RUHR
ECONOMIC PAPERS

Matthias Giesecke
Sarah Okoampah

Inequality of Opportunity in Retirement Age – The Role of Physical Job Demands

#492

Imprint

Ruhr Economic Papers

Published by

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI)
Hohenzollernstr. 1-3, 45128 Essen, Germany

Editors

Editorial Office

Ruhr Economic Papers #492

Responsible Editor: Volker Clausen

ISSN 1864-4872 (online) – ISBN 978-3-86788-561-4

Ruhr Economic Papers #492

Matthias Giesecke and Sarah Okoampah

Inequality of Opportunity in Retirement Age – The Role of Physical Job Demands

Bibliografische Informationen der Deutschen Nationalbibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über: *http://dnb.d-nb.de* abrufbar.

http://dx.doi.org/10.4419/86788561
ISSN 1864-4872 (online)
ISBN 978-3-86788-561-4

Matthias Giesecke and Sarah Okoampah[1]

Inequality of Opportunity in Retirement Age – The Role of Physical Job Demands

Abstract

We quantify differences in the retirement age between manual and non-manual workers and evaluate these differences in the context of the literature on equality of opportunity. The focus is on the question how individual background during childhood transmits through physical demands of occupations on retirement ages. Individual retrospective data from the German Socio-Economic Panel are used to analyse labour force dynamics over the years 1984 to 2011. Discrete time duration models suggest that retirement ages differ substantially between manual and non-manual workers. To elaborate how such differences are explained by individual background characteristics on the one hand and effort and luck on the other hand, we make use of tests for stochastic dominance and a Blinder-Oaxaca decomposition. The result is that individual background characteristics explain a share of about one third of inequality in retirement ages as transmitted through physical demands of occupations.

JEL Classification: D63, J26, J62, C14

Keywords: Retirement age; inequality of opportunity; physical job demands; blinder-oaxaca-decomposition

June 2014

[1] *Matthias Giesecke, RWI, RGS Econ, UDE; Sarah Okoampah, RGS Econ, UDE - We are grateful to Martin Karlsson and Paul Lambert for critical remarks. Furthermore, we thank participants of the annual conferences of the EEA (2012), the NOeG (2012) and the SOEP Symposium (2012) for helpful discussions and comments. – All correspondence to Matthias Giesecke, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: matthias.giesecke@rwi-essen.de*

1 Introduction

In 2007, the German Federal Parliament approved a law to gradually increase the normal retirement age from 65 to 67. The decision was accompanied by a public debate on the justness of a legal retirement age fixed at a high level towards workers being exposed to different levels of physical job demands. In particular, high physical demands of job duties may force a worker to retire early because work-related health impairments accumulate over time and human physical capacity declines naturally with increasing age. This may disadvantage respective occupations since retirement previous to the normal retirement age reduces benefit entitlements for two reasons. First, fewer years of work imply fewer years of contribution and thus lower pension claims, since their overall amount depends on the duration of preceding contributions. Second, early retirement is subject to actuarial adjustments, which additionally reduces pension claims by 3.6 per cent for each year by which an old age pension is claimed early.[1] In addition, occupations with high physical job demands tend to be low-wage professions, which restricts the potential for private pension provision.

The purpose of this paper is to quantify differences in the retirement age between manual and non-manual workers and to evaluate these differences with respect to equality of opportunity. The focus is on the question how individual background during childhood transmits through physical demands of occupations on retirement ages. Our study contributes to the existing literature in several respects. First, we provide a precise empirical description of labour force dynamics of older manual and non-manual workers with a particular focus on retirement patterns. Second, we contribute to the literature on equality of opportunity (EOP hereafter) as prominently discussed by Roemer (1993, 1998), by distinguishing between individual background beyond individual influence on the one hand and effort and luck on the other hand. This framework is useful to structure thoughts in a debate, where early retirement of manual workers is frequently declared as “unfair” because this usually implies a reduction in social security wealth. To the best of our knowledge, this is the first study on EOP in retirement age. Finally, we use data for Germany which provides an eminent case study for analyses of an ageing population. Demographic change

[1] Actuarial adjustments have been introduced in the German public pension system between 1997 and 2004.

will continue to impose a fair amount of pressure on the pay-as-you-go pension system. The baby boom cohorts born between 1955 and 1970 move towards retirement as of the year 2015, once they successively become eligible for old age pensions. At the same time, younger birth cohorts are much smaller (Federal Statistical Office, 2014). Severe population ageing will either induce raising contributions, alleviate benefit entitlements or both.

Our analysis departs from a description of labour force dynamics of older workers beginning at age 40 to elaborate differences in the retirement age for manual workers compared to non-manual workers. In a first step, discrete time duration models are used to estimate the hazard rate for transitions out of full-time employment, part-time employment or unemployment into retirement. To distinguish manual from non-manual occupations, we make use of a well-defined measure for the degree of physical demands on respective jobs (Kroll, 2011). In a second step, the question of EOP in retirement is elaborated. We begin with a non-parametric test for stochastic dominance at first order, which is applied to the EOP framework as in Lefranc et al. (2009, 2008); Trannoy et al. (2010). This approach compares the cumulative distribution of the outcome retirement age, conditional on specific individual background characteristics or "circumstances" in the terminology of Roemer (1998). We then proceed to a decomposition as established by Blinder (1973) and Oaxaca (1973). This technique allows us to infer on how much of the difference in retirement ages between manual and non-manual workers is due to circumstances. Finding an answer to this question is crucial when evaluating policy design that may involve benefit reductions for early retirees.

Our results indicate that the estimated hazard profile of non-manual workers is about 20% lower compared to individuals with physically demanding occupations for the age group 55 to 65. Moreover, non-parametric tests for stochastic dominance at first order indicate that the distribution of retirement age differs significantly between individuals across circumstances. Most importantly, the Blinder-Oaxaca decomposition suggests that circumstances explain at least one third of the observed differences in the retirement age between workers of different degrees of physical job demands. This finding is important because it indicates that a considerable part of differences in retirement age are predetermined and thus not subject to individual choice.

The remainder of this paper is structured as follows. Section 2 reviews previous research on EOP, discusses ambiguity in the evaluation of early retirement as a "good" or a "bad" and provides an overview on the employment behaviour of older workers. Section 3 describes the data and sample construction. Section 4 provides the empirical analysis, quantifies differences in retirement age between manual and non-manual workers and attributes these differences to circumstances and effort/luck in a corresponding decomposition. Section 5 concludes.

2 Equality of Opportunity and Retirement

Modern egalitarian views such as expressed in Rawls (1971); Cohen (1989); Fleurbaey (1995a,b) postulate that, instead of equality in outcomes, distributive justice only requires equality of opportunity in achieving those outcomes. The recent economic literature usually follows the terminology as introduced by Roemer (1998), according to which individual outcomes are generated by two fundamental determinants: "Circumstances" and "effort", which are defined to be orthogonal. While circumstances reflect background characteristics for which an individual cannot be held responsible, differences in outcome due to effort are considered a legitimate source of inequality. Consequently, given equal circumstances, all remaining differences in outcomes are subject to personal responsibility. Lefranc et al. (2009) state that no consensus has been reached so far on how opportunities are precisely defined. They provide an extension of the EOP framework by introducing luck as an additional determinant of individual outcome. Lefranc et al. (2009) conclude that luck is a legitimate source of inequality in outcomes, as long as it is not correlated to circumstances and is thus "even-handed".

A large body of recent economic literature on EOP has emerged, with numerous applications to income distributions (e.g. Devooght, 2008; Lefranc et al., 2008, 2009; Aaberge et al., 2011) and health (e.g. Fleurbaey and Schokkaert, 2009; Trannoy et al., 2010; Jusot et al., 2013). In the present paper, we provide the first application of the EOP framework to inequality in retirement age. Specifically, we investigate the extent to which circumstances are mediated through physical demands of occupations to the age of retirement.

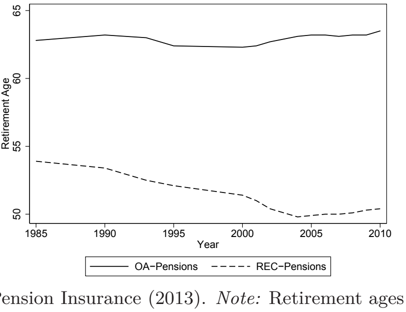
This question is often raised in the public debate, where early retirement of manual workers is frequently considered to be “unfair” because this usually implies a reduction in social security wealth.

Whether early retirement is a “good” or a “bad” is not unambiguous and deserves some further discussion. In previous applications of EOP, a natural ordering of the outcome of interest is straightforward, i.e. “more income is better than less income” or “good health is better than poor health”. Our research question differs from former applications in a sense that such an ordering is not as straightforward for the retirement age; it is difficult to say whether early retirement is good or bad. We take this puzzle as a motivation to briefly outline the view to be taken in this paper. The traditional view on retirement decisions are individual preferences for consumption and leisure in a combination to incentives that are set by the social security system (see e.g. Weiss, 1972; Sheshinski, 1978, for early contributions). Clearly, the consequence of early retirement is more leisure (less work) accompanied by less consumption (lower income from labour and/or social security), and thus retirement is an issue of labour supply (Hurd, 1990). Beyond individual preferences for leisure and consumption, retirement may coincide with subsequent phenomena that either support or prevent an individual to live longer. Retirement may relieve individuals from work-related stress with a positive impact on the remaining years to live, but empirical evidence suggests that cognitive decline sets in after retirement (see e.g. Rohwedder and Willis, 2010; Bonsang et al., 2012). Moreover, no causal link between retirement age and mortality can be established according to Hernaes et al. (2013). Instead, recent work by Giesecke and Schnabel (2014) indicates a strong selection into specific retirement ages, where the type of individual to retire at a certain age differs substantially by characteristics that are strongly correlated to mortality, such as health related behaviours and wealth. Aside from labour supply, employer behaviour may be responsible for the early termination of employment contracts if demand is weak and layoffs are necessary (Hutchens, 1999). In this context, demand-sided factors may induce early retirement even if employees wish to retire later (Hakola and Uusitalo, 2005).

The evaluation of early retirement is obviously an intricate task because a complex mix of “goods” and “bads” needs to be taken into account. For example, an individual with a strong preference for consumption may want to work longer and retire later but may be forced to behave differently due to plant closure or health issues. In the context of this paper, our interest in early retirement refers to the case where individuals retire early for reasons that are correlated to physical demands of occupations. Specifically, we calculate the difference in mean retirement age between manual and non-manual workers to assess the proportion of this difference which is due to individual background characteristics. Therefore, our view on early retirement focuses on its adverse effects, because it reduces retirement benefits and thus social security wealth in a situation where postponed retirement would avoid a decline in retirement income but is either difficult or impossible to realise.

Recent retirement patterns for Germany suggest that the average retirement age increases. However, figure 1 indicates that this trend is not quite the same for old age pensions (OA-pensions) and reduced earnings capacity pensions (REC-pensions).[2]

Figure 1: Development of Average Retirement Age in Germany



Source: German Federal Pension Insurance (2013). *Note:* Retirement ages previous to 1993 are for former West Germany only, while all subsequent values are reported for reunified Germany.

Apparently, there is a large difference in the average retirement age between OA-pensions and REC-pensions. Most notably, while the average retirement age for OA-pensions exhibits an upward trend especially after the introduction of actuarial adjustments in the late 1990s, the retirement age for REC-pensions declined. These differences are substantial, which needs some explanation. First, while REC-pensions do not necessarily coincide

[2]In contrast to old age pensions which are available after age 60 depending on the eligibility type, reduced earnings capacity pensions are available at any age before 60, once the corresponding medical indication has been assigned.

with physically demanding occupations, eligibility for REC-pensions is usually due to poor health, which itself is expected to be positively correlated to physically demanding occupations. Thus, manual workers should be largely over-represented in the group of individuals that receive REC-pensions. Second, selection into REC-pensions may have changed in the course of a large decrease in the total number of entries into REC-pensions (German Federal Pension Insurance, 2013), leaving a sample of the "worst cases" who retire earlier on average. Consequently, the diverging pattern of average retirement ages for OA-pensions and REC-pensions in figure 1 has important implications for the present study as it provides a first hint of differences in the retirement age between manual and non-manual workers; these differences will subsequently be analysed in further detail.

3 Data and Sample Construction

The empirical analysis of this paper is based on data from the German Socio-Economic Panel (SOEP) for the waves 1984 to 2012. The SOEP is a representative panel study for Germany which annually interviews households and its individual members since 1984. The survey started with about 6,000 interviewed households per year and comprises about 12,000 households per year since 2000 (see Haisken-DeNew and Frick, 2005). As the focus of this study is on transitions into retirement, we use individual retrospective calendar data on employment spells as provided by the SOEP.[3]

In order to analyse labour force transitions of older workers we restrict our sample to individuals aged 40 and older. For those individuals, who meet this restriction in the observation period from 1984 to 2011, we construct spells with respect to four defined states of labour force participation. Specifically, we distinguish spells of (i) full-time employment, (ii) part-time employment, (iii) unemployment and (iv) retirement. Our primary sample provides 13,304 total transitions from 17,594 individual spells as reported in tables 4 and 5 in the appendix.[4] Central to our analysis is the number of total transitions into retirement from all other states, which amounts to 3,036.

[3] Taking into account retrospective calendar records where individuals are asked to report their labour force participation from the previous year, we effectively draw on information until 2011.

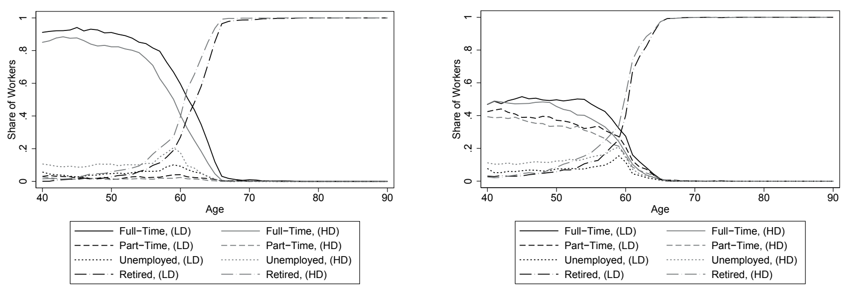
[4] Note that depending on the state of departure and the state of destination for specific transitions, the number of observations varies considerably in subsequent empirical investigations and is thus lower compared to the primary sample.

4 Empirical Analysis

4.1 Retirement across Physical Job Demands: Evidence from Duration Models

To classify individuals by the physical demands of their reported occupation, we make use of the International Standard Classification of Occupations from 1988 (ISCO 88). This classification serves to categorise physical demands on a 1-10 ordinal scale for physical job demands as constructed by Kroll (2011).[5] Using this index, we categorise individuals into a group of low physical job demands (index values 1-5, abbreviated as LD and also referred to as manual workers), and a group of high physical job demands (index values 6-10, abbreviated as HD and also referred to as non-manual workers). Figure 2 distinguishes between low physical demands (LD) and high physical demands (HD) in occupations and shows how shares of individuals in defined labour force states evolve over age separately for the two sexes.

Figure 2: Distribution of Labour Force States across Age by Occupational Types



(a) Male (b) Female

Source: Own calculations based on SOEP (1984-2012). *Note:* High and low (physical) demands are abbreviated by HD and LD respectively.

According to figure 2, manual workers both exit full-time employment and enter retirement at lower ages compared to non-manual workers. Exits from full-time employment increase

[5]The scale was developed using data from a large-scale representative survey for Germany from 2006, which collected information on workplace characteristics such as job requirements, main tasks, working conditions and job demands.

substantially after age 55. Moreover, retirement predominantly takes place between age 55 and 65, which is strongly driven by social security legislation. Aside from social security legislation, retirement patterns as displayed in figure 2 capture a rather broad situation where potentially unobserved factors such as mutual agreements or social norms do play a role; such aspects are taken into account in the subsequent duration model. Finally, the figure indicates that full-time employment is more prevalent among male individuals while female individuals work more frequently in part-time employment. As we are primarily interested in labour force dynamics that document transitions into retirement, the observed patterns in figure 2 justify that we restrict our analysis to individuals aged 55 to 65 (equivalent to 11 years or 132 months) in subsequent regressions, while capturing all relevant transition dynamics.

Further descriptive evidence for systematic differences in retirement across physical demands is attained from discrete time duration models.

Table 1: Discrete Time Duration Models: Differences Estimation for Transitions into Retirement by Physical Demands

	Compl. Log-Log		Multinomial Logit	
	coeff.	s.e.	coeff.	s.e.
Binary Case				
Manual	.247	(.041)	–	–
MNL (Coefficient w.r.t. Outcome):				
Manual (Part-Time)	–	–	−.417	(.098)
Manual (Unemployment)	–	–	.765	(.075)
Manual (Retirement)	–	–	.277	(.063)
+ Duration-Dummies	Yes		Yes	
Predicted Transition Rate (%)	3.00		3.19	
Obs.(Person-Month-Obs.)	5146(210770)		3630(134960)	

Source: Own calculations based on SOEP (1984-2012). *Note:* Reported values are estimated coefficients. For the multinomial logit, coefficients are estimated with respect to full-time employment as base category. Precise definition of labour force states for all ages requires more information and thus the multinomial logit has more missings, i.e. fewer observations.

Table 1 reports the results for two discrete time duration models, i.e. a binary complementary log-log model assuming discrete time proportional hazards and a multinomial logit assuming discrete time proportional odds. The binary model describes transitions into retirement from any of the other labour force states, while the multinomial logit model allows for transitions into all different states, i.e. full-time employment, part-time employment, unemployment and retirement. Duration time enters both models in its most flexible form, where 132 dummies capture variation for each month (i.e. age) and thus no functional form assumption on the baseline hazard is imposed. The variable "Manual" discriminates between occupations with high physical demands (Manual = 1) and low physical demands (Manual = 0). The estimated coefficient on "Manual" is positive for the binary proportional hazards model, which indicates that manual workers have a larger hazard to enter retirement on average. In the multinomial logit model, the coefficient for "Manual" is as well positive and of similar magnitude for transitions into retirement (i.e. the respective outcome). This result is important to underline what we have found in the binary case, because the multinomial model allows for transitions into other states and is thus more general.

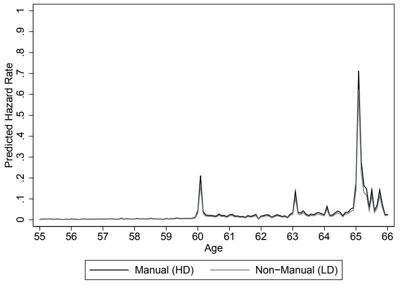
Figure 3 reports hazard profiles for exits into retirement as predicted from the complementary log-log model. Hazard profiles in figure 3 show that retirement entries accumulate around age 60, 63 and 65, as suggested by the respective peaks in predicted hazard rates. This pattern is a perfect projection of the German social security legislation, where eligibility for specific types of old-age pensions are achieved at these specific ages.[6] Similar patterns for Germany with spikes at age 60, 63 and 65 have been recognised in previous studies, such as Börsch-Supan and Schnabel (1998); Börsch-Supan (2000). Moreover, the hazard profile for non-manual workers (average hazard to enter retirement is 2.5%) is systematically lower compared to manual workers (average hazard to enter retirement is 3.2%) for the observed ages. Thus, the hazard profile of non-manual workers is about 20% lower compared to individuals with physically demanding occupations.

4.2 Retirement and Individual Background: Evidence from Non-Parametric Tests

A simple test of equality of opportunity is to check whether the retirement age distributions differ between individuals with different circumstances. If so, this points at differences in the timing of retirement which are beyond individual responsibility. Assume two retirement age distributions A and B and their cumulative distribution functions (CDF) $F_A(r)$

[6] Note that eligibility refers to both early and normal retirement ages. The normal retirement age for a regular old-age pension was 65 until December 2011, where our observation period ends. Besides regular old-age pensions, other types are available such as pensions for unemployed, women, long-term insured and severely disabled individuals. These types of old-age pensions are typically available "early", i.e. at age 60 or 63.

Figure 3: Predicted Hazard Profile for Retirement Entries by Physical Demands



Source: Own calculations based on SOEP (1984-2012). *Note:* High and low (physical) demands are abbreviated by HD and LD respectively.

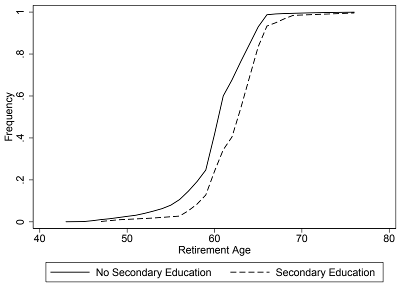
and $F_B(r)$. Then, A dominates B at first order if and only if $F_A(r) \leq F_B(r)$ for any retirement age $r_j = \{r_1, r_2, ..., r_k\}$. We apply the first order stochastic dominance concept using three different categories of circumstance variables to divide our sample, namely, personal characteristics, socio-economic background, and urbanisation of area of residence during childhood. We test for equality of distributions conducting Kolmogorov-Smirnov tests of equality of distributions.

4.2.1 Dominance According to Socio-Economic Background

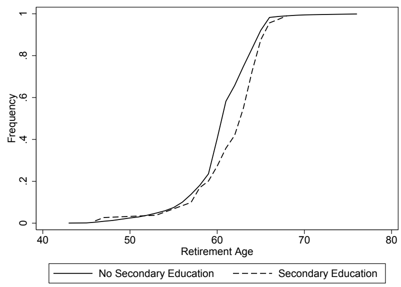
We use parental educational attainment as a proxy for socio-economic background. Figure 4 plots the CDFs of retirement age for individuals whose fathers achieved a secondary education degree (i.e. German "Abitur" or "Fachoberstufe") and individuals whose fathers did not achieve such a degree (panel (a)). With an exception for the tails, the CDF of individuals born to highly educated fathers lies below the CDF of individuals born to less educated fathers across the complete distribution of retirement age. The largest difference between highly and less educated fathers is 0.286, the largest difference between less and highly educated fathers is zero. The distributions are tested to be significantly different from each other. Hence, the CDF of individuals born to highly educated fathers first order dominates the CDF of individuals born to less educated fathers.

Figure 4 illustrates the analogous CDFs with respect to maternal educational attainment (panel (b)). The overall picture is similar to the one based on paternal education. Again, the CDFs are significantly different with the CDF of individuals born to mothers with a secondary degree lying below the CDF of individuals born to mothers without such a degree. Both the findings based on paternal and maternal education indicate that equality of opportunity is violated.

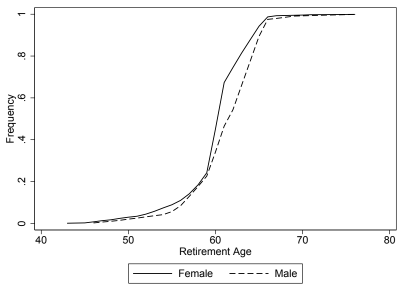
Figure 4: Cumulative Distribution Function of Retirement Age by Circumstances



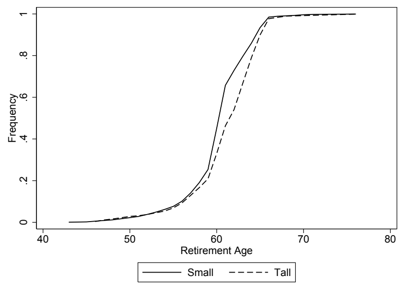
(a) Father's Schooling



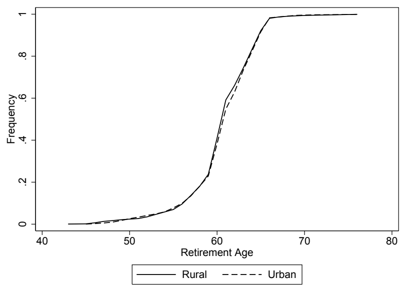
(b) Mother's Schooling



(c) Sex



(d) Body Height



(e) Urbanisation

Source: Own calculations based on SOEP (1984-2012). *Note:* Graphs are smoothed by averaging cumulative distributions on the level of age in years.

Table 2: Tests for Stochastic Dominance at First Order: Differences in Distribution of Retirement Age by Circumstances

Test	Maximum Difference	p-value	Corrected p-value
By Father's Schooling			
No Secondary Education	0.286	0.000	
Secondary Education	0.000	1.000	
Combined	0.286	0.000	0.000
By Mother's Schooling			
No Secondary Education	0.273	0.000	
Secondary Education	-0.024	0.000	
Combined	0.273	0.000	0.000
By Sex			
Female	0.215	0.000	
Male	-0.004	0.185	
Combined	0.215	0.000	0.000
By Body Height			
Small	0.209	0.000	
Tall	-0.009	0.001	
Combined	0.209	0.000	0.000
By Urbanisation			
Rural	0.078	0.000	
Urban	-0.016	0.000	
Combined	0.078	0.000	0.000

Source: Own calculation based on SOEP (1984-2012).

4.2.2 Dominance According to Personal Characteristics

We consider sex and body height as personal characteristics, which are attributes that individuals clearly cannot be held responsible for. Figure 4 illustrates CDFs of age at retirement by specific circumstances, where sex is displayed in panel (c). While the overall shapes of the distributions appear to be quite similar, the lines diverge between ages 60 and 65, implying that females enter retirement earlier than males. Table 2 reports all results of according stochastic dominance tests for equality of distribution by specific circumstances. The largest difference between the distribution functions is 0.215. The maximum difference between females and males is negative (-0.004), which indicates that the CDF of males lies below the CDF of females at any possible retirement age. The small p-value for the combined test indicates that the distributions of males and females are significantly different. Hence, the CDF of males first order dominates the CDF of females. However, differences in retirement age by sex cannot generally be considered as illegitimate inequalities since males and females are subject to different retirement rules and social norms and are therefore of limited comparability.

In contrast, retirement rules are independent of body height. Height is a proxy for childhood health as well as height-related differences in self-perception and the perception by others which may both provoke differences in career chances. In a comparison of CDFs by body height, first order stochastic dominance would clearly imply the presence of inequality of opportunity in the timing of retirement. Figure 4 (panel d) illustrates the distribution functions for individuals who differ by body height, where the sample mean of body height has served as a threshold to assign individuals to the two groups. Again, the distributions appear very similar with a divergence between ages 60 and 65; the maximum difference amounts to 0.209. The largest difference between small and tall individuals is negative (-0.009), which implies that the CDF of tall individuals is below the CDF of small individuals at any retirement age. According to the combined test, the CDFs are significantly different from each other. The conditions for first order stochastic dominance are fulfilled, suggesting the presence of inequality of opportunity in favour of tall people.

4.2.3 Dominance According to Urbanisation in Area of Residence During Childhood

In contrast to personal characteristics and socio-economic background, visible differences in retirement age are not as distinctive when individuals who grew up in areas of different degrees of urbanisation are compared. Figure 4 suggests that the CDFs about coincide at most retirement ages (panel (e)). There is a slight divergence between ages 60 and 63. The stochastic dominance test reveals that at any retirement age the CDF of individuals who grew up in urban areas lies below the CDF of individuals who grew up in rural areas. The largest difference amounts to 0.078 and the CDFs are estimated to be significantly different. Hence, although the visible differences appear rather small when comparing CDFs by urbanisation, the urban-CDF dominates the rural-CDF at first order, suggesting inequality of opportunity in age at retirement as well for this characteristic.

4.3 Decomposition of the Difference in Retirement Age by Physical Demands: Circumstances versus Effort and Luck

Up to this point, we focused on retirement inequalities between different degrees of physical job demands (duration models) and inequality of opportunity in retirement (tests for stochastic dominance) separately. The ultimate aim of this study is, however, a combination of the two, i.e. an evaluation of the proportion of differences in retirement age between manual and non-manual workers that are attributed to circumstances as distinguished from effort and luck. In order to estimate this proportion, we conduct the decomposition method proposed by Blinder (1973) and Oaxaca (1973) based on the following linear model:

$$RA_g = \mathbf{X_g}'\beta_g + \varepsilon_g \,, \tag{1}$$

where $g = (N, M)$ denotes the groups of non-manual workers N and manual workers M, respectively, RA denotes individual retirement age expressed in years whereas varying by month, $\mathbf{X}$ contains a constant and a range of circumstance variables, and ε is an error term. The mean difference in retirement age, which is given by

$$\begin{aligned} \Delta_{NM} &= E(RA_N) - E(RA_M)\,, \\ &= E(\mathbf{X}_N)'\beta_N - E(\mathbf{X}_M)'\beta_M\,, \end{aligned} \tag{2}$$

where $E(\beta_g) = \beta_g$ and $E(\varepsilon_g) = 0$ by assumption, can generally be decomposed into

$$\{E(\mathbf{X}_N) - E(\mathbf{X}_M)\}'\beta^* + \{E(\mathbf{X}_N)'\{\beta_N - \beta^*\} + E(\mathbf{X}_M)'\{\beta^* - \beta_M\}\}\,, \tag{3}$$

such that the first summand refers to the "explained" part and the second summand represents the "unexplained" part of the outcome difference between the two groups. The literature proposes several variants of the decomposition in equation (3) by determining β^* in different ways. Specifically, β^* can be defined as a weighted average of the group coefficient vectors:

$$\beta^* = \mathbf{\Omega}\beta_N + (\mathbf{I} - \mathbf{\Omega})\beta_M , \tag{4}$$

where $\mathbf{\Omega}$ denotes a weighting matrix and $\mathbf{I}$ is an identity matrix. $\mathbf{\Omega} = \mathbf{I}$ and $\mathbf{\Omega} = \mathbf{0}$ represent the special cases proposed by Oaxaca (1973) and Blinder (1973). These two decompositions provide the extreme cases of assigning the complete interaction effect between endowments and coefficients either to differences explained by endowments ("explained" part) or to differences explained by coefficients ("unexplained" part), respectively. Several authors have suggested alternatives leading to decompositions in between. Neumark (1988) suggests to estimate a pooled model over both groups to infer β^*. Cotton (1988) proposes to choose $\mathbf{\Omega} = s\mathbf{I}$, where s denotes the sample fraction of group N.

In Section 4, we report estimates of all four described variants of equation (3), while our preferred decompositions are those proposed by Neumark (1988) and Cotton (1988) since they provide convincing strategies of achieving a result between the extreme cases. As the circumstances we include in our model are only a subset of all relevant circumstances (we do not observe talent, for example), the estimate of the explained part of equation (3) must be interpreted as a lower bound of the contribution of circumstances to the retirement differential between manual and non-manual workers. The unexplained part is to be interpreted as arising from differences in the coefficients as well as differences in unobserved predictors, such as effort and luck (Jann, 2008).

4.4 Decomposition Results

Table 3 reports the results from the Oaxaca-Blinder decompositions. While on average both considered occupation types retire in their early 60s, it is predicted that manual workers retire 1.1 years earlier than non-manual workers. The decomposition results shown in the lower panel of table 3 suggest that endowments explain between 0.25 and 0.46 years of this differential, depending on the choice of $\mathbf{\Omega}$, which is equivalent to a contribution of between 23.2% and 42.3%. When considering the results based on the pooled model over groups, 0.44 years of the differential (39.8%) are explained, while 0.66 years (60.2%) remain unexplained. Finally, the results for the decomposition proposed by Cotton (1988), suggest that 0.37 years of the difference (33.5%) are attributed to differences in endowments. The findings from the latter two decompositions indicate that circumstances account for at least 33.5% to 39.8% of the differences in retirement age between manual and non-manual workers, while at most 60.2% to 66.4% can be attributed to effort and luck. The estimated contribution of circumstances can be considered as a lower bound since the range of circumstances accounted for is unlikely to be complete (e.g., we do not observe innate talents) and, in addition, circumstance effects are likely to be mediated partly through characteristics not included in the model which are potentially influenced by individual choices, such as educational attainment, occupational choice, or health behaviours, which cannot be distinctively classified as circumstance or effort variables. In sum, the decomposition results suggest that circumstances explain at least one third of the observed differences in the retirement age between workers of different degrees of physical job demands, which indicates that a considerable part of differences in retirement ages are predetermined and thus not subject to individual choice.

Table 3: Oaxaca-Blinder Decomposition

Non-Manual Workers:				
Average retirement age	61.42			
Obs.(Person-Month-Obs.)	499(82185)			
Manual Workers:				
Average retirement age	60.33			
Obs.(Person-Month-Obs.)	539(97363)			
Difference	1.099			
Decomposition:				
	$\mathbf{\Omega = I}$	$\mathbf{\Omega = 0}$	Pooled	Cotton
Explained	0.255	0.465	0.437	0.369
	23.18%	42.30%	39.77%	33.55%
Unexplained	0.844	0.634	0.662	0.730
	76.82%	57.70%	60.23%	66.45%

Source: Own calculation based on SOEP (1984-2012).

Note: Decomposition of the difference in mean retirement age in years between non-manual and manual workers.

5 Conclusion

The purpose of this paper is to quantify differences in the retirement age between manual and non-manual workers and to evaluate these differences with respect to EOP. The focus is on the question how individual background during childhood transmits through physical demands of occupations on retirement ages.

Individual retrospective data from the SOEP are used to analyse labour force dynamics over the years 1984 to 2011. Discrete time duration models are estimated in the most flexible version, where age (i.e. duration time) enters the model on a monthly level and thus accounts for variation in the relevant range from age 55 to 65. The estimated hazard profile of non-manual workers is about 20% lower compared to individuals with physically demanding occupations. Non-parametric tests for stochastic dominance at first order indicate that the distribution of retirement age differs significantly between individuals across circumstances. However, the ultimate aim of this study is an evaluation of the proportion of differences in retirement age between manual and non-manual workers that are attributed to circumstances as distinguished from effort and luck. The result from a Blinder-Oaxaca decomposition suggests that circumstances explain at least one third of the observed differences in the retirement age between workers with different degrees of physical job demands. The result is a lower bound, as we do not observe the full set of individual circumstances. This finding is important because it indicates that a considerable part of differences in retirement age is predetermined and thus not subject to individual choice.

Retirement decisions are complex. Aside from general preferences for consumption and leisure, several aspects such as health-related behaviours, wealth and occupational sorting play a role in retirement choices, and most of these factors are not exogenously determined. Beyond individual choice, employer behaviour and the availability of retirement benefits (i.e. social security legislation) influence the observed outcomes for retirement ages. Thus, retirement decisions are influenced by a number of factors which in sum do not clearly indicate whether retiring early or working longer is more desirable from an individual point of view. In the present paper, we apply an approach that carries on the EOP literature and decomposes differences in the retirement age into individual responsibility (i.e. effort and luck) and personal background (i.e. circumstances). Thus, the relevant quantity is the share of individual background characteristics that transmits through physical demands of occupations to retirement ages. By nature, individual circumstances are predetermined to any endogenous decision which individuals could be held responsible for. Early retirement usually implies a reduction in social security wealth and to this end, differences in retirement age between subgroups do have economic relevance. When raising the normal retirement age, policy makers must be aware of potential disadvantages in terms of reduced benefit entitlements for manual workers. While the interpretation of our result is highly normative, it allows to focus thoughts in a debate, where early retirement of manual workers is often considered to be “unfair”.

References

Aaberge, R., M. Mogstad, and V. Peragine (2011). Measuring long-term inequality of opportunity. *Journal of Public Economics 95*(3-4), 193–204.

Blinder, A. S. (1973). Wage Discrimination: Reduced Form and Structural Estimates. *Journal of Human Resources 8*(4), 436–455.

Bonsang, E., S. Adam, and S. Perelman (2012). Does Retirement Affect Cognitive Functioning? *Journal of Health Economics 31*(3), 490–501.

Börsch-Supan, A. (2000). A Model under Siege: A Case Study of the German Retirement Insurance System. *Economic Journal 110*(461), 24–45.

Börsch-Supan, A. and R. Schnabel (1998). Social Security and Declining Labor-Force Participation in Germany. *American Economic Review, Papers and Proceedings 88*(2), 173–78.

Cohen, G. A. (1989). On the Currency of Egalitarian Justice. *Ethics 99*(4), 906–944.

Cotton, J. (1988). On the Decomposition of Wage Differentials. *Review of Economics and Statistics 70*(2), 236–243.

Devooght, K. (2008). To Each the Same and to Each his Own: A Proposal to Measure Responsibility-Sensitive Income Inequality. *Economica 75*(298), 280–295.

Federal Statistical Office (2014). Statistik der Geburten 1950-2012. Technical report, Statistisches Bundesamt, Wiesbaden.

Fleurbaey, M. (1995a). Equality and Responsibility. *European Economic Review 39*(3-4), 683–689.

Fleurbaey, M. (1995b). Three Solutions for the Compensation Problem. *Journal of Economic Theory 65*(2), 505–521.

Fleurbaey, M. and E. Schokkaert (2009). Unfair Inequalities in Health and Health Care. *Journal of Health Economics 28*(1), 73–90.

German Federal Pension Insurance (2013). Rentenversicherung in Zeitreihen. *DRV-Schriften, Band 22.*

Giesecke, M. and R. Schnabel (2014). A Note on Retirement Age and Differential Mortality. *Mimeo*, 1–14.

Haisken-DeNew, J. P. and J. Frick (2005). Desktop Companion to the German Socio-Economic Panel (SOEP). *Berlin: German Institute for Economic Research.*

Hakola, T. and R. Uusitalo (2005). Not so Voluntary Retirement Decisions? Evidence From a Pension Reform. *Journal of Public Economics 89*(11-12), 2121–2136.

Hernaes, E., S. Markussen, J. Piggott, and O. L. Vestad (2013). Does Retirement Age Impact Mortality? *Journal of Health Economics 32*(3), 586–598.

Hurd, M. D. (1990). Research on the Elderly: Economic Status, Retirement, and Consumption and Saving. *Journal of Economic Literature 28*(2), 565–637.

Hutchens, R. (1999). Social security benefits and employer behavior: Evaluating social security early retirement benefits as a form of unemployment insurance. *International Economic Review 40*(3), 659–678.

Jann, B. (2008). The Blinder-Oaxaca Decomposition for Linear Regression Models. *Stata Journal 8*(4), 453–479.

Jusot, F., S. Tubeuf, and A. Trannoy (2013). Circumstances And Efforts: How Important Is Their Correlation For The Measurement Of Inequality Of Opportunity In Health? *Health Economics 22*(12), 1470–1495.

Kroll, L. E. (2011). Construction and Validation of a General Index for Job Demands in Occupations Based on ISCO-88 and KldB-92. *Methoden — Daten — Analysen 5*(1), 63–90.

Lefranc, A., N. Pistolesi, and A. Trannoy (2008). Inequality Of Opportunities Vs. Inequality Of Outcomes: Are Western Societies All Alike? *Review of Income and Wealth 54*(4), 513–546.

Lefranc, A., N. Pistolesi, and A. Trannoy (2009). Equality of Opportunity and Luck: Definitions and Testable Conditions, with an Application to Income in France. *Journal of Public Economics 93*(11-12), 1189–1207.

Neumark, D. (1988). Employers' Discriminatory Behavior and the Estimation of Wage Discrimination. *Journal of Health Economics 23*(3), 279–295.

Oaxaca, R. (1973). Male-Female Wage Differentials in Urban Labor Markets. *International Economic Review 14*(3), 693–709.

Rawls, J. (1971). *A Theory of Justice*. Harvard University Press, Cambridge.

Roemer, J. E. (1993). A Pragmatic Theory of Responsibility for the Egalitarian Planner. *Philosophy and Public Affairs 22*(2), 146–166.

Roemer, J. E. (1998). *Equality of Opportunity*. Cambridge University Press.

Rohwedder, S. and R. J. Willis (2010). Mental Retirement. *Journal of Economic Perspectives 24*(1), 119–38.

Sheshinski, E. (1978). A Model of Social Security and Retirement Decisions. *Journal of Public Economics 10*(3), 337–360.

Trannoy, A., S. Tubeuf, F. Jusot, and M. Devaux (2010). Inequality of Opportunities in Health in France: A First Pass. *Health Economics 19*(8), 921–938.

Weiss, Y. (1972). On the Optimal Lifetime Pattern of Labour Supply. *Economic Journal 82*(328), 1293–1315.

A Appendix

Table 4: Distribution of Individual Transitions across States

Origin	Transition into State				Total Net Transitions	Total
	(1)	(2)	(3)	(4)		
(1) Full-time Employment	559,944	1,656	2,977	1,323	5,956	565,900
	(98.95)	(0.29)	(0.53)	(0.23)	(1.05)	(100.00)
(2) Part-time Employment	1,595	177,439	727	583	2,905	180,344
	(0.88)	(98.39)	(0.40)	(0.33)	(1.61)	(100.00)
(3) Unemployment	2,294	738	94,057	1,130	4,162	98,219
	(2.34)	(0.75)	(95.76)	(1.15)	(4.24)	(100.00)
(4) Retirement	142	122	116	762,117	380	762,497
	(0.02)	(0.02)	(0.02)	(99.94)	(0.06)	(100.00)
Total					13,403	1,606,960

Source: Own calculation based on SOEP (1984-2012).
Note: Absolute transitions are reported; relative shares in parentheses. “Net transitions” refer to all transitions into respective other states.

Table 5: Number of Spells per Individual

Number of Spells	Number of Individuals	Per Cent
1	12,132	68.96
2	2,415	13.73
3	1,314	7.47
4	620	3.52
5	463	2.63
6	181	1.03
7	169	0.96
8	88	0.50
9	71	0.40
10 or more	141	0.80
Total	17,594	100.00

Source: Own calculation based on SOEP (1984-2012).