1), 20–36.
- Palme, M. and S. Sandgren (2008). Parental Income, Lifetime Income, and Mortality. *Journal of the European Economic Association* 6(4), 890–911.
- Reichling, G. (1958). *Die Heimatvertriebenen im Spiegel der Statistik*. Duncker & Humblot.
- Ruiz, I. and C. Vargas-Silva (2013). The Economics of Forced Migration. *The Journal of Development Studies* 49(6), 772–784.
- Ruiz, I. and C. Vargas-Silva (2015). The Labor Market Impacts of Forced Migration. *The American Economic Review, Papers and Proceedings* 105(5), 581–586.
- Sarvimäki, M., R. Uusitalo, and M. Jantti (2009). Long-Term Effects of Forced Migration. *IZA Discussion Paper 4003*.
- Schumann, A. (2014). Persistence of Population Shocks: Evidence from the Occupation of West Germany after World War II. *American Economic Journal: Applied Economics* 6(3), 189–205.

- Schwandt, H. and T. von Wachter (2017). Unlucky Cohorts: Earnings, Income, and Mortality Effects from Entering the Labor Market in a Recession. *Mimeo (April 2017)*.
- Smith, J. P. (1999). Healthy Bodies and Thick Wallets: The Dual Relation between Health and Economic Status. *Journal of Economic Perspectives* 13(2), 145–166.
- UNHCR (2016). Global Trends - Forced Displacement in 2015. Technical report, United Nations High Commissioner for Refugees.
- van den Berg, G. J., M. Lindeboom, and F. Portrait (2006). Economic Conditions Early in Life and Individual Mortality. *The American Economic Review* 96(1), 290–302.

# Figures

Figure 1: Regions of Origin of Displaced Individuals

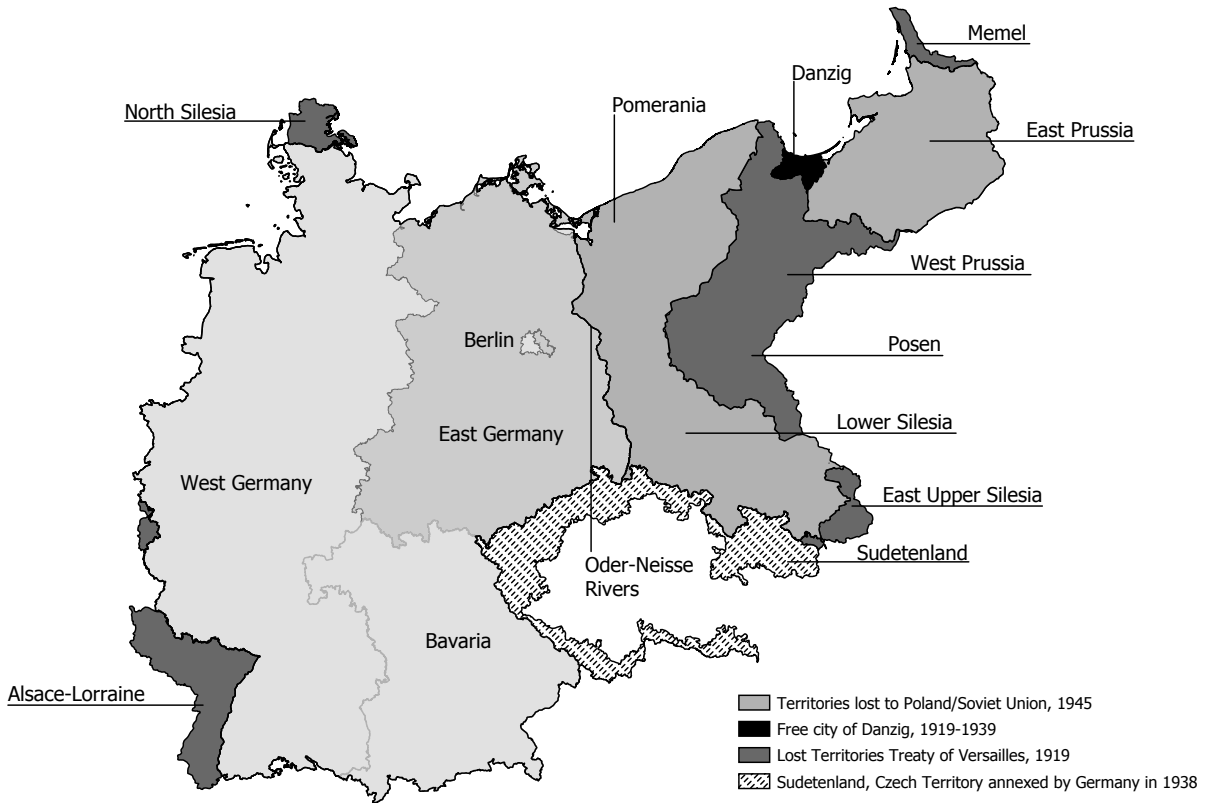
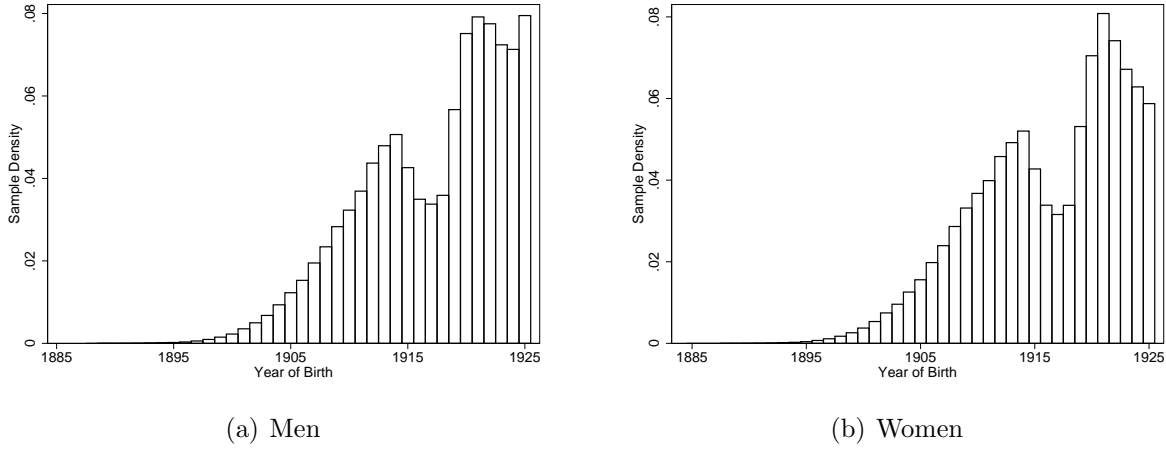
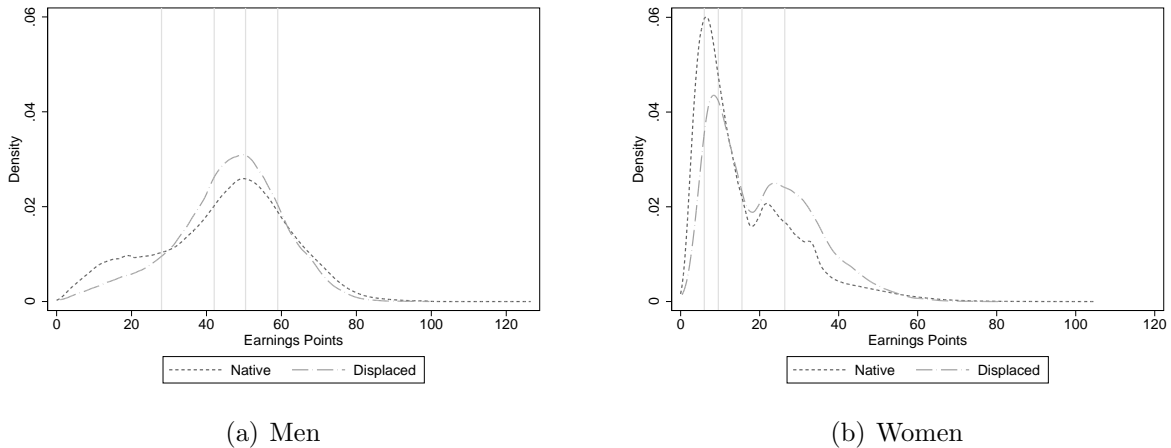


Figure 2: Birth Cohort Distribution



Source: Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).

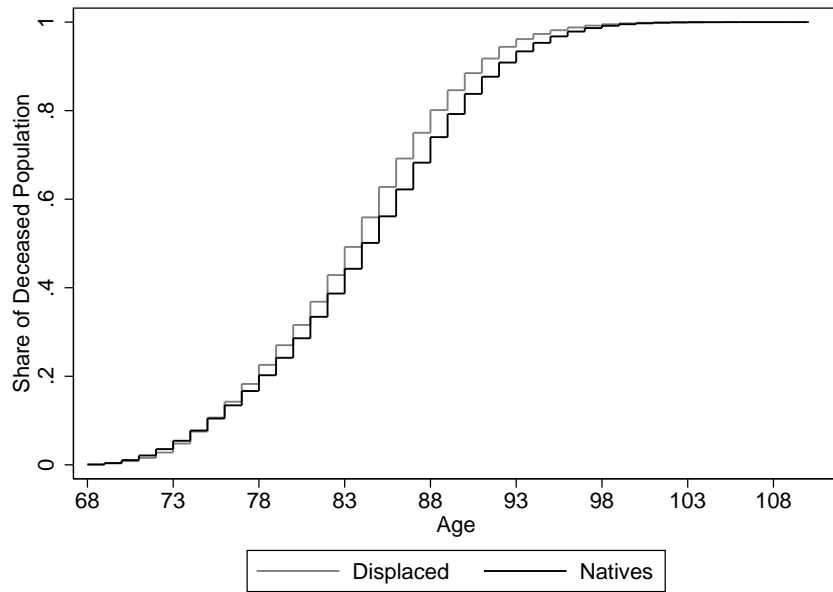
Figure 3: Pre-Retirement Lifetime Earnings Distribution



Source: Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).

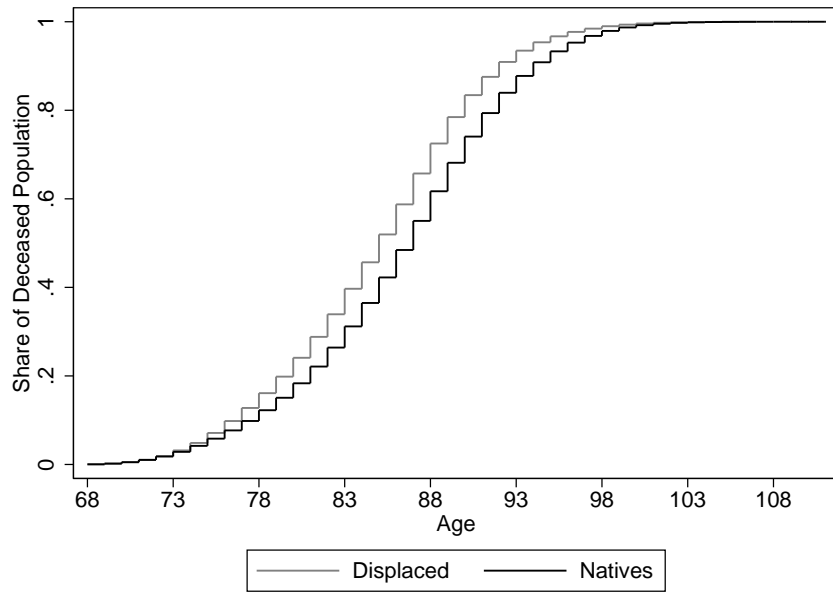
Note: To approximate pre-retirement lifetime earnings, we use the total sum of earnings points that document pension claims. This variable predominantly includes labor earnings which are the primary source of public pension claims. In addition, the measure also includes earnings points that are acquired from indirect labor market related activities that are creditable for monthly pension benefits (e.g. periods of unemployment, education, child raising and creditable periods of illness). Vertical lines indicate the quintile cutoffs.

Figure 4: Cumulative Distribution of Deceased Population: Men



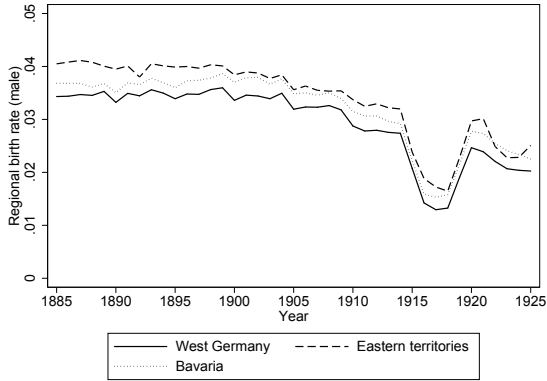
Source: Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).

Figure 5: Cumulative Distribution of Deceased Population: Women

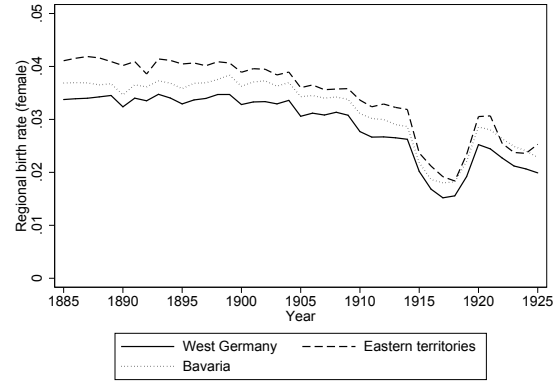


Source: Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).

Figure 6: Regional Birth Rates



(a) Men

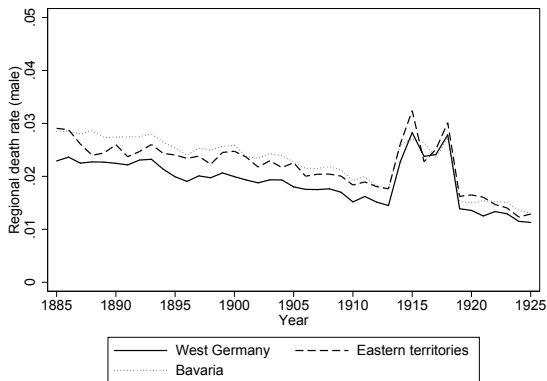


(b) Women

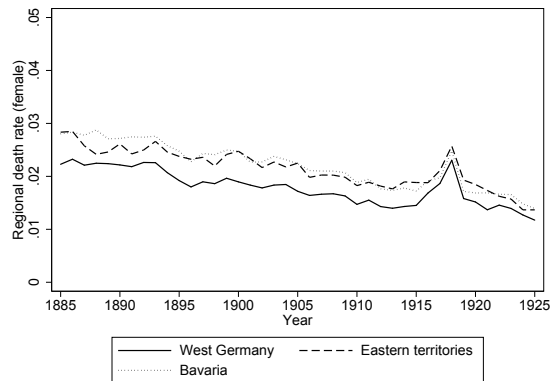
Source: Own calculations based on Besser (2008).

Note: Annual birth rates are calculated as the number of births relative to the number of residents within a region.

Figure 7: Regional Death Rates



(a) Men



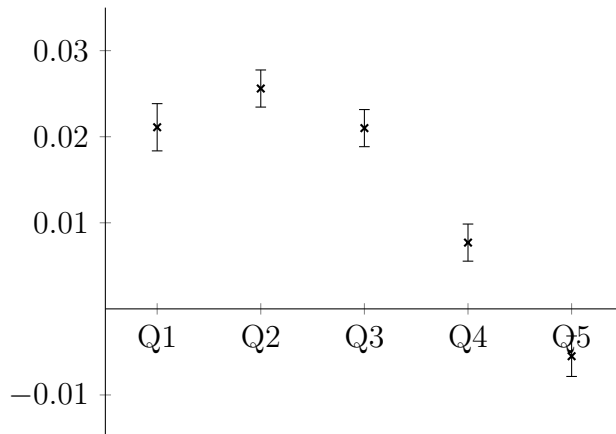
(b) Women

*Source:* Own calculations based on Besser (2008).

*Note:* Annual death rates are calculated as the number of deaths relative to the number of residents within a region.



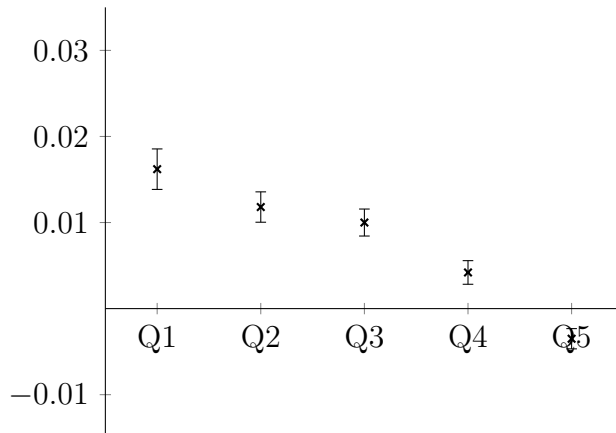
Figure 8: Displacement Effects across the Earnings Distribution: Men



*Source:* Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).

*Note:* The figure plots marginal effects and 95% confidence bands from the Cox proportional hazards model (vertical line). The estimates are obtained separately within each earnings quintile (horizontal line).

Figure 9: Displacement Effects across the Earnings Distribution: Women



*Source:* Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).

*Note:* The figure plots marginal effects and 95% confidence bands from the Cox proportional hazards model (vertical line). The estimates are obtained separately within each earnings quintile (horizontal line).

## Tables

Table 1: Differences in Means between Displaced and Natives

	Men			
	Displaced	Natives	Difference	t-Stat.(p-value)
Age at Death	83.3	84.2	0.9	15.7(0.000)
Birth year	1917.2	1917.1	-0.1	-1.9(0.000)
Earnings Points	45.9	44.2	-1.7	-10.5(0.000)
Pension insurance months	471.8	449.4	-22.4	-16.2(0.000)
Regional birth rate	0.027	0.024	-0.003	-66.0(0.000)
Regional death rate	0.019	0.017	-0.002	-46.7(0.000)
N	12 072	1 980 891		
Share Displaced (%)	0.6			
	Women			
	Displaced	Natives	Difference	t-Stat.(p-value)
Age at Death	84.8	86.4	1.6	37.4(0.000)
Birth year	1918.5	1916.3	-2.2	-50.5(0.000)
Earnings Points	20.8	16.3	-4.5	-51.1(0.000)
Pension insurance months	303.7	262.5	-41.2	-41.6(0.000)
Regional birth rate	0.027	0.025	-0.003	-79.0(0.000)
Regional death rate	0.018	0.016	-0.002	-110.0(0.000)
N	21 031	2 964 372		
Share Displaced (%)	0.7			

Source: Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).

Table 2: Baseline Estimates of the Mortality Hazard

	Men			Women		
	(1)	(2)	(3)	(4)	(5)	(6)
Displaced	0.0073 (0.0005)	0.0079 (0.0005)	0.0127 (0.0005)	0.0018 (0.0003)	0.0022 (0.0003)	0.0048 (0.0003)
Earnings Points		-0.0001 (0.0000)	-0.0001 (0.0000)		- 0.0001 (0.0000)	- 0.0001 (0.0000)
Death Rate			0.0060 (0.0007)			0.0129 (0.0006)
Birth Rate			-0.0168 (0.0007)			-0.0144 (0.0006)
∅ Mortality Rate (%)	6.0	6.0	6.0	5.3	5.3	5.3
N Displaced	12 072	12 072	12 072	21 031	21 031	21 031
N Natives	1 980 891	1 980 891	1 980 891	2 964 372	2 964 372	2 964 372

*Source:* Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).  
*Note:* Reported values are average marginal effects from a discrete time Cox proportional hazards model. Standard errors in parentheses. All specifications include duration dummies for each year at risk (reference: first year at risk) and birth cohort dummies (reference: oldest birth cohort) and these estimates are available from the authors upon request. Birth and death rates are measured by region of origin at the year of birth for each individual.

Table 3: Estimates of the Mortality Hazard across the Earnings Distribution

Specification	Men		Women	
	All Natives	Bavarian Natives	All Natives	Bavarian Natives
<i>Full Earnings Distribution</i>				
Displaced	0.0127 (0.0005)	0.0116 (0.0006)	0.0048 (0.0003)	0.0046 (0.0004)
∅ Mortality Rate (%)	6.0	5.9	5.3	5.3
N Displaced	12 072	12 072	21 031	21 031
N Natives	1 980 891	334 369	2 964 372	531 188
<i>Quintile 1</i>				
Displaced	0.0211 (0.0014)	0.0221 (0.0020)	0.0162 (0.0012)	0.0167 (0.0013)
∅ Mortality Rate (%)	5.9	5.9	5.2	5.2
N Displaced	1 422	909	1 641	1 907
N Natives	397 197	68 386	595 445	108 537
<i>Quintile 2</i>				
Displaced	0.0256 (0.0011)	0.0241 (0.0015)	0.0118 (0.0009)	0.0107 (0.0009)
∅ Mortality Rate (%)	5.2	6.0	6.0	5.2
N Displaced	2 785	1 951	3 390	3 941
N Natives	395 837	67 341	593 775	106 507
<i>Quintile 3</i>				
Displaced	0.0210 (0.0011)	0.0237 (0.0014)	0.0100 (0.0008)	0.0082 (0.0009)
∅ Mortality Rate (%)	6.1	6.1	5.3	5.2
N Displaced	3 052	2 791	4 135	4 167
N Natives	395 664	66 512	592 921	106 273
<i>Quintile 4</i>				
Displaced	0.0077 (0.0011)	0.0105 (0.0012)	0.0042 (0.0007)	0.0043 (0.0008)
∅ Mortality Rate (%)	5.3	6.0	5.6	5.3
N Displaced	2 768	3 485	5 042	4 873
N Natives	395 756	65 776	592 035	105 572
<i>Quintile 5</i>				
Displaced	-0.0055 (0.0012)	-0.0039 (0.0011)	-0.0035 (0.0006)	-0.0037 (0.0007)
∅ Mortality Rate (%)	6.2	5.5	5.4	5.3
N Displaced	2 045	2 936	6 823	6 143
N Natives	396 437	66 348	590 195	104 299

*Source:* Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI). *Note:* Reported values are average marginal effects from a discrete time Cox proportional hazards model. Standard errors in parentheses. All specifications include duration dummies for each year at risk (reference: first year at risk), birth cohort dummies (reference: oldest birth cohort) and the full set of covariates as in columns (3) and (6) of Table 2. These estimates are available from the authors upon request.

Table 4: Sensitivity Checks on Birth Cohort Restriction and Contribution Period

	Men			
	Baseline	Cohort Restriction		Contribution ≥ 40 Yrs
		1927	1929	
	(1)	(2)	(3)	(4)
<i>Without Covariates</i>				
Displaced	0.0073 (0.0005)	0.0083 (0.0005)	0.0089 (0.0005)	0.0068 (0.0006)
<i>With Covariates</i>				
Displaced	0.0127 (0.0005)	0.0140 (0.0005)	0.0150 (0.0005)	0.0133 (0.0006)
∅ Mortality Rate (%)	6.0	6.3	6.6	6.0
N Displaced	12 072	13 993	17 055	8 067
N Natives	1 980 891	2 291 845	2 596 879	1 189 894
	Women			
	Baseline	Cohort Restriction		Contribution ≥ 40 Yrs
		1927	1929	
	(5)	(6)	(7)	(8)
<i>Without Covariates</i>				
Displaced	0.0018 (0.0003)	0.0025 (0.0003)	0.0023 (0.0008)	-0.0058 (0.0009)
<i>With Covariates</i>				
Displaced	0.0048 (0.0003)	0.0057 (0.0003)	0.0064 (0.0003)	-0.0031 (0.0009)
∅ Mortality Rate (%)	5.3	5.5	5.6	5.4
N Displaced	21 031	24 508	27 117	3 131
N Natives	2 964 372	3 248 183	3 475 929	290 478

*Source:* Own calculations based on pension shortfall records 1994 - 2013 (FDZ-RV-RTWF94-13DemoRWI).

*Note:* Reported values are average marginal effects from a discrete time Cox proportional hazards model. Standard errors in parentheses. All specifications include duration dummies for each year at risk (reference: first year at risk) and birth cohort dummies (reference: oldest birth cohort). Models with covariates include the full set of covariates as in columns (3) and (6) of Table 2. These estimates are available from the authors upon request.

## A Approximating Pre-Retirement Lifetime Earnings by Earnings Points: Limitations

One important limitation of our data is that the EP measure also contains information other than plain labor earnings, including all labor market related information as needed by German federal pension insurance to calculate monthly pension benefits. This information comprises the entire labor market history (pre-retirement lifetime earnings, creditable periods of unemployment), education (creditable periods of vocational training or higher education), family background (creditable periods of child raising) and health-related aspects (creditable periods of illness). While not reflecting plain labor earnings, it is apparent that EP are a particularly powerful measure of a wide range of observable socio-economic characteristics. Effectively, EP are completed earnings biographies that capture large parts of variation that may be part of the process that also determines mortality outcomes. The reason why we still refer to EP as “earnings” or “pre-retirement lifetime earnings” is that it predominantly consists of total labor earnings previous to pension claiming. Although we cannot show the share of labor earnings within individual EP, it is clear that EP strongly correlate to labor earnings. The amount of EP from other sources than earnings are strongly limited because there exist defined maxima (e.g. EP are limited to a maximum of 3 for education and a maximum of 2 per child for child-raising for children born until 1992). In this regard, a person who never worked will have low values of EP or, put differently, it is virtually impossible to reach the top 20% of the earnings point distribution without high labor earnings and/or long periods of gainful employment.

Another limitation is that labor earnings are top-coded since they are measured in terms of contributions to the German public pension system that are subject to a contribution ceiling. This threshold is annually fixed and introduces censoring at the upper margin of the earnings distribution (right censoring). The contribution ceiling is adjusted every year. For

example, it was fixed at 85200 Euro in the most recent observation year 2013 and, evaluated at average earnings in this year (33659 Euro), the maximum amount documented in the data is  $85200/33659 = 2.5$  earnings points. However, top-coding is not a drawback in our empirical setting because we mainly use the earnings distribution, stratified by quintiles, to obtain separate estimates of the mortality hazard. Furthermore, Figure 3 shows that there are no significant anomalies such as bunching of individuals in upper regions of the distribution.