London School of Economics and Political Science

Long-Term Effects of Economic Fluctuations on Health and Cognition in Europe and the United States

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Declaration of Authorship

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This thesis conforms to the requirements of a doctoral thesis from the London School of Economics and Political Science. Guidelines state a minimum of three papers of publishable standard – in addition to introduction and concluding chapters – not exceeding 100,000 words. Accordingly, this thesis presents an introductory chapter which gives an overview, the motivation and objectives. The second chapter provides an overview of the literature and the third chapter describes the data used in the empirical chapters. Chapters 4, 5, 6 and 7 are presented in the style of a journal article. Chapter 8 brings together key findings and discusses general methodological issues as well as a future research agenda.

I declare that chapters 4 and 5 were jointly co-authored with Dr Mauricio Avendano. For both chapters, I accessed and compiled the micro as well as macro data, carried out the statistical analyses and completed a first full draft of the manuscript. Paper 4 was then jointly revised for publication in the journal *Annals of Epidemiology* (Are economic recessions at the time of leaving school associated with worse physical functioning in later life? Annals of Epidemiology, Volume 23, Issue 11 , Pages 708-715, November 2013). Chapter 5 is currently being revised for re-submission to a journal. Chapter 6 was jointly authored with Dr Mauricio Avendano and Dr Anja Leist. For this chapter I again accessed and compiled the micro as well as macro data and carried out the statistical analyses. The manuscript was jointly authored and subsequently published in the *Journal of Epidemiology and Community Health* (Do economic recessions during early and mid-adulthood influence cognitive function in older age? Journal of Epidemiology and Community Health, Volume 68, Issue 2, Pages 151-158, November 2013). Chapter 7 is authored solely by the author of this thesis, though I received support with the construction of the dataset from Dr Ivan Mejia.

Abstract

Several studies suggest that population health improves during recessions and deteriorates during economic expansions. However, the majority of these studies only focus on the short-term or contemporaneous effects of economic fluctuations on health. As a result, very little evidence exists on potential long-term health effects of exposure to booms or recessions. This can be regarded as a major gap in knowledge, given the fact that most diseases are the results of exposure or behaviours during a longer period of time. Furthermore, a large body of research also suggests that many risks associated with recessions may accumulate over the course of life and lead to a gradual deterioration in health. By focusing only on the short-term effects, most studies thus ignore potential long-run health effects of economic fluctuations.

This thesis aims to bridge the gap between studies on the population level assessing the short-term effects of economic fluctuations on health, and studies on the individual level, which have analysed the health-effects of risks associated with a declining economy including unemployment, job loss and job insecurity. In order to assess potential long-term effects of business cycles on health, I linked historical information on macroeconomic fluctuations during the 20th century to individual-level data from the Survey of Health, Ageing and Retirement in Europe (SHARE) as well as the U.S. Health and Retirement Study (HRS). This approach makes it possible to identify the state of the economy during different life-course periods for every respondent and relate it to health outcomes measured in later life.

Regarding the macroeconomic conditions at any given age as largely exogenous, the four empirical papers included in this thesis thereby assess the relationship between business cycles and health during three different life-course periods: the time around graduation from full-time education, middle and late adulthood as well as the years nearing retirement. Overall, the results suggest that individuals who experienced less favourable economic conditions during these life-course periods have a higher risk of having additional limitations in physical functioning, lower levels of cognitive functioning, as well as higher risks of cardiovascular disease in later life.

In contrast to studies showing that population health improves during recessions, these findings suggest that potential short-term improvements in health may be outweighed by deteriorations in health in the long run. They also raise important questions about the role of potential mechanisms linking differential exposure to the business cycle to health in later life.

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Although a thesis is required to be the genuine work of the author, few important things in life can usually be achieved alone. This PhD is no exception to this rule.

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List of Abbreviations

ADL	Activities of Daily Living
AHEAD	Asset and Health Dynamics among the Oldest Old
BLS	U.S. Bureau of Labor Statistics
BMI	Body Mass Index
CHARLS	Chinese Health and Retirement Longitudinal Study
CHS	Cardiovascular Health Study
CI	Confidence Interval
CODA	Children of the Depression Age
Coeff.	Coefficient
CPS	Current Population Survey
CVD	Cardiovascular Disease
EBB	Early Baby Boomer
ELSA	English Longitudinal Study of Ageing
FHS	Framingham Heart Study
GCNKY	Greater Cincinnati/Northern Kentucky
GDP	Gross Domestic Product
GNP	Gross National Product
GS	Grip Strength

HMD	Human Mortality Database
HP	Hodrick-Prescott filter
HR	Hazard Rate
HRS	Health and Retirement Study
IADL	Instrumental Activities of Daily Living
IRB	Internal Review Board
ILO	International Labor Organization
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
JSTAR	Japanese Study on Aging and Retirement
Kg	Kilogram
KLoSA	Korean Longitudinal Study of Aging
LASA	Longitudinal Aging Study Amsterdam
LASI	Longitudinal Aging Study in India
LCI	Lower Confidence Interval
LTC	Long Term Care Insurance
MHAS	Mexican Health and Aging Study
NCDS	National Child Development Study
NHIS	National Health Interview Survey
NIA	National Institute on Aging

NIH	National Institute of Health
NLSY79	National Longitudinal Survey of Youth 1979 Cohort
NOMASS	Northern Manhattan Stroke Study
NSHD	National Survey of Health & Development
OECD	Organisation of Economic Cooperation and Development
OR	Odds Ratio
PH	Cox Proportional Hazard
PPP	Purchasing Power Parities
PSM	Propensity Score Matching
PSU	Primary Stage Units
RHS	Retirement History Study
RR	Rate Ratio
SAGE	World Health Organization Study on Global Ageing and Adult Health
SD	Standard Deviation
SHARE	Survey of Health, Ageing and Retirement in Europe
SHARELIFE	Survey of Health, Ageing and Retirement in Europe Life Event History
SRH	Self-Rated Health
SSI	Social Security Income
SSU	Selection of Area Segments

TILDA	Irish Longitudinal Study on Ageing
U.S.	United States
UCI	Upper Confidence Interval
WB	War Baby
WHO	World Health Organization
WWII	Second World War

Chapter 1 Introduction

During the 20th century, populations in both Europe as well as the United States (U.S.) have witnessed a generally steady increase in economic output. However, despite the overall expansion, during the same period both regions also experienced a series of major recessions. These include the Great Depression in 1929-1933, the Second World War (WWII), the Oil Crisis in 1973-1975, as well as the most recent recession.

Whereas it is well established that long-term economic growth as such is positively associated with improvements in population health, due to improvements in living conditions and an expansion of education as well as social welfare systems (Janssen, Kunst and Mackenbach 2006), a question which has received considerable attention among scholars is how economic cycles affect health. Such fluctuations alternatively referred to as economic or business cycles refer to the upward and downward movements in key measures of economic activity such as gross domestic product (GDP) or unemployment around a long-term trend (Burns and Mitchell 1946). The first studies to empirically address the relationship between fluctuations in economic output and health were published by Brenner in the 1970s (Brenner 1973, 1975, 1979). In this seminal work, Brenner attributed decreases in mortality to increases in GDP per capita and speculated that "[…] economic instability and insecurity increase the likelihood of immoderate and unstable life habits, disruption of basic social networks, and major life stresses […]" (1979: 568).

The argument that economic instability is caused by a declining economy, that it may be related to a number of adverse individual experiences and ultimately leads to a worsening in both individual as well as population health seems to be well supported. For example, a large number of studies has found experiencing unemployment, job loss or job insecurity to be associated with increased risk of depression and anxiety (Catalano et al. 2000; Dooley, Prause and Ham-Rowbottom 2000; Ferrie et al. 2001; Thomas, Benzeval and Stansfeld 2005), substance abuse (Falba et al. 2005; Gallo et al. 2001a; Janlert and

Hammarström 1992), suicide (Fergusson, Boden and Horwood 2007; Kposowa 2001), cardiovascular disease (Gallo et al. 2004; Gallo et al. 2006) and obesity (Deb et al. 2011).

Whereas the early studies by Brenner have been widely criticised for the methodology used, based on a time period for individual countries, a series of influential studies have shown that in fact economic expansions seem to be followed by increases in mortality – thus a worsening in population health (Ruhm 2000, 2003). Seemingly at odds with the initial reasoning of Brenner as well as the body of individual-level studies, the more recent studies argue that increases in economic output usually lead to increases in work-related stress and a number of unhealthier behaviours such as an increase in smoking or alcohol consumption (Ruhm 2005).

Despite the fact that a number of studies have analysed the potential long-term effects of unemployment or job loss (Eliason and Storrie 2009a; Ferrie et al. 1998; Lundin et al. 2010; Sullivan and von Wachter 2009), most studies assessing the relationship between business cycles and health to date have focused exclusively on the short-term or contemporaneous effects. Thus changes in economic output in one year are related to changes in health in the same year. A notable exception is a series of papers showing that adverse macroeconomic conditions experienced around the time of birth have long-lasting negative effects on health (van den Berg, Doblhammer-Reiter and Christensen 2011; van den Berg, Doblhammer and Christensen 2009; van den Berg, Lindeboom and Portrait 2006). What is common to these studies is that the time around birth is generally understood as a critical period of development with a particular sensibility of the biological system to external influences and circumstances. However, there is limited knowledge on how economic cycles experienced during other life-course periods may influence health outcomes later in life.

Analysing the relationship between economic cycles[1] and health from a life-course perspective is important for several reasons. For example, studies focusing only on short-term effects of economic cycles ignore the circumstances whereby most diseases, such as

[1] Throughout the thesis the expressions economic cycles, business cycles and macroeconomic conditions are used interchangeably.

lung cancer or liver cirrhosis, are the result of exposure over a relatively long period of time and take several years to manifest clinically (Bartley, Blane and Montgomery 1997). In addition, a large body of literature within epidemiology as well as sociology has shown that many risks that may be related to economic cycles, such as unemployment, economic insecurity or poverty, gradually accumulate over the life course (DiPrete and Eirich 2006), so that lifetime experiences shape health and mortality outcomes in old age. As a result, macro-economic conditions throughout the years of a working life, after school graduation and before retirement, may be important for the accumulation of an individual's health stock in later life. For example, recent evidence suggests that cohorts who experienced a major recession in the year of graduation from college experienced less favourable career trajectories, higher job instability, reduced earnings and less favourable working conditions in midlife (Kahn 2010; Oreopoulos, von Wachter and Heisz 2012; Raaum and Røed 2006). Given the strong correlation between socio-economic status and health (Marmot and Wilkinson 2009), cohorts experiencing less favourable economic conditions during specific periods in their life-course may be at increased risk of experiencing bad health in old age compared to cohorts who experienced more favourable economic conditions during the same stages in their life-course.

Even though the most recent recession has led to a significant increase in the number of publications assessing the relationship between business cycles and health, the vast majority of these studies still focus only on the short-term effects. Although much of the existing research suggests that in the short-run recessions may be associated with improvement in population health, most of the effects of economic fluctuations on health may only become visible after several years. Therefore, evidence about the potential long-term effects of differential exposure to the business cycle is important for designing public policies aiming to protect people from the potentially negative effects of such fluctuations. The main inspiration for the papers included in this thesis have been studies which looked at the long-term effects of economic fluctuations around the time of birth (van den Berg et al. 2009; van den Berg et al. 2006) and studies in the tradition of life-course epidemiology, which have studied the long-term health effects of social conditions at specific life-course periods (Ben-Shlomo and Kuh 2002; Smith et al. 1997). The central

aim of this thesis is therefore to bridge the gap between studies looking at the short-term health-effects of economic fluctuations at the population level and those studies looking at the long-term effects of individual experiences of adverse outcomes. More specifically, this thesis aims to assess whether there exists a relationship between the economic conditions experienced at an earlier period of the life-course and health in later life. At the same time, this thesis also aims to identify specific mechanisms that may help to explain potential long-term effects of economic fluctuations on health.

The following papers all relate macroeconomic conditions experienced at different stages of the life-course to health and cognitive functioning in later life. To achieve this aim, I combine historical information about macroeconomic conditions such as GDP and unemployment rates for the most part of the 20th century, with individual-level survey data from the Survey of Health, Ageing and Retirement in Europe (SHARE) as well as the U.S. Health and Retirement Study (HRS). This approach makes it possible to assess how the exposure to different macroeconomic conditions at various ages affects health and cognitive outcomes years after the original exposure. The papers included in this thesis follow a chronological order with regard to the life-course: 1) the first paper assesses the long-term effects of macroeconomic conditions experienced during the transition between education to the labour market on functional health using data from eleven European countries. 2) The second and third papers also use data from SHARE but focus on the effects of economic conditions during ages 16-49 in general. This period usually coincides with several important life-course events such as the entrance into the labour market, leaving the parental home or the transition into parenthood, which may be affected by macroeconomic conditions. Whereas the second paper uses functional health as the outcome of interest, the third paper focuses on cognitive functioning (3). Cognitive functioning is an important dimension of healthy ageing (Craik and Salthouse 2011) and has previously been shown to be associated with occupational solvent exposures, career trajectories as well as work complexity (Andel et al. 2006; Bickel and Kurz 2009; Finkel et al. 2009; Stern et al. 1995), which in turn may be very sensitive to macroeconomic fluctuations. 4) The final paper uses data from HRS to look at the long-term effects of state-level unemployment rates in the years approaching retirement on the risk of

cardiovascular disease. The years when individuals approach retirement is a very sensitive period as older workers generally have few chances to make up for losses in income, housing wealth or retirement savings occurring as a result of any economic downturns during this period. As a consequence, losses experienced during this time are likely to affect welfare throughout retirement and may therefore also affect health.

1.1 A life-course perspective linking economic fluctuations and health

As mentioned in the previous chapter, the majority of studies looking at the relationship between economic cycles and health have only included a very short time frame and typically related changes in economic output in one year to changes in health in the same year. One exception has been a series of studies that have analysed the long-term effects of economic conditions around the time of birth on health (van den Berg et al. 2011; van den Berg et al. 2009; van den Berg et al. 2006). Whereas these studies have generally found that being born during a recession can have a long-lasting negative effect on subsequent survival probabilities, the time around birth is regarded as a critical period with a particular biological sensitivity to external influences. The critical period concept thereby assumes that "[…] an exposure acting during a specific period has lasting or lifelong effects on the structure or function of organs, tissues and body systems which are not modified in any dramatic way by later experience" (Ben-Shlomo and Kuh 2002: 286). The latter is also often referred to as the biological programming or latency model, and is also at the centre of the so-called 'fetal origins hypothesis' (Ben-Shlomo and Kuh 2002). Formulated by Barker, it postulates that foetal undernutrition may increase the risk of experiencing a number of chronic diseases in adulthood (Barker 1998). The critical period concept assumes that damage caused by external exposure during a limited window of time in a person's life-course is permanent and irreversible. Outside this time frame, it is assumed, there exists no excessive risk from specific exposure (Kuh et al. 2003).

Partly in opposition to the critical period approach, scholars in the tradition of life-course epidemiology, in particular, have argued that almost all disease aetiology must be analysed across the life-course. Scholars in this tradition have attempted to study "[…] how socially patterned exposures during childhood, adolescence, and early adult life

influence adult disease risk and socio-economic position, and hence may account for social inequalities in adult health and mortality" (Kuh et al. 2003: 778). The tradition of life-course epidemiology is thereby closely related to that of social epidemiology, which attempts to study the social determinants of health and wellbeing and in particular how individuals' developmental trajectories are shaped by historical as well as environmental contexts (Krieger 2001). Two key concepts of life-course epidemiology are accumulation of risks as well as the chain of risk model (Kuh et al. 2003). The former assumes that exposures and risks gradually accumulate during periods of illness, adverse socio-economic conditions or adverse contextual conditions. These exposures may either be independent or clustered. For example, an individual may experience an accident, a period of unemployment or the death of a partner, which may be independent of another. However, in many cases exposures and risks are clustered and affect a group of individuals with certain socio-economic characteristics. For instance, children growing up in an impoverished neighbourhood may be more likely to experience air pollution or unemployment of a parent compared to children growing up in better neighbourhoods. The chain of risk model assumes that many events can be regarded as a sequence of linked exposures (Kuh et al. 2003). Thus a specific exposure may increase the risk of subsequently experiencing a second adverse event, whereas the initial exposure may have an independent effect on health (additive model) or alternatively only through its effect on the final event (trigger effect) (Kuh et al. 2003). For example, dropping out of school may lead to unemployment and excessive alcohol consumption. In the additive model, each individual event has an independent effect on health, whereas according to the trigger effect model only the final event in the chain – excessive alcohol consumption – would have an independent measurable effect on health.

Focusing only on short-term effects, most existing studies on the effects of economic cycles on health typically ignore that diseases in adulthood take years to develop and have complex aetiologies involving exposure over the entire life course (Bartley et al. 1997), with clinical manifestations only evident at relatively old age. For example, risk factors such as tobacco and alcohol consumption have cumulative effects on chronic disease and

may result in disability and poor health at old age, without any clinical manifestation during early adulthood.

Many of the risks associated with a declining economy or a recession may be linked to subsequent events in the sense that they increase the likelihood of another related event. One classical example is that of unemployment and the so-called scar effect. A large body of evidence accordingly shows that experiencing unemployment or job loss can have fundamental consequences on an individuals' future career, both in terms of earnings as well as employment trajectories. Scarring in general is believed to be the result of a depreciation of work-related skills as well a lack of work experience, compared to individuals who retain their jobs (Arulampalam, Gregg and Gregory 2001). For example, Ruhm (1991) found that the wages of workers in the U.S. who were once unemployed were between 16 and 18 per cent lower compared to workers who did not lose their jobs. The findings also suggest that once displaced, workers have little prospect of catching up in terms of earnings, even after several years.

Against this background, the life-course approach appears to be particularly suitable for the study of the relationship between economic cycles and health for several reasons. First of all, the tradition of life-course epidemiology is closely linked to the tradition highlighting the importance of socio-economic factors in determining health. The latter approach is based on the observation that disadvantaged groups, for example, measured in terms of income, education, class or ethnicity, usually have worse health than their better-situated counterparts (Blane 1995; Graham 2004; Marmot et al. 2008; Marmot and Wilkinson 2009). This social gradient in health has been well established and has highlighted the importance of social conditions and circumstances beyond biological or genetic factors. Among other things, housing quality, access to healthcare and the quality of work have been shown to be associated with various health outcomes (Bambra et al. 2010). Mortality has also been shown to be significantly higher among temporary workers (Kivimäki et al. 2003). Furthermore, work-related stress and job insecurity are associated with worse physical as well as mental health and low income is associated with higher mortality (Ferrie et al. 2002b). Although many of the studies linking socio-economic status and health are not able to establish a causal link, recent studies based on natural

experiments have shown that, for example, income (Frijters, Haisken-DeNew and Shields 2005; Lindahl 2005) as well as education (Silles 2009) may have a causal effect on health.

At the same time, studies have also shown that socio-economic conditions measured at various stages of the life course are associated with health in later life (Blane et al. 1996; Mann, Wadsworth and Colley 1992). Several longitudinal studies have found that health can be a strong predictor for subsequent social mobility, unemployment or working conditions. For example, Power et al. (1996) found that those individuals reporting bad health at the age of 23 were more likely to experience downward social mobility than their counterparts with good health. Using data from the 1958 British birth cohort, Power et al. (1999) found that low socio-economic status measured at ages 16, 23 as well as 33 was a significant predictor of subsequent poor health. Lynch et al. (1994a), using data from Finland, found that men who experienced poor socio-economic circumstances in childhood as well as adulthood were about twice as likely to die during the follow-up than their counterparts who experienced more favourable socio-economic conditions. Bartley and Plewis (2002), using data from the Office for National Statistics' Longitudinal Study, found that for working-age men, each occurrence of disadvantaged social-class membership or unemployment was independently related to the experience of a limiting long-standing illness. In another study, using data from the British Whitehall II study, the authors found that accumulation of disadvantage, measured by childhood circumstances, education as well as occupational position, was associated with poor health (Singh-Manoux et al. 2004).

The concept of cumulative disadvantage is also widely used within sociology and in particular as an explanation for social inequality (DiPrete and Eirich 2006). The central assumption underlying the concept is that an advantage or disadvantage of an individual or a group of individuals over another increases over time (DiPrete and Eirich 2006). An advantage enjoyed by an individual or group, for example in terms of education, health, wealth or cognitive functioning, often plays a major role in the stratification process within a society (DiPrete and Eirich 2006). Small differences between individuals or a group in a key resource at one point in time may accumulate over a period and make it impossible for the disadvantaged group to catch up (DiPrete and Eirich 2006). In

particular, the concept of cumulative disadvantage is often used to explain social inequality between cohorts as well as cohort trajectories (Dannefer 2003).

Taken together, there is sufficient reason to assume that macroeconomic conditions experienced at different stages in an individual's life course will have an effect on their health in later life. Individuals who experience less or more favourable economic conditions during specific life-course periods may be pushed onto a more or less favourable trajectory. Furthermore, experiencing less favourable economic conditions at an earlier age may lead to an accumulation of disadvantage and increased vulnerability to additional experiences of adverse economic conditions such as a recession. One question which is of central interest when analysing the potential long-term effects of economic conditions on health is whether there exist distinct critical periods during which individuals are particularly sensitive or vulnerable to changes in the macroeconomic climate. Critical periods with regard to the exposure to macroeconomic conditions may be major transition-periods in the life course such as the transition from school to work, the formation of a family or the establishment of one's own residency, as well as the transition from work to retirement.

Chapter 2 Literature Review

This chapter reports the results of previous studies that have assessed the relationship between economic fluctuations and health. Although some recent studies have assessed the latter relationship also in low- and middle-income countries, this review of the literature is limited to studies on high-income countries given the very different institutional and demographic conditions. The first section reviews studies that have assessed the short-term effects of economic fluctuations on health at the population level as well as potential mechanisms. The second section reviews studies that have analysed the health effects of unemployment at the individual level. The third section reviews studies that have assessed long-term effects of business cycles on health.

2.1 The short-term effects of economic fluctuations on health

The first series of studies assessing the relationship between economic cycles and health was published by Harvey Brenner in the 1970's (Brenner 1973, 1975, 1979). In his seminal studies, Brenner used aggregate time-series data for the U.S., Sweden and England and Wales to show that infant mortality rates, admissions to mental health hospitals, suicides, homicides and cardiovascular disease all decreased in times of economic expansions and increased during downturns. Brenner hypothesised that this association would be mainly driven by workers at the lower end of the income and skill distribution since they would generally face the highest risk of unemployment and related stress during a downturn. Furthermore, Brenner hypothesised that unemployed lower-skilled workers would also face the greatest difficulty in finding re-employment when the economy recovered (Laporte 2004). Brenner also speculated that the structural change in the economy, which often follows a recession, would lead to long-term unemployment for many workers with little chances to adapt to the restructured labour market (Laporte 2004).

However, Brenner's studies have been widely criticised by several authors showing serious flaws related to the method of analysis, as well as the choice of time periods and

countries (Cook and Zarkin 1986; Forbes and McGregor 1984; Kasl 1979; McAvinchey 1988; Wagstaff 1985). The main criticism centres around two major points (Forbes and McGregor 1984). On the one hand, critics have argued that results obtained from the use of time-series for comparatively long periods of time for a single country are likely subject to an omitted variables bias. For example, as Ruhm argues (2000), significant reductions in unemployment rates at the end of the great depression coincided with improvements in health. However, this correlation is not explained by reductions in the unemployment rate but rather by improvements in nutrition and the spread of new medicines including antibiotics. On the other hand, Brenner's results were found not to be robust to alternative model specifications, choice of countries or periods of analysis.

Although the use of time series from single populations certainly has many limitations, several more recent studies have used similar research designs. However, in contrast to the results of Brenner, their results tend to suggest that expansions in the economy are associated with a worsening in population health. For example, in one study, Tapia Granados (2005b) used historical time series for the U.S. spanning almost the entire 20th century to assess the relationship between annual national fluctuations in a number of macroeconomic indicators and mortality. The study suggests that throughout the entire 20th century, expansions of the economy were associated with increases in mortality for all causes, except for suicide. Another study using data for England and Wales for the years 1840–2000 found a negative relationship between economic growth and increases in life expectancy at birth for males and females (Tapia Granados 2012). The effects were more pronounced in the period 1900 to 1950 than afterwards, whereas the relationship was very weak in the 19th century. Using a similar time series for Sweden, Tapia Granados and Ionides found that economic growth was positively related with health progress in the 19th century, measured by declines in mortality rates and increases in life expectancy, (2008). However, this relationship became weaker over time and reversed in the second half of the 20th century.

To overcome many of the limitations associated with the use of time series for a single population, the majority of recent studies on the short-term health effects of economic fluctuations have used geographically-disaggregated information. This approach was

pioneered by the economist Christopher Ruhm, who in the year 2000 published a controversial paper titled 'Are recessions good for your health?' (2000). In his paper, Ruhm used aggregate data on unemployment and mortality rates from U.S. states for the years 1972 to 1991 to estimate a state-level fixed-effects model. This model used the state-level unemployment rate as a proxy for general economic conditions and exploits within state variation in order to estimate the effect of the latter on mortality, which is used as a proxy for population health. The approach of Ruhm (2000), which uses panel data and a fixed-effects design, has the advantage over simple time-series data, since it is able to control for time-invariant state-specific effects and hence is less prone to the omitted variables bias (Neumayer 2004). Using this research design, Ruhm's study suggests that health improves when the economy worsens. In other words, the results imply that increases in the state unemployment rate are associated with a decrease in mortality. More specifically, the results suggest that a one per cent increase in the state unemployment rate leads to a reduction of overall mortality by around 0.5 to 0.6 per cent. The results also suggest that the so-called pro-cyclical relationship between the business cycle and mortality is most pronounced among those individuals aged between 20-44 years, whereas no significant relationship exists among those aged 45-64 years and only a very weak one among senior individuals. Ruhm argues that the strong association between state unemployment rates and mortality in the 20-44 age-group could be explained by the circumstance whereby this age-group shows the strongest association between the state mean personal income and mortality. The results from Ruhm also show that state unemployment rates are pro-cyclically related, with 8 out of 10 causes of death, deaths from homicides, motor vehicle crashes and other crashes showing the strongest associations. The only exception is suicides, which increase along with the state unemployment rate.

The 2000 paper fro, Ruhm (2000) was followed by a paper by the same author titled 'Good times make you sick' in 2003 (2003). In this study Ruhm used micro data from the National Health Interview Survey (NHIS) for the years 1972–1981 to assess the association between state-level unemployment rates and a number of health outcomes measured at the individual level. Whereas this approach makes it possible to control for

individual characteristics, it is otherwise similar to the earlier study as it also uses state-level fixed effects. The results of this study confirmed those of the author's earlier study (Ruhm 2000) and suggest that a decrease in the state unemployment rate is associated with increases in the likelihood of individuals reporting one or more medical problems, restricted activity days and acute or chronic conditions. This significant pro-cyclical association appears to be the most pronounced among males, employed individuals as well as those at prime working age. Consistent with earlier findings for the U.S., Ruhm (2007) showed additional evidence that increases in unemployment are associated with decreases in mortality rates for cardiovascular disease (CVD). The latter may be a particularly important health indicator as it has been shown to be strongly associated with health behaviours, the general socio-economic position, and the employment situation including job loss, which may be affected by macroeconomic conditions. The results suggest that a one percentage increase in the unemployment rate on average increases the number of deaths from CVD by around 0.75 per cent, which would correspond with about 3,900 annual fatalities in the U.S.

Overall, the studies by Christopher Ruhm have been highly influential and the controversial finding that economic decline may be good for health has created a large debate about the relationship between macroeconomic conditions and health. Moreover, the study design used by Ruhm has been accepted as a quasi-template for a large number of studies, which assess the relationship between economic fluctuations and health. In consequence, the studies by Ruhm were replicated in different countries, notably by Neumayer using data for Germany (2004) and by Tapia Granados using data for Spain (2005a). Neumayer uses data for 16 German states for the years 1980–2000 to assess the relationship between state unemployment rates and the ten most common causes of death (2004). Neumayer's findings confirm those of Ruhm, by showing that for all age groups, as well as for both sexes, overall mortality decreases when the unemployment rate increases. Similar to the findings of Ruhm, this association is particularly pronounced among the 20-44 age group, but also among those aged 65 and above, which contrasts with the Ruhm's findings. What is notable about the study by Neumayer is that he shows

in detail the sensitivity of the results to the control of time-invariant state characteristics, since not including the latter leads to a complete reversal of the results.

Tapia Granados also using a similar design draws on data for (50) Spanish provinces for years 1980-1997 to study the mortality-effects of fluctuations in the unemployment rates (Tapia Granados 2005a). Spain at the time differed substantially from more developed countries such as Germany and the U.S. because of much lower income levels and overall higher unemployment rates and thus represents an interesting alternative setting to test the relationship between economic cycles and health. The results of Tapia Granados for Spain also confirm the earlier findings of Ruhm, by showing that mortality due to all causes except suicide is lower at times when unemployment levels are high. Interestingly, the relationship between unemployment rates and mortality among all Spanish provinces found in this study was far less pronounced than reported by Ruhm for the U.S., whereas the size of the effect was similar for the most developed provinces.

A number of studies have also incorporated data from several countries. For example, using aggregate data for 23 member-countries of the Organisation of Economic Cooperation and Development (OECD) for the years 1960–1997, Gerdtham and Ruhm (2006) found that the number of deaths generally increases when the economy expands and that the association is weakest among countries with comparatively low social expenditures. Using data from the World Health Organization (WHO) for eleven European countries for the years 1971–2001, Bender et al. (2012) found that, with the exception of suicide, mortality from all major causes of death increases along with national unemployment. Furthermore, a study using data for nineteen developed countries from the Human Mortality Database (HMD) for the years 1950–2008 also found that most countries show a pattern of pro-cyclical mortality among older individuals (Rolden et al. 2014).

Several recent studies suggest that especially in recent years, the strength of the pro-cyclical mortality has weakened or even ceased to exist. For example, in a study using micro-data for Sweden, Gerdtham and Johannesson (2005) found a counter-cyclical relationship between the business cycle and mortality among men, whereas no significant

relationship existed for women. Using data for the U.S. from the Medicare Current Beneficiary Survey, McInerney and Mellor (2012) found that during the years 1994 to 2008 mortality for older individuals (aged 65 and above) was counter-cyclical during most of the period. Whereas recent studies have highlighted that older individuals account for the large part of pro-cyclical mortality (Miller et al. 2009; Stevens et al. 2011), Stevens et al. (2011) showed that incorporating more recent data in the original sample of Ruhm (2000) reduces the size of the effect of state unemployment rates on mortality by around a half. Ruhm himself recently published a working paper titled 'Recession, Healthy No More?' in which he re-analysed his original study but incorporates data for the more recent period, namely until 2010 (Ruhm 2013). Incorporating the more recent years into the earlier study, which used data for the period 1972-1991, thereby suggests that "[...] mortality has shifted from being strongly pro-cyclical at the beginning of the analysis period to being only weakly related or unrelated to macroeconomic conditions at the end of it" (Ruhm 2013: 3). Ruhm argues that one of the main reasons for this shift would be the circumstance whereby cancer and external causes of death have become strongly counter-cyclical over time. He furthermore speculates that the reason for the emergence of counter-cyclical cancer mortality may be due to the "[…] increasing importance of financial resources used to purchase sophisticated (and expensive) treatments that have become available in recent years […]" (Ruhm 2013: 4).

A series of studies from both the U.S. as well as Europe have assessed the effects of the most recent recession on health. For example, in the United Kingdom, higher regional unemployment rates have been shown to be associated with higher risks of reporting bad self-rated health (Astell-Burt and Feng 2013). Using repeated cross-sectional data for Greece, Zavras et al. (2013) found that the number of people reporting bad self-rated health has increased since the onset of the recession, a finding previously also reported by Kentikelenis et al. (2011). Whereas comparisons of trends within a single population may be problematic, Vandoros et al. (2013) showed that the increase in the number of people reporting bad self-rated health in Greece is significant also when using a control population who did not experience a recession. Barr et al. (2012) used regional data for the United Kingdom to analyse the association between unemployment rates and the

number of suicides during the years 2000 to 2010. Their findings suggest that among men, a 10 per cent increase in the number of unemployed individuals was associated with a 1.4 per cent increase in the number of suicides. Using similar analytical approaches, higher unemployment rates have also been linked to excess suicides in Spain (Bernal et al. 2013), Greece (Economou et al. 2013), Italy (De Vogli, Marmot and Stuckler 2013), the U.S. (Reeves et al. 2012) as well as a panel of 54 countries worldwide (Chang et al. 2013).

2.1.1 Potential mechanisms linking the business cycle and health in the short-term

One of the most prominent mechanisms discussed in the literature is the so-called stress mechanism. Researchers who have found a declining economy to be associated with worsening of health-status (i.e. counter-cyclical) have argued that this may be caused by the experience of adverse events such as job loss or adverse financial events. Furthermore, such adverse events may increase the risk of experiencing additional adverse events not directly related to the economy such as marital difficulties or divorce (Catalano et al. 2010; Vinokur, Price and Caplan 1996). The potential deleterious effects of a declining economy on health may not only exist for those individuals directly affected by adverse events but also for those workers retaining their job who experience increased job insecurity (Ferrie et al. 2002a; Lee et al. 2004; Manski and Straub 2000).

In contrast to this line of reasoning, researchers who have found evidence for a pro-cyclical relationship, have generally argued that work itself would be a major stressor of everyday life (Catalano et al. 2010). Hence, a reduction in the hours worked as a result of a declining economy may decrease the risks of experiencing a stress-related illness (Catalano et al. 2010). Given that many studies have found job stress to be associated especially with CVD (Black and Garbutt 2002; Fenwick and Tausig 1994; Kivimäki et al. 2002), one of the major causes of death, the stress mechanisms maintain a prominent place in the literature. Related to the stress mechanism is the argument that work accidents may increase in an economic upturn, especially in sectors such as construction and manufacturing, which are strongly tied to the business cycle (Brooker, Frank and Tarasuk 1997; Catalano 1979).

Another mechanism (frustration-aggression) often referred to in the literature is based on the observation that "[…] individuals who are denied an expected reward may experience psychosomatic antecedents of aggression" (Catalano et al. 2010: 432), which may lead to antisocial behaviour or drug abuse. An economic downturn may lead to an increase in the number of people who are suffering from unfair losses or are denied a reward, which then may lead to violent behaviour or substance abuse (Catalano et al. 2010). On the other hand, as the pro-cyclical literature argues, the principal aim of workers in fear of losing their job would be to keep their job. As a result, the affected workers would try to prevent being laid-off, for example by avoiding antisocial behaviour, excessive substance use or alcohol consumption (inhibition effect) (Catalano et al. 2010: 431).

A third mechanism (effect budgeting) is based on the assumption that individuals have a limited amount of time and resources available to manage their everyday lives. Hence, these resources are budgeted in a way which best reflects the associated costs and benefits (Catalano et al. 2010). On the one hand, a declining economy may not only reduce the disposable income available for a number of health-related activities such as exercise, healthy food or socially supportive behaviours but also the time available, since the latter may have to be spent coping with the loss of income or job. As a result, an individual which attributes a relatively low level of importance to healthy behaviours such as exercise, healthy nutrition, or regular use of medical check-ups will reduce the investment in time and money into the latter and by doing so ultimately worsen their health. On the other hand, individuals who do not attribute high importance to goods with potentially detrimental health effects such as alcohol or cigarettes for example – the pro-cyclical argument goes – should tend to reduce their consumption of these goods when their incomes are reduced. At the same time, reductions in the time worked, as a result of a declining economy, may make more time available for health-seeking behaviour such as medical check-ups, leisure activities, looking after children or cooking healthy foods (Ruhm 2000).

Ruhm (1995) was among the first to show that in the U.S., alcohol consumption was pro-cyclical, implying that it increased during economic expansions and declined during recessions. This finding was later confirmed by Freeman (1999), Ruhm and Black (2002)

and Ettner (1997). However, results from Dee (2001) using data from the U.S. for the years 1984 to 1995 suggest that binge drinking was counter-cyclical during this period, including among those remaining employed in times of high unemployment. Charles and Decissa (2008) did not report any significant relationship between macroeconomic conditions and alcohol consumption using data from the National Health Interview Survey (NHIS) for the years 1997 to 2001. Regarding cigarette consumption, among the few existing studies Ruhm found that the latter was also pro-cyclically related, but that most of the effect existed among heavy smokers (Ruhm 2000, 2005). Also Charles and Decissa (2008) and Xu (2013) found that cigarette consumption was pro-cyclical. With regard to the effects of the business cycle on physical activities Ruhm (Ruhm 2000, 2005), as well as Dustman and Windmeijer (2000) found that the latter was counter-cyclical, whereas Charles and Decissa (2008) found no evidence for a significant relationship between either moderate or vigorous physical activities and the state of the economy. Using very detailed individual-level data from the U.S. Time Use Survey covering the years 2003–2010, Colman and Dave (2013) found that during a recessions time spent on recreational exercise, television watching, sleeping, childcare as well as housework increases. Interestingly, the study showed that the overall increase in non-work physical activities during a recession does not compensate for the decrease in work-related physical activities as a result of job loss or reduced hours spent at work. The evidence on the effects of the business cycle on food consumption is very limited. In one study, Dave and Kelly (2012) found that in the U.S., higher unemployment rates are associated with reductions in the amount of fruit and vegetables consumed. Also, the study suggested that during recessions, individuals were more likely to substitute healthier foods with more snacks and fast food.

Several studies have analysed the relationship between business cycles and the use of medical services. Ruhm (2000) found that a higher unemployment rate has a negative effect on the probabilities of undergoing routine medical examinations as well as mammograms, although the effect on the latter was insignificant. Furthermore, Ruhm (2003) also found that higher unemployment has a negative effect on visits to physicians. Lusardi et al. (2010) found that during the most recent economic crisis in the U.S.,

households showed a decline in the use of routine non-emergency medical care. Among older Americans, McInerney and Mellor (2012) found that higher unemployment rates were associated with an increase in the use of in-patient medical services, which, as the authors speculate, may be a result of an increased willingness of physicians to accept Medicare patients.

Stevens et al. (2011) argue that the pro-cyclical relationship between the business cycle and mortality among older individuals is mostly driven by deaths occurring in nursing homes. The pro-cyclical relationship is particularly strong in U.S. states with a relatively high share of older individuals residing in nursing homes. The authors also shows that staffing in nursing homes is counter-cyclical, implying that in times of higher unemployment nursing homes are able to attract better qualified personnel. These findings imply that the so-called pro-cyclical mortality could be driven largely by fluctuations in the quality of available health and social care (Stevens et al. 2011).

2.2 Effects of unemployment on health

A large number of studies have assessed the association between unemployment or job loss and the onset of depression, suicide, cardiovascular disease or low self-esteem. Despite the significant number of existing studies addressing the issue, to what extent unemployment causes poor health is still debated.

One the one hand, researchers argue that the existing association between unemployment and poor health could be spurious (Roelfs et al. 2011), mainly because unemployment itself is often caused by poor health or health behaviours (latent sickness hypothesis) (Jusot et al. 2008). Many studies have shown that individuals with poor health-status or pre-existing medical conditions are generally more likely to lose their jobs (Bartley and Owen 1996; Böckerman and Ilmakunnas 2009; Roelfs et al. 2011). At the same time, studies have also shown that individuals who consume comparatively higher amounts of alcohol, drugs or cigarettes are more likely to become unemployed (Fergusson and Boden 2008; Hammer 1992; Hoffmann, Dufur and Huang 2007; Leino-Arjas et al. 1999; Roelfs et al. 2011). Furthermore, several studies have shown that unemployment can result in

healthier behaviours such as reductions in smoking and drinking (Fagan et al. 2007) as well as higher levels of physical activity (Matoba, Ishitake and Noguchi 2003). However, other studies have found no significant association between unemployment and health behaviours (Gallo et al. 2001b; Hoffmann et al. 2007; Peretti-Watel and Constance 2009).

On the other hand, scholars argue that the association between unemployment and poor health would be causal with health behaviours representing an important mediator (coping hypothesis) (Roelfs et al. 2011). According to this line of reasoning, unemployment may cause people to behave in less healthy ways (Hammarström and Janlert 1994), something which has been found in numerous studies. For example, unemployment has been found to be associated with increases in alcohol consumption and binge drinking (Claussen 1999) especially among men (Hammarström and Janlert 2003; Mossakowski 2008) and lower educated individuals (Broman et al. 1995). Recently unemployed individuals have also been found to increase their levels of tobacco consumption (Barnes and Smith 2009; Bolton and Rodriguez 2009; Falba et al. 2005; Reine, Novo and Hammarström 2004) and are less likely to stop smoking (Weden, Astone and Bishai 2006).

A number of cross-sectional (Brackbill, Siegel and Ackermann 1995; Cook et al. 1982; Iversen et al. 1987) as well as longitudinal studies (Janlert 1992; Kasl and Cobb 1980; McLeod et al. 2012) have found unemployment to be related to poor health. However, the problem with the majority of studies is that, even when controlling for an extensive number of pre-unemployment characteristics, the results of many studies may be subject to reverse causality and hence overstate the causal effect of unemployment on health.

One way to address this issue in the literature is based on identifying individuals who lost their job involuntarily because of a plant closure. The assumption underlying this approach is that the individual did not cause the business to close so that the job loss is largely exogenous. Using job loss as a result of plant-closure as the exposure of interest, Ruhm (1991) as well as Jacobson et al. (1993) found that those who lost their jobs suffered from long-term earning losses. Sullivan and von Wachter (2009) published an influential study on the long-term effects of job loss on mortality among male workers who lost their job during an episode of mass unemployment in Pennsylvania in the 1970s

and 1980s. For this purpose, they linked individual-level data on earnings as well as employment histories to death records from the Social Security Administration (SSA). Their results showed that male workers who were working with the same company for a comparatively long time and who lost their job suffered from a significant increase in subsequent mortality rates. In the years immediately after the displacement, the mortality hazard increased by 50 to 100 per cent, but then dropped to 10 to 15 per cent over time. Over a follow-up of 25 years, this would equal in a shortening of life expectancy of around 1 to 1.5 years. No significant effect of job loss on mortality was found for workers who were near the retirement age. Schröder (2013) used information on self-reported job loss from eleven European countries and found that the displaced men are more likely to suffer from depression and memory loss compared to those workers who retained their jobs years after the displacement. Thereby, displaced women experienced increased risks of poor self-rated health status as well as chronic conditions. Strully (2009), using data from the U.S. Panel Study of Income Dynamics (PSID) found significant adverse health-effects of involuntary job loss, which did not differ between white- or blue-collar workers.

Another study used administrative data from Denmark for the years 1980 to 2006 to study the effects of unemployment on hospitalisation and cause-specific mortality (Browning and Heinesen 2012). Their findings, which are based on propensity score-matching in combination with a duration analysis, show that becoming unemployed increased the mortality-risks for circulatory disease as well as suicide and attempted suicides. At the same time, job loss also increased the likelihood of being hospitalised due to traffic accidents, mental illness as well as alcohol-related disease. Using Swedish register data, Eliason and Storrie (2009a) found that the mortality-risk for men increased by around 40 per cent in the first four years after losing their job. For women there was no significant effect, whereas for both sexes mortality from suicides as well as alcohol increased in the short-term. In contrast, Lundin et al. (2010) using administrative data from Sweden, only found unemployment to increase the short-term (4 years) risk of mortality, but this was not the case afterwards. Using register data for Finland, Martikainen et al. (2007) found that in times of higher unemployment individual unemployment has only a very small

effect, which, as the authors argue, may indicate that most individual-level studies overestimate the causal effect of unemployment on health.

2.3 Long-term effects of economic fluctuations on health

To date, only a handful of studies have analysed potential long-run effects of macroeconomic conditions on health. The first series of studies that have partly filled this gap have been published by Gerard van den Berg et al. (van den Berg et al. 2011; van den Berg et al. 2009; van den Berg et al. 2006). In all of these studies the authors focus on macroeconomic conditions around the time of birth, building on previous research which has documented that poor socio-economic conditions during early childhood are related with adverse health outcomes in later life (Case, Fertig and Paxson 2005). In particular, the supply of sufficient nutrition and good living conditions to pregnant women, including access to sanitary facilities or hot water, may be negatively affected by an unfavourable economic climate. In their first paper, van den Berg et al. (2006) used historical data from the Netherlands, which included individual birth-records from years between 1812 to 1912, with a mortality follow-up until the year 2000. These records were then merged with historical information on annual gross national product (GNP) per capita as an indicator of macroeconomic conditions around the time of birth. Since the GNP has been steadily increasing over the respective time period, it would be problematic to use the level of GNP as an indicator, as the latter would be highly correlated with time and secular trends in the investment in healthcare or patterns of diseases. Hence, in order to distinguish good economic times from bad economic times, the authors de-trend the time-series of GNP using the Hodrick-Prescott filter (HP) (Hodrick and Prescott 1997). Based on the de-trended time-series, the authors then distinguish between those years in which the increase in GNP fell in the highest quartile and the quarter of years in which GNP increased the least. The years with the highest increase were then considered as a boom and those years showing the smallest increase or highest decrease were considered a recession. Based on this analysis, the authors found that those individuals who were born in a recession lived several years less than those born in a boom. These findings have been confirmed using data about births in Denmark (van den Berg et al. 2011; van den Berg et al. 2009) as well as the Netherlands (Portrait, Alessie and Deeg 2010). Another

recent study using retrospective data from SHARE found that individuals who experienced a recession around the time of birth were more likely to report bad self-reported health as well as a number of other adverse health conditions during childhood (Angelini and Mierau 2014).

One study assessed the effects of graduating in a recession on health using data from the U.S. (Maclean 2013). The rationale for this study comes from a number of earlier studies, which have shown that graduating in a recession can have significant and long-lasting negative effects on a range of career-related outcomes such as incomes and employment prospects (Genda, Kondo and Ohta 2010; Kahn 2010; Oreopoulos et al. 2012; Raaum and Røed 2006). Maclean (2013) used individual-level data from the U.S. National Longitudinal Survey of Youth 1979 Cohort (NLSY79) with state unemployment rates matched to the school-leaving year of each respondent to compare various health outcomes measured at age 40, depending on the state unemployment rate in the year of graduation. The results suggest that men who left school in times of higher unemployment had worse health in terms of self-rated health and physical functioning as well as mental health at age 40 than their peers who graduated in more favourable economic times. Furthermore, women who graduated in times of comparatively higher unemployment had fewer depressive symptoms than their counterparts who left school in times of lower unemployment.

Another recent study extends the research of Ruhm (2000) by explicitly asking the question 'How Long Are Recessions Good For Your Health?' (Coile, Levine and McKnight, 2014). To answer this question, the authors use aggregate data for U.S. states to assess the effects of changes in the local labour market conditions in the years prior to retirement (ages 55 to 64) on cohorts' subsequent survival probabilities. Whereas the results also show short-term reductions in mortality as the economy expands, their study suggests that those cohorts who experience higher local unemployment rates at the ages 58-60 have lower survival probabilities than at age 62 and above compared to otherwise similar cohorts. Using individual-level data from the Current Population Survey (CPS), the authors moreover show that increases in the state unemployment rate also reduce the chances of being in employment, having healthcare insurance as well as for using medical

services. This study complements earlier work by the same authors, which showed that increases in the state unemployment rate experienced at age 62 or later led to a significant increase in the likelihood of withdrawing from the labour force and receiving a Social Security Income (SSI) (Coile and Levine 2011b).

Although at first glance these results seem to contradict those by Christopher Ruhm and other authors showing a pro-cyclical relationship, Coile et al. (2014) argue that their results should not be interpreted as directly contradicting earlier findings. As discussed earlier, Ruhm and other authors who have analysed the short-term effects of business cycles on health have argued that changes in the latter are not mainly the result of changes in one's own labour force status but rather due to general external factors. According to Coile et al. (2014), their results of negative long-run effects of higher unemployment rates should be interpreted as consequences of experiences of actual adverse events such as job loss, losses of healthcare insurance or reductions in SSI wealth.

So far, only two studies have analysed potential long-run effects of macroeconomic conditions on cognition. In one study by Doblhammer et al. (2011). the authors use data from SHARE for eleven countries to assess the relationship between economic conditions around birth on cognitive performance at ages 50 and above. Similar to the study by van den Berg et al. (2006), the authors also de-trend the time-series of GDP for each country and code those years as a recession which falls in the lowest country-specific quartile. Those years falling in the highest country-specific quartile, implying an increase in GDP, are considered a boom with those years falling in the second or third quartile on average. Taken together, their findings suggest that those individuals who were born in a recession perform significantly worse in terms of a number of cognitive domains compared to those born in a boom. The negative effects of being born during a recession are particularly strong for less educated individuals, whereas it appears that those individuals born in a boom do notably better in the tests of numeracy as well as verbal fluency. Although the authors do not empirically assess potential mechanisms, they argue that the link between early-life economic conditions and later-life cognition likely operates through similar mechanisms than mortality, including malnutrition, psychological stress at home and

reduced access to healthcare. These mechanisms may in consequence affect future educational as well as employment chances.

Being born during a recession may not only have direct effects on cognition but also lead to an increased vulnerability to additional adverse events experienced later in life. Using data from the Longitudinal Aging Study Amsterdam (LASA) van den Berg et al. (2010) show that those individuals who were born in a recession are worse affected by a stroke in later life than their counterparts born in more favourable economic times. Those individuals born in a recession also suffer more from surgery and illness as well as the death of a family member whereas the authors found no significant interaction between the economic conditions around birth and the experience of financial shocks in later life.

Chapter 3 Data

This section provides a detailed overview of the data sources used in the empirical papers included in this thesis. As mentioned in the introduction, the empirical analyses are based on a linkage of individual-level survey data with historical time series on macroeconomic conditions. Three of the empirical papers use data from the Survey of Health, Ageing and Retirement in Europe (SHARE), merged with information on gross domestic product (GDP) as well as unemployment rates. The final paper uses data from the U.S. Health and Retirement Survey (HRS), merged with information on state unemployment rates derived from the Current Population Survey (CPS).

3.1 Survey of Health, Ageing and Retirement in Europe (SHARE)

Partially in response to the strong interest of policymakers in obtaining detailed information about the living conditions of older Europeans, the Survey of Health, Ageing and Retirement in Europe (SHARE) was created to provide a multidisciplinary research infrastructure and by now has its own legal status as part of the European Research Infrastructure Consortium (ERIC) (Börsch-Supan et al., 2013). SHARE is modelled closely after its sister study, the U.S. Health and Retirement Study (HRS), and is part of a family of harmonised ageing surveys which include the English Longitudinal Study of Ageing (ELSA), the Korean Longitudinal Study of Aging (KLoSA), the Japanese Study on Aging and Retirement (JSTAR), the Chinese Health and Retirement Longitudinal Study (CHARLS), and the Longitudinal Aging Study in India (LASI), The Irish Longitudinal Study on Ageing (TILDA), the Mexican Health and Aging Study (MHAS) as well as the World Health Organization Study on Global Ageing and Adult Health (SAGE).

What sets SHARE apart from its sister studies, is its cross-national design with an ex-ante harmonisation of questionnaires, sampling designs and a common research infrastructure. This makes it the first available dataset containing comparable information on various

dimensions of the ageing process of the population aged 50 and above in various European countries. So far, SHARE consists of three panel waves collected in 2004/05, 2006/07 and 2010/11 as well as a life-event history interview carried out in 2008/09 (SHARELIFE). More than 150,000 interviews with around 86,000 individuals aged 50 and above have been conducted in eighteen European countries (Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Sweden, Slovenia, Spain and Switzerland) and Israel (Börsch-Supan et al., 2013).

The SHARE questionnaire includes information on health (e.g. self-reported health, physical functioning, cognitive functioning, physical measures such as grip strength and walking speed, health behaviours, use of health care facilities), psychological wellbeing (e.g. psychological health, wellbeing, life satisfaction, beliefs about control), socio-economic conditions (e.g. job characteristics, job flexibility, current work activity, employment histories, pensions, incomes, wealth, consumption, housing, education), and social support (e.g. assistance within families, transfers of income and assets, social networks, volunteer activities) (Börsch-Supan et al. 2013).

The target population of SHARE consists of cohorts who were born before the year 1954 at the time of the baseline (Wave 1) interview in 2004/05, before 1956 in 2006/07 (Wave 2) and before the year 1960 in 2010/11 (Wave 4). Furthermore, to be eligible for the sample, individuals had to be living in private households and not permanently living outside the country, or have moved to an unknown address, and had to be able to speak the county's language. Current partners who lived in the same household were interviewed irrespective of their age. In some European countries, existing population registers make it possible to draw an age-stratified sample. However, such population registers do not exist in all countries or were not accessible. In consequence, the sampling frame varies by countries, as shown in Table 1.

Table 1: Examples of sampling frame by country

Sampling design	Country
(Stratified) simple random sampling from national population registers	Denmark, Sweden
Multi-stage sampling using regional/local population registers	Germany, Italy, Spain, The Netherlands
Single or multi-stage sampling using telephone directories followed by screening in the field	Austria, Greece, Switzerland

Adapted from (Börsch-Supan and Jürges 2005)

The baseline data collection was carried out in 2004/05 in 11 countries (Table 2). The sample collection at baseline contains information about 28,517 individuals from around 15,000 households. Additional data was collected in 2005 in Belgium and in 2006 in Israel. As a result, the countries included in SHARE represent different geographical areas as well as welfare states within Europe including Scandinavia (Denmark, Sweden), Western and Central Europe (Austria, Germany, France, Belgium, The Netherlands, Switzerland), and the Mediterranean (Greece, Italy and Spain) and Israel.

Table 2: Overview of wave 1 (2004/05) samples by country, sex and age

Country	Total	Male	Female	Under 50	50 to 64	65 to 74	75+	Household Response Rate	Individual Response Rate
Austria	1,893	783	1,110	44	949	544	356	55.60%	87.50%
Belgium	3,827	1,741	2,086	128	1,947	992	760	39.20%	90.50%
Denmark	1,707	771	936	92	916	369	330	63.20%	93.00%
France	3,193	1,384	1,809	141	1,627	768	657	81.00%	93.30%
Germany	3,008	1,380	1,628	65	1,569	887	486	63.40%	86.20%
Greece	2,898	1,244	1,654	218	1,450	714	516	63.10%	91.80%
Italy	2,559	1,132	1,427	51	1,342	785	381	54.50%	79.70%
Netherlands	2,979	1,367	1,612	102	1,693	715	462	61.60%	87.80%
Spain	2,396	996	1,400	42	1,079	701	574	53.00%	73.70%
Sweden	3,053	1,412	1,641	56	1,589	816	592	46.90%	84.60%
Switzerland	1,004	462	542	42	505	252	204	38.80%	86.90%
Total	28,517	12,672	15,845	981	14,666	7543	5,318	56.39%	86.82%

Note: Only countries included in the subsequent analysis are shown.

Adapted from: (Börsch-Supan et al. 2013)

The second wave of data collection was collected in 2006 and 2007 with three new countries joining. In addition, refreshment samples were included to increase the sample size and compensate for attrition (Table 3) due to migration, death or a refusal to participate. Of the participants who were interviewed in Wave 1, around 68 per cent also participated in Wave 2. Greece had the lowest attrition rate of around 13 per cent and Germany the highest with 41 per cent.

Table 3: Overview of wave 2 (2006/07) samples by country, sex and age

Country	Total	Male	Female	Under 50	50 to 64	65 to 74	75+
Austria	1,341	546	795	19	544	476	302
Belgium	3,169	1,435	1,734	84	1,615	773	697
Denmark	2,616	1,176	1,440	83	1,409	618	506
France	2,968	1,273	1,695	117	1,518	718	615
Germany	2,568	1,184	1,384	41	1,245	833	449
Greece	3,243	1,398	1,845	162	1,624	820	636
Italy	2,983	1,345	1,638	56	1,365	971	591
Netherlands	2,661	1,212	1,449	46	1,478	681	456
Spain	2,228	1,003	1,225	46	958	651	573
Sweden	2,745	1,267	1,478	38	1,294	808	605
Switzerland	1,462	645	817	37	770	356	299
Total	27,984	12,484	15,500	729	13,820	7,705	5,729

Note: Only countries included in the subsequent analysis are shown.

Adapted from: (Börsch-Supan et al. 2013)

The third wave of SHARE focused on individual life histories and is also-called SHARELIFE. Using the so-called life calendar method, respondents were asked detailed questions about their past labour market trajectories, childhood circumstances, health, family circumstances and other major life-domains. The life calendar method is based on the observation that specific significant life-course events, such as the completion of full-time education, marriage, or childbirth can be used as an anchor to date other events that are less significant (Mazzonna and Havari 2011). The total sample size of the third wave is around 22,000 individuals (Table 4).

Table 4: Breakdown of wave 3 (SHARELIFE, 2008/09) samples by country, sex and age

Country	Total	Male	Female	Under 50	50 to 64	65 to 74	75+
Austria	847	343	504	14	300	325	208
Belgium	2,832	1,267	1,565	45	1,280	758	747
Denmark	2,141	958	1,183	44	1,090	556	451
France	2,483	1,078	1,404	42	1,151	643	647
Germany	1,852	864	988	22	793	682	355
Greece	2,951	1,275	1,676	84	1,414	787	666
Italy	2,492	1,129	1,363	28	1,030	878	556
Netherlands	2,210	1,007	1,203	22	1,090	673	425
Poland	1,918	852	1,066	22	1,076	467	353
Spain	2,048	904	1,144	32	828	593	595
Sweden	1,893	848	1,045	9	731	679	474
Switzerland	1,296	559	737	33	611	359	293
Total	22,471	9,955	12,515	369	10,364	6,522	5,770

Note: Only countries included in the subsequent analysis are shown.

Adopted from: (Börsch-Supan et al. 2013)

Whereas in any survey the accuracy of self-reported information is an issue, the latter may be particularly the case regarding retrospective questions about events or circumstances dating back several decades. Several existing studies have evaluated the accuracy of retrospective information collected from surveys. For example, Smith (2009) compared self-reported prevalence of diseases during childhood from HRS and the Panel Study of Income Dynamics (PSID) with prevalence rates from nationally-representative surveys carried out in the respective years and found a high level of agreement. Also, Elo (1998) found that self-reported information about childhood-health from HRS was highly consistent with information on health-related absence from school. Havari and Mazzona (2011) have compared the information on childhood-health and socio-economic

circumstances from SHARELIFE with historical statistics and, except for self-rated health, found that the information provided by the respondents generally has a high level of external consistency.

3.2 Health and Retirement Study (HRS)

HRS is a survey with the purpose of providing information on health and socio-economic conditions of older individuals living in the U.S. The study is supported by the National Institute on Aging (NIA), which is part of the National Institutes of Health (NIH), as well as the Social Security Administration. HRS is managed mainly by the Survey Research Center of the University of Michigan. Although the data collection for HRS only started in the year 1992, its origins date back to the mid-1980s. At that time, the NIA/NIH and its advisory body realised that the ageing of the baby boom-cohorts, as well as the drop in fertility would present a major challenge for the American society (Willis 2006). At the same time, the NIA/NIH also recognised that the available datasets, including the existing Retirement History Study (RHS), which was carried out between 1969 and 1979, were not sufficient to present a sound scientific base for the design of policies.

Up to date, more than 27,000 individuals have been interviewed as part of HRS. Originally, HRS was created to follow older individuals and their partners during their transition between working-life and retirement (University of Michigan 2008a). The data collection for HRS started in 1992, data for a second and third wave being collected in 1994 and 1996. A parallel study, the Asset and Health Dynamics among the Oldest Old (AHEAD) study, was designed to collect information on the interaction between family, health and economic characteristics in the years following retirement. Both studies were merged in 1998 and additional cohorts were added. Before the merging of the two studies in 1998, the target population of HRS were those cohorts born between 1931 and 1941. The target population for AHEAD were those individuals born in the year 1923 or earlier (University of Michigan 2008c). For the baseline data collection of HRS in 1992, around 15,000 individuals were eligible and around 12,500 individuals in 7,700 households were interviewed. This corresponds to an overall response rate of 81.6% (University of

Michigan 2008c). The initial AHEAD sample thereby contained about 8,000 individuals from 6,000 households and also achieved an overall response rate of slightly more than 80%.

In order to be representative for the U.S. population aged 50 and above, subsequent cohorts were added to the HRS/AHEAD sample. As such, the War Baby (WB) cohort contains individuals born in the years 1942 to 1947. The Children of the Depression Age (CODA) cohort contains individuals born between 1924 and 1930. For both the WB, as well as the CODA cohort, the overall response rate was above 70% (University of Michigan 2008c). In 2004 another cohort, called Early Baby Boomer (EBB), was added and contained individuals born between 1948 and 1953. The EBB cohort contains around 3,000 individuals from approximately two thousand households.

Table 5: Number of individuals interviewed by birth cohort and year in HRS

Year of Data Collection									
Birth Cohorts	**1992**	**1993/94**	**1995/96**	**1998**	**2000**	**2002**	**2004**	**2006**	**2008**
1890-1923	213	7,573	6,415	5,357	4,454	3,561	2,862	2,235	1,715
1924-30	1,020	1,611	1,514	3,752	3,435	3,165	2,886	2,628	2,347
1931-41	9,817	8,917	8,537	8,240	7,777	7,530	7,229	6,859	6,545
1942-47	1,195	1,144	1,123	3,101	2,948	2,910	2,816	2,715	2,654
1948-53	295	285	280	675	677	682	3,370	3,108	3,022
1954+	111	111	122	259	286	317	966	924	934
Unknown	1	1	0	0	1	1	0	0	0
Total	12,652	19,642	17,991	21,384	19,578	18,166	20,129	18,469	17,217

Source: Adopted from (University of Michigan 2008c)

The HRS sample is based on a multi-stage area probability sample with four selection stages. The first stage of the selection process involves a selection of U.S. Metropolitan Statistical Areas and the second stage a selection of area segments (SSU) within primary stage units (PSU) included in the sample (University of Michigan 2008b). The next (third) stage entails a complete enumeration of all housing units located within a SSU and the final (fourth) stage of sample selection consists of the selection of individuals within each housing unit who are age-eligible. In addition to the core sample, HRS also contains oversamples. The oversamples are designed to increase the number of Black and Hispanic individuals as well as individuals living in the state of Florida (University of Michigan 2008b).

HRS uses a mix of face-to-face interviews as well as telephone and mail surveys for the data collection. Baseline surveys are usually conducted face-to-face (Sonnega et al. 2014). Before the year 2004 follow-up interviews were usually conducted by telephone, except for individuals older than 80 years, which were interviewed face-to-face. Since 2006, half of the sample is followed-up by face-to-face interviews whereas the other half is interviewed usually by telephone. As a result, since 2006, most respondents will conduct a face-to-face interview every four years. In addition to the core interviews, HRS occasionally also uses mail or internet surveys (Sonnega et al. 2014).

Table 6: Overview of HRS sample and response rates

	Wave								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Health and Retirement Study (HRS)									
No. of cases	15,497	12,777	12,622	12,202	11,762	11,230	10,835	10,026	9,587
No. of respondents	12,652	11,420	10,964	10,584	10,044	9,724	9,362	8,879	8,493
Response rate	81.6%	89.4%	86.9%	86.7%	85.4%	86.6%	86.4%	88.6%	88.6%
Year	1992	1994	1996	1998	2000	2002	2004	2006	2008
Asset and Health Dynamics among the Oldest Old (AHEAD)									
No. of cases	10,229	7,554	6,512	5,526	4,559	3,766	2,979	2,362	2,362
No. of respondents	8,222	7,027	5,951	5,000	4,107	3,365	2,700	2,142	
Response rate	80.4%	93.0%	91.4%	90.5%	90.1%	89.4%	90.6%	90.7%	
Year	1993	1995	1998	2000	2002	2004	2006	2008	
Children of the Depression Age (CODA)									
No. of cases	3,200	2,300	2,140	1,973	1,770	1,608			
No. of respondents	2,320	2,124	1,951	1,777	1,618	1,454			
Response rate	72.5%	92.3%	91.2%	90.1%	91.4%	90.4%			
Year	1998	2000	2002	2004	2006	2008			
War Babies (WB)									
No. of cases	3,619	2,652	2,630	2,612	2,539	2,488			
No. of respondents	2,529	2,410	2,384	2,295	2,237	2,165			
Response rate	69.9%	90.9%	90.6%	87.9%	88.1%	87.0%			
Year	1998	2000	2002	2004	2006	2008			
Early Baby Boomer (EBB)									
No. of cases	4,420	3,461	3,433						
No. of respondents	3,330	3,035	2,963						
Response rate	75.3%	87.7%	86.3%						
Year	2004	2006	2008						

Source: Adopted from (University of Michigan 2008c)

The questionnaire of HRS thereby covers a wide range of topics such as household demographics (e.g. living arrangements, birthplace, education, marital history, residence and religion), physical health (e.g. hearing, fractures, depression, stroke, self-rated health, medical conditions, daily activities, height and weight), family structure (children, grandchildren, household members, transfers, children demographics and grandchildren assistance), housing (e.g. home facilities, mortgage, second home, taxes, type of residence, loans, home ownership and value of homes), cognition (e.g. self-rated memory and word recall), employment (e.g. main job characteristics, self-employment, former employment, job requirements and early retirement), assets and income (expenses, social security, stocks, assets, pensions, real estate and social security benefits) as well as health services and insurance (e.g. health providers, drugs, financial assistance, health insurance, long-term care insurance and Medicaid).

A major analytical strength of HRS is its longitudinal design, making it possible to follow individuals over many years of their life. With the latest wave, collected in 2012, it is possible to analyse life-course trajectories over a period of up to twenty years. The comparatively long time period covered by HRS makes it possible to assess the consequences of unexpected macroeconomic or political events (Willis 2006). The design of HRS also makes it possible to study specific policies by including supplementary questions. For example, in 2005, HRS carried out a supplementary mail survey asking participants about their use of prescription drugs as well as their knowledge of the Medicare part D programme which was scheduled to be implemented at the beginning of 2006 (Willis 2006). Another feature of HRS is that the survey data have been linked to Social Security Administrative data sets, Medicare records as well as the National Death Index.

3.3 Data on macroeconomic conditions

As mentioned in the previous chapters, existing studies assessing the relationship between macroeconomic fluctuations and health have typically used information on GDP or

unemployment rates as the main exposure. The following chapters provide an overview about the sources of macro-economic indicators used in the subsequent papers.

3.3.1 Unemployment rates for European countries from the Organisation for Economic Cooperation and Development Annual Labour Force Statistics

The first paper of this thesis ('Are Economic Recessions at the Time of Leaving School Associated with Worse Physical Functioning in Later Life?') uses national unemployment rates for different Western European countries as the main independent variable. As described in more detail below, we matched the national unemployment rates in a given year and country to the individual records from SHARE based on the year in which individuals completed their full-time education. Restricting the sample to individuals, who left school at a minimum age of 14 years and a maximum age of 28 as well as allowing for a lag-time between graduation and interview of at least 20 years, implied a range of school-leaving years between 1955 and 1986.

The only source of information containing comparative annual unemployment rates dating back to the 1950s comes from the Organisation for Economic Cooperation and Development (OECD) Annual Labour Force Statistics. More specifically, we derived information on the rate of unemployment as a percentage of the total civilian labour force for eleven Western European countries included in SHARE (Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Sweden, Spain and Switzerland).

The unemployment rate for different Western European countries between the years 1955 and 1986 varied substantially over time, both between as well as within countries. Many countries, such as Switzerland, France and the Netherlands, enjoyed unemployment rates below 2% until around 1970, whereas other countries, e.g. Italy and Greece, witnessed unemployment rates above 4% throughout the same period. With the exception of Switzerland, in practically all countries unemployment started to increase steadily from the 1970s. By the year 1986, most countries had reached levels of unemployment above 6%.

Since the time-series of unemployment rates for almost all included countries shows a clear secular trend over the relevant time period, individuals who graduated in more recent years on average experienced higher unemployment rates than those who graduated in earlier years. However, for the purpose of the analysis we were less interested in the effects of levels of unemployment but rather in the effects of the state of the business cycle during which an individual graduated. In other words, our aim was to assess how graduating during different stages of the business cycle is related to health in later life. In order to separate the secular trend of unemployment rates for each country from the so-called cyclical component, we therefore used a de-trending technique widely used for the analysis of business cycles called the Hodrick-Prescott (HP) filter (Hodrick and Prescott, 1997).

3.3.2 Gross domestic product derived from the Madisson database

The second ('The Long-Term Effects of Recessions During Early and Mid-Adulthood on Functional Health in Europe') and third ('Do Economic Recessions During Early and Mid-Adulthood Influence Cognitive Function in Older Age?') papers of this thesis are based on a combination of individual-level data from SHARE and information on GDP for several Western European countries (Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Sweden, Spain and Switzerland). Since for this paper we were interested in assessing the relationship between business cycles experienced at ages 16 to 49 on individuals' health at ages 50-74 measured between 2004 and 2006, the relevant time period is the years 1946-2006. Since official statistics provided by international organisations such as the OECD or the International Labor Organization (ILO) is generally only available from around 1950, we relied on data about GDP per capita in constant prices from 'The World Economy: a Millennial Perspective' database which was published on behalf of the OECD and compiled by Angus Maddison (Maddison 2003; Maddison and Centre 2003, 2006).

During the years 1946-2006, GDP per capita shows a clear positive trend in all countries included in the study. However, our exposure of interest is the business cycle, thus the repeated sequences of economic expansions and recessions. For this reason, we separated

the cyclical component from the increasing secular trend in the log of GDP per capita for each country using the Hodrick-Prescott Filter (HP) (Hodrick and Prescott, 1997). To derive information on individual exposure to recessions over the life course, we implemented the following steps: Based on the approach previously used in other studies (Angelini and Mierau 2014; Doblhammer et al. 2011), we converted the cyclical component for each country into quartiles distinguishing different stages of the business cycle. For each country, a deviation from the trend in GDP that fell in the lowest quartile was classified as a recession. We then linked this information to individual records from SHARE based on the year of birth and the country of birth. The result was a dataset indicating whether an individual experienced a recession at every single age between 16 and 49. We choose this upper age boundary because SHARE participants enrolled at age 50 or older.

We then used this yearly information on life-time exposure to the business cycle to create a variable measuring the number of years in recession during consecutive decades of life from age 16 until age 49. For this purpose, we created a set of variables each indicating the number of years in recession an individual experienced at ages 16-24, 25-34 and 35-44. The last interval, 45-49, was treated as a separate period. Age 16 was chosen as lower limit as it is widely considered as the beginning of early adulthood, and it is the earliest age at which individuals in most countries could leave full-time education based on compulsory schooling laws. The classification of the specific age intervals was done in order to identify age periods of particular sensibility to macro-economic conditions, as well as to distinguish between early and later adulthood.

3.3.3 Unemployment rates for the United States from the Current Population Survey

For the fourth paper (‘Do Recessions in the Pre-Retirement Years Affect Subsequent Risk of Cardiovascular Disease? Evidence from Cohorts Born Between 1922 and 1945 in the United States’) I use data on state-level unemployment rates in the U.S. as the main independent variable. State unemployment rates were calculated based on the March Supplement from the Current Population Survey (CPS). The latter was accessed through the CPS Integrated Public Use Microdata Series (King et al. 2010). Based on this

information, information was derived by state and sex on the proportion of individuals aged 50-64 currently unemployed.

In general, the CPS is the primary source of labour force statistics in the U.S. and sponsored by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics (BLS). The CPS is the base for a series of major economic indicators including the national unemployment rate, and has been carried out on a monthly basis since 1940. Overall, there are around 60,000 households included in the survey, which equals about 110,000 individuals (U.S. Bureau of Labor Statistics 2009). Compared to many other surveys, which often have a sample size of less than 3,000 individuals, the CPS thus has a comparatively large sample size. The sample of the CPS is aimed to be entirely representative of the non-institutionalised population (this excludes individuals currently on active duty in the armed forces) aged 16 years and older residing in the U.S. (U.S. Census Bureau 2006). To achieve this aim, the Census Bureau first groups all counties into approximately 2,000 geographical areas, representing the sampling units. In a second step, 824 of the latter are selected to represent each state as well as the District of Colombia (U.S. Census Bureau 2006). The 824 sampling units are designed to represent urban and rural areas as well as different concentrations of industries.

The CPS collects a broad range of information, including households' demographic and labour force information. The main aim of the questions related to labour force participation is to identify whether a person is employed, unemployed or not in the labour force at all (U.S. Census Bureau 2006). Additional information is collected on the number of hours worked, industry and occupation. The CPS questions regarding labour force participation refer to the week (Sunday to Saturday), which includes the 12th day of the month. The latter is also-called the reference week. Employed individuals are those who, during the reference week:

> "(a) did any work at all (for at least 1 hour) as paid employees; worked in their own businesses, professions, or on their own farms; or worked 15 hours or more as unpaid workers in an enterprise operated by a family member or (b) were not working, but who had a job or business from which they were temporarily absent

> because of vacation, illness, bad weather, childcare problems, maternity or paternity leave, labour-management dispute, job training, or other family or personal reasons whether or not they were paid for the time off or were seeking other jobs" (U.S. Census Bureau 2006: 42).

Individuals are regarded unemployed if, during the reference week, they were not employed "[…] but were available for work (excluding temporary illness) and had made specific efforts to find employment sometime during the 4-week period ending with the reference week are classified as unemployed" (U.S. Census Bureau 2006: 44). Individuals counted as not in the labour force are those who are neither employed nor unemployed, hence not actively looking for a job. The group of people not in the labour force thereby includes so-called discouraged workers. The latter refers to individuals who have been actively looking for a job at some point, but have stopped doing so because they believe that there are no adequate jobs available.

In 2014, about 59 percent of the population aged 16 years and above was employed in the U.S., a share which has been rather constant over time. Whereas the unemployment rate in 2014 was 6.2 percent, discouraged workers present about one percent of the population not in the labour force (Burea of Labor Statistics (BLS) 2014).

Chapter 4 Are Economic Recessions at the Time of Leaving Full-Time Education Associated with Worse Physical Functioning in Later Life?

4.1 Abstract

This paper examines whether economic conditions at the time of leaving school or college are associated with physical functioning at old age among cohorts in 11 European countries. Data came from 10,338 participants in the Survey of Health, Ageing and Retirement in Europe (SHARE) aged 50-74 who left school or college between 1956 and 1986. Data on functional limitations, as well as employment, marriage and fertility retrospective histories were linked to national unemployment rates during the year individuals completed their full-time education. Models included country-fixed effects and controls for early-life circumstances. Higher unemployment rates relative to the trend in the year of completing full-time education were associated with fewer functional limitations at ages 50-74 among men (RR[Rate ratio]=0.63, 95%CI=0.47-0.83). However, among women, higher unemployment rates relative to the trend in the year of completing full-time education were associated with more limitations in physical functioning (RR=1.30, 95%CI=1.13-1.50), particularly for women with (post-) secondary education. Economic conditions at the age of completing full-time education were also associated with several labour market, marriage, fertility and health behaviour outcomes, but controlling for these factors did not attenuate associations. Results were similar in models that controlled for selection into higher education due to measured covariates. Worse economic conditions during the year of completing full-time education predicted better health at old age among men but worse health among women. Both selection and causation mechanisms may explain this association.

4.2 Introduction

The recent financial crisis has led to a sharp increase in youth unemployment rates in many European countries, with Spain and Greece experiencing unemployment rates as high as 40% for ages 15-24 (Eurostat 2012b). Recent reports have warned of the emergence of a 'lost generation' of young graduates unable to make the transition from school to work, who might suffer poor future career prospects and substantial earning losses up to fifteen years after graduation (Genda et al. 2010; Kahn 2010; Oreopoulos et al. 2012). While recent research has emphasized the short-term effects of recessions on health (Ruhm 2000; Stuckler et al. 2009), there has been little emphasis on the permanent effects of economic recessions during the transition from school to work on health in middle and old ages.

Several mechanisms have been proposed to explain the link between economic downturns and health. In the short-run, economic contractions may influence health by increasing the stress associated with economic insecurity and unemployment (Catalano et al. 2010), changing behaviour (Ruhm 1995; Ruhm 2005) or influencing the delivery of health and other social services. Paradoxically, some studies suggest that economic contractions may bring some health benefits and lead to declines in mortality from some causes (Gerdtham and Ruhm 2006; Ruhm 2000). According to these studies, temporary economic downturns may promote healthy living, discourage smoking and alcohol consumption, while providing more time for physical activity and a healthy diet (Ruhm 1995; Ruhm 2000, 2005; Ruhm and Black 2002). Most of these studies, however, have focused on short-term and temporary changes in health, while less is known about the long-term, permanent effects of economic contractions experienced during early adulthood on health in later life.

Recent research suggests that economic recessions experienced around birth, a critical developmental period, are associated with increased mortality during old age (van den Berg et al. 2006). Likewise, an economic recession during the transition from school to work, another critical life-course period (Blossfeld 2005; Saar, Unt and Kogan 2008),

may trigger a pathway towards cumulative disadvantage characterized by less favourable and unstable labour market trajectories (Genda et al. 2010; Kahn 2010; Oreopoulos et al. 2012), which may ultimately lead to poorer health later in life. On the other hand, seminal work by Glen Elder based on the Oakland study suggested that children exposed to the Great Depression followed a trajectory of resilience into the middle years of life (Elder 1999). In relationship to their peers who were not affected equally by economic hardship as a result of the recession, the more disadvantaged children became more engaged in the family economy and hence became economically independent at an earlier stage of their life-course. These children became nearly as accomplished in midlife as youth who had not experienced hardship. One of the main reasons for the fact that those cohorts who were most affected by the recession as teenagers showed few signs of disadvantage in adulthood, according to Elder (1999), is that they showed a very strong motivation for achievement, comparatively clearer career plans and a greater risk aversion.

Based on data for 11 European countries, this paper examines the association between macroeconomic conditions during the time of completing full-time education[2] and functional status at older age for individuals who completed their education between 1956 and 1986. We focused on functional status because in part it reflects cumulative disadvantage over the life-course. We hypothesized that effects differ by educational attainment. Previous research suggests that recessions in early adulthood have stronger negative effects on the labour market careers of lower-skilled and lower-educated workers, but in the long-run, lower-educated workers recover faster than their middle or higher educated workers, who suffer larger permanent earnings losses (Genda et al. 2010; Sullivan and von Wachter 2009). To shed light on some of the potential mechanisms we also examine how economic conditions around the year of completing full-time education relate to labour market, marriage, fertility and behavioural outcomes. Our study is innovative by linking individual life history event data from the Survey of Health, Ageing and Retirement in Europe (SHARE) to macro-data on unemployment rates between 1956 and 1986.

[2] Throughout this thesis the expressions graduation, school-leaving and completing full-time education are used interchangeably.

4.3 Methods

4.3.1 Data

SHARE is a longitudinal, nationally representative survey designed to provide comparable information on the health, employment (histories) and social conditions of Europeans aged 50+ in 11 countries (Sweden, Denmark, Austria, France, Germany, Switzerland, Belgium, the Netherlands, Spain, Italy, Greece, Poland and the Czech Republic). Specific details on the survey are available elsewhere (Börsch-Supan and Jürges 2005; Börsch-Supan and Schröder 2011a; Börsch-Supan and Schröder 2011b; Schröder 2011). Participants in each country were interviewed in 2004/05 and subsequently re-interviewed in 2006/07 and 2008/09. Expert agencies translated items, with extensive pre-testing to ensure comparability. Response rates varied from country to country, but overall household response at enrolment was 62% (Börsch-Supan and Jürges 2005; Börsch-Supan and Schröder 2011a; Börsch-Supan and Schröder 2011b; Schröder 2011).

Our study is primarily based on data from the third wave of SHARE, also-called SAHRELIFE, conducted in 2008/09 and including retrospective life-histories expanding through early childhood until last interview. We included respondents who completed the life-history assessment and who had enrolled in the study in either 2004/05 or 2006/07. Data from the Czech Republic and Poland were not included due to lack of comparable data on unemployment rates before 1990. The total sample included 20,780 participants. We restricted the sample to participants aged 50 to 74 years who completed full-time education after 1956 (N=12,716), the earliest year for which comparable information on unemployment rates were available. We excluded individuals with missing values on educational level (n=230), functional limitations (n=15), and control variables or sampling weights (n=237). To allow for a lag time of at least 20 years, we excluded participants who graduated after 1986 (n=50). We also excluded participants who graduated before age 14 (n=1,068) and those graduating after age 27 (n=778). However, including these individuals did not change the substantive results. The final sample comprised 10,338 men and women from 11 countries who were born between 1934 and 1959 and graduated between 1956 and 1986 (Table 7).

4.3.1.1 Functional status

Functional status was measured by self-reported difficulties with activities to maintain basic self-care needs (Tsae-Jyy 2004) using three scales: The Katz Activities of Daily Living (ADL) scale, assessing difficulties with six basic self-care tasks (bathing, dressing, toileting, transferring, continence, and eating) (Katz et al. 1970); the index of Instrumental Activities of Daily Living (IADL), assessing difficulties with more advanced activities (using a map, preparing hot meals, shopping, telephone use, taking medications, housekeeping tasks, and managing money) (Lawton and Brody 1969); and an index of mobility partly based on the Nagi-scale (Nagi 1976), which assessed difficulties with 10 mobility and fine motor control items such as walking 100 meter, sitting two hours and climbing stairs. We initially conducted all analyses separately for each index, but found the results to be highly consistent for each of the three indicators. For this reason we constructed a summary score based on the number of difficulties reported for any of the three scales and subsequently only report the results for this indicator.

4.3.1.2 Macro-economic conditions in the year of leaving school or college

The unemployment rate as a percentage of the civilian labour force was obtained from the Organization for Economic Cooperation and Development (OECD) annual labour force statistics, and was used as indicator of macro-economic conditions (OECD 2012). To isolate the business cycle from secular trends in unemployment, we detrended the unemployment series using the Hodrick-Prescott-filter applying a smoothing parameter of 100 (HP) (Hodrick and Prescott 1997). The HP-filter, which is often used for the analysis of business cycles, separates the cyclical pattern of a time series from its general trend. It can be interpreted as the annual deviation in the unemployment rate from the smoothed time trend. We identified the year of completing full-time education by asking each participant ‘in which year did you finish continuous full-time education at school or college?’. For each individual, we matched the country-specific unemployment rate and trend deviation based on the reported year of leaving full-time education. To account for patterns of migration across countries, merging was based on country of birth for those individuals which were born in one of the countries participating in SHARELIFE.

4.3.1.3 Control and early childhood variables

Control variables included sex, year of birth, country of birth and educational attainment, based on three broad categories from the International Standard Classification of Education (ISCED) (UNESCO 2012). We incorporated extensive measures of childhood conditions to control for systematic differences in functional status between individuals completing their full-time education in different states of the economy, including: (a) self-rated health during childhood; (b) an index of childhood deprivation based on items available at the parental home (e.g. a fixed bath, water supply or central heating); (c) self-reported diagnosis of major childhood illnesses (infectious, non-communicable or mental/cognitive); (d) the occupation of the main breadwinner based on four major categories from the International Standard Classification of Occupations (ISCO) (ILO 2012); (e): the number of books in the parental home; (f): having missed school due to illness for more than one month; (g): having lost a parent before reaching age 16; and (h): index of comfort of childhood home (e.g. fixed bath or cold running water supply).

4.3.1.4 Potential mechanisms

Based on the retrospective histories, we constructed a set of indicators of labour market, fertility and marriage outcomes in the first 10 years after leaving school. We focused on this period because prior evidence indicates that the effects of economic conditions at graduation last for approximately 10 years (Oreopoulos et al. 2012). Indicators included having an employment gap of at least six months immediately after leaving school or at least once in the 10 years after leaving school. We distinguished gaps due to lay-off or a worker's plant been closed down from gaps due to other reasons ('resigned', 'mutual agreement', 'a temporary job had been completed', 'retired', or 'other reason'). We also constructed indicators for whether individuals experienced fluctuations between full-time and part-time working hours at least once in the 10 years after leaving school; and the age at first marriage and first childbirth. We furthermore incorporated measures of whether individuals reported drinking more than two glasses of alcohol almost every or 5/6 days a week at the time of interview, and whether they currently smoked.

4.3.2 Statistical analysis

After confirming that the index of functional limitations did not exhibit over-dispersion, we implemented a country-fixed effect Poisson model, which regressed the number of functional limitations on country-specific economic conditions in the year of leaving school. In this model, the impact of macroeconomic fluctuations is identified by within-country temporal variations in unemployment rates in the school leaving year, relative to changes occurring in other countries. These estimates automatically control for cross-country differences in determinants of health that are time-invariant (e.g., institutional or geographic factors), as well as determinants that vary over time but spread rapidly across countries (e.g., medical technologies) (Gerdtham and Ruhm 2006). The basic model was as follows:

$$Ln(D_i) = \alpha_i + \overline{X}_i\beta_1 + E_{ct}\beta_2 + C_c\beta_3 + T_t\beta_4 + \varepsilon_i$$

where $Ln(D_i)$ is the natural logarithm of the ADL, IADL and mobility index for individual *i*, α_i is the intercept, $\overline{X}_i$ is a matrix of individual-level controls, E_{ct} is a proxy for economic conditions (annual deviations from the unemployment trend) for country *c* at year of leaving full-time education *t*, and ε_i is the error term. The country-fixed effect C_c controls for all unmeasured differences across countries such as institutional characteristics or levels of functional health, while the year of graduation fixed-effect T_t controls for time-varying factors that changed homogenously across countries (Gerdtham and Ruhm 2006).

Models were implemented separately by sex given major differences in labour market trajectories and the potential for differential effects between women and men (Blossfeld 2005; Brzinsky-Fay 2007). To assess whether relationships varied by educational attainment, we included interactions between educational level and the deviations of the unemployment rate in the year of leaving school. To explore possible mechanisms, we used logistic or linear regression to relate economic conditions at school-leaving age to subsequent labour market, marriage, fertility and health behaviour outcomes.

Individuals may decide to stay longer or shorter in full-time education due to the economic conditions during the schooling years, potentially leading to selection. For example, individuals with a higher socio-economic background may be more likely to stay longer at school during adverse economic times until the economy improves. This selection may lead to compositional differences between educational groups due to economic conditions around the schooling years. To explore the impact of this selection mechanism, we first assessed whether childhood health and socio-economic characteristics predicted unemployment rate deviations at the time of graduation. We then implemented a Heckman selection model to explicitly account for selection associated with educational attainment. In the first stage, we modelled the probability of having secondary or higher education (inverse Mills ratio) as a function of childhood health and socio-economic characteristics (Heckman 1979). The inverse Mills ratio was then included in the Poisson models to account for selective educational attainment associated with economic conditions around the school-leaving years.

Standard errors were clustered by country and regression estimates exponentiated to obtain rate ratios (RR) and corresponding 95% confidence intervals (CI). Analyses were conducted in Stata/SE 11.2 using weights that controlled for the sampling design, survival and attrition across waves (Mannheim Research Institute for the Economics of Ageing 2011).

4.4 Results

4.4.1 Main results

Table 7 shows basic sample descriptives. 34% of respondents reported having at least one limitation with physical functioning, but this ranged from 25% in Switzerland to 43% in Austria. Over two thirds of respondents left school during a year of unemployment lower than 3%, while 15% left school during a year of unemployment of 5% or higher. Within each country, there were large fluctuations around the unemployment trend (Figure 1).

Table 7. Sample characteristics

	n	%		n (mean)	% (SD)
N=10,338					
Unemployment rate in year of completing full-time education			**ISCO main breadwinner**		
0 to <1 %	2,168	20.97	Low skilled blue collar	2,679	25.91
1 to <2 %	3,403	32.92	High skilled blue collar	4,302	41.61
2 to <3 %	1,934	18.71	Low skilled white collar	1,690	16.35
3 to <4 %	613	5.93	High skilled white collar	1,668	16.13
4 to <5 %	633	6.12	**Number of books when ten**		
5 to <6 %	1,036	10.02	None or very few (0-10 books)	3,145	30.42
>=6 %	551	5.33	Enough to fill one shelf (11-25 books)	2,576	24.92
Year of birth			Enough to fill one bookcase (26-100 books)	2,837	27.44
1934-38	407	3.94	Enough to fill two bookcases (101-200 books)	901	8.72
1939-43	1,949	18.85	Enough to fill two or more bookcases (more than 200 books)	879	8.5
1944-48	2,740	26.50	**Childhood self-rated health**		
1949-53	3,346	32.36	Excellent, very good or good	9,316	91.97
1954-59	1,897	18.35	Fair or poor	1,022	8.03
Year of graduation			**Mental condition as child (yes)**	187	1.83
1956-65	4,538	43.90	**Physical condition as child (yes)**	3,230	31.25

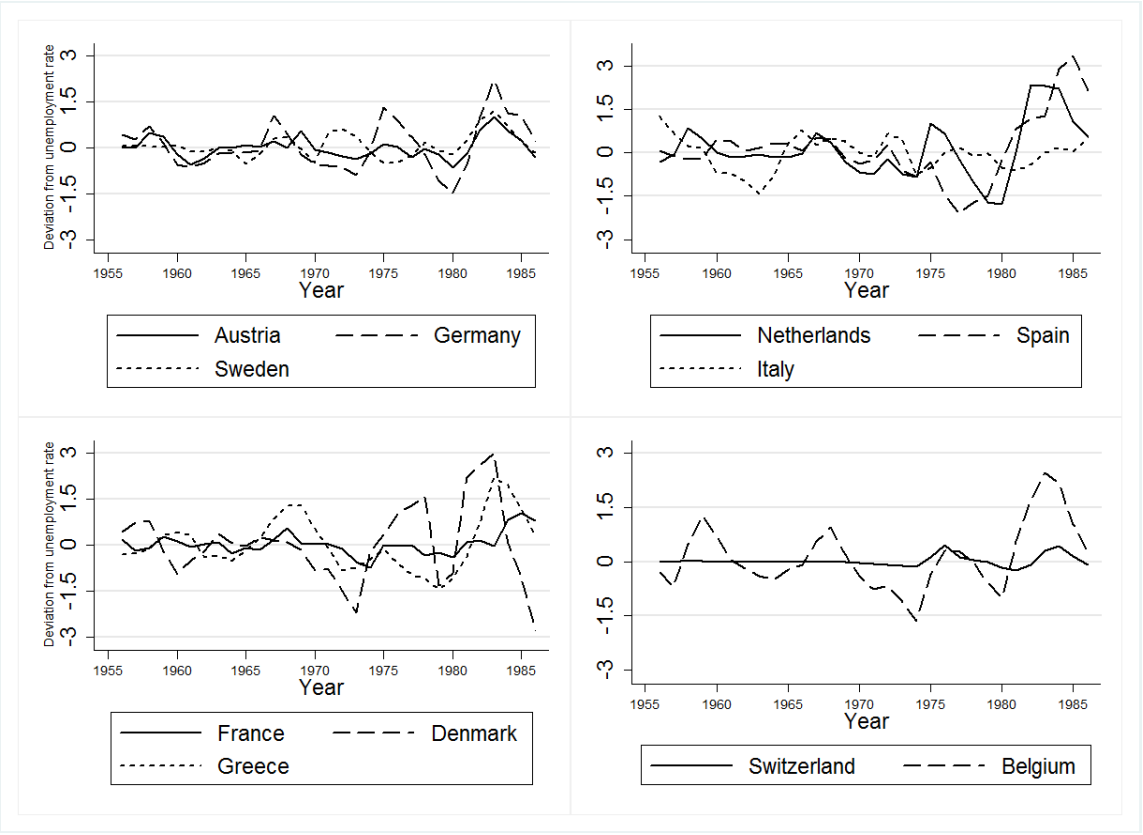
	n	%		n (mean)	% (SD)
1966-75	5,170	50.01	**Missed school for > 1 month (yes)**	1,105	10.69
1976-86	630	6.09	**Lost parent before age 16 (yes)**	36	0.35
Age at graduation			**Infectious condition as child (yes)**	8,942	86.50
14-16	3,190	30.86	**Country**		
17-19	3,981	38.51	Austria	350	3.39
20-22	1,822	17.63	Belgium	444	4.29
23-25	1,024	9.91	Denmark	250	2.42
25-27	321	3.10	France	2,044	19.77
Female	5,379	53.52	Germany	3,261	31.54
Education (ISCED-categories)			Greece	331	3.20
Primary edu. or 1st stage of basic edu.	949	9.18	Italy	1,477	14.28
Lower secondary or 2nd stage of basic edu.	1,748	16.91	Netherlands	627	6.07
(Upper) secondary edu.	4,538	43.90	Spain	912	8.82
Post-secondary non-tertiary edu.	338	3.27	Sweden	314	3.03
First stage of tertiary edu.	2,765	26.74	Switzerland	328	3.18
Childhood deprivation index			**Employment trajectories**		
0	996	9.63	Non-employed (yes)	5,477	52.98
1	1,816	17.57	Laid-off/plant-closures (yes)	968	9.36
2	1,887	18.25	Work fluctuations (yes)	1,233	11.93

	n	%		n (mean)	% (SD)
3	1,697	16.42	Working part-time (yes)	1,676	16.21
4	1,539	14.89	Unemployment gap after graduation (yes)	441	4.27
>=5	2,403	23.24	**Health behaviours**		
Index of limitations (ADL + IADL + Mobility)			Heavy drinking (yes)	1,066	10.31
No limitations	6,791	65.55	Current smoker (yes)	2,593	25.08
1 limitation	1,467	14.38	**Age at first child**	(26.41)	(4.92)
2 limitations	807	7.50	**Age at first marriage**	(24.27)	(4.78)
3+ limitations	1,309	12.56			

Abbreviations: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; ISCED, International Standard Classification of Education; SD, standard deviation.

Note: Calculations based on data from SHARELIFE rel. 1 and SHARE rel. 2.5.0; results are unweighted.

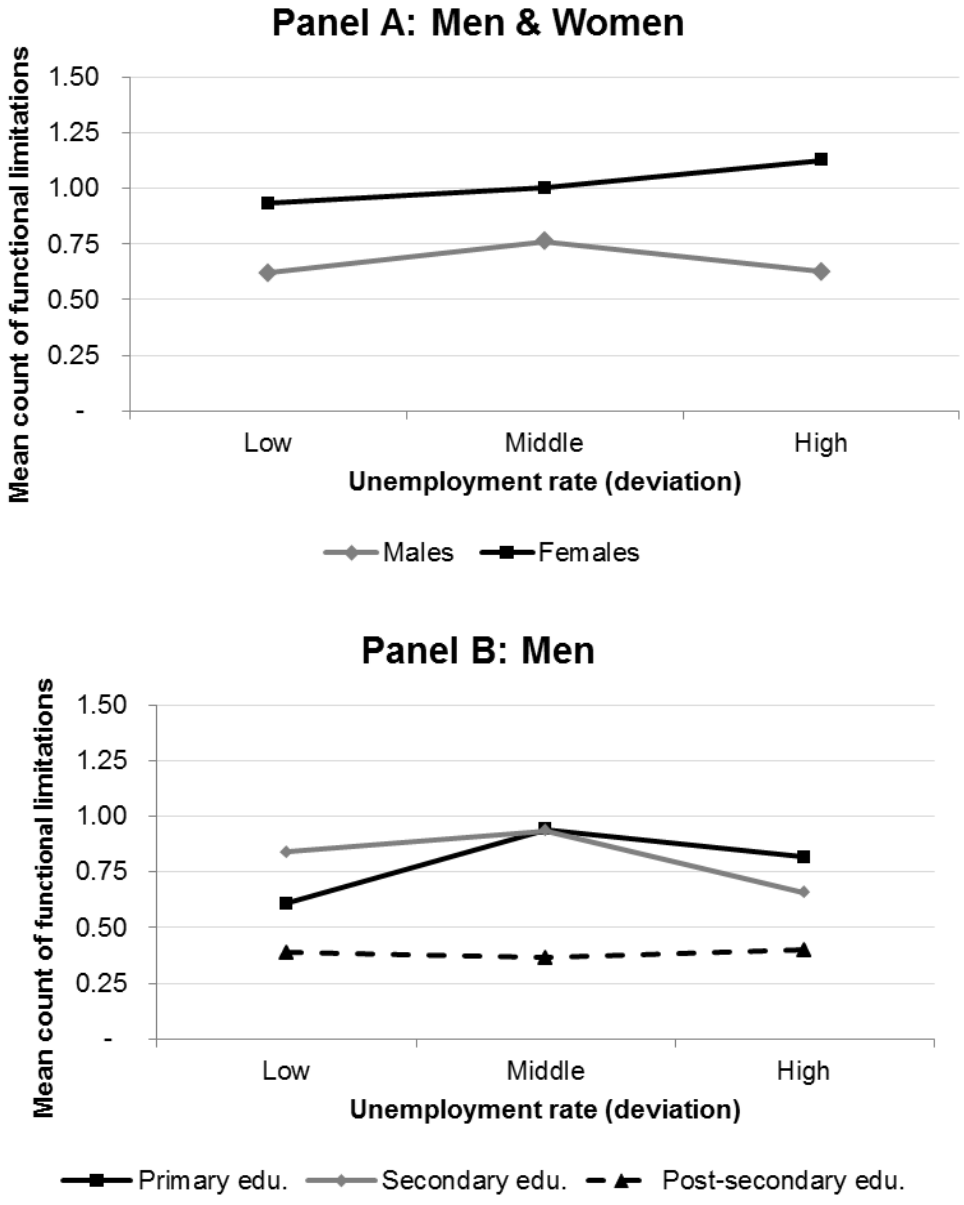
Figure 1: Deviations from the unemployment rate in 11 European countries (1956 to 1986)

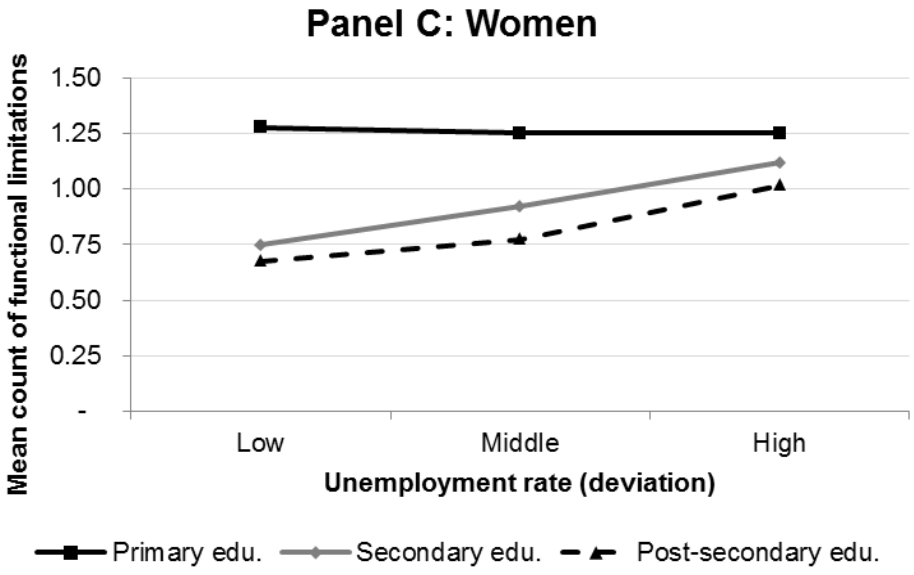


Note: The figures show the deviations from the unemployment rate (% of civilian labour force) obtained with the Hodrick-Prescott filter.

Before including all individual-level controls, we first explored the association between unemployment rates at the time of completing full-time education and functional limitations for men and women (by educational level) controlling only for age and country of birth. For the purpose of graphical representation we divided the country-specific deviations in the unemployment rate in tertiles, representing low, middle and high deviations. Panel A of Figure 2 shows predicted means of functional limitation scores according to country-specific tertile of unemployment deviation at the school-leaving year, only controlling for age and country of birth. For men, there were no consistent differences in functional status for cohorts completing full-time education at different levels of unemployment. In contrast, among women, completing school in a year of higher unemployment was associated with a higher number of limitations at ages 50-74. For example, women who left school during a year in the lowest tertile of unemployment (low unemployment) had on average 0.93 limitations, as opposed to 1.13 limitations for cohorts leaving school in a year in the highest tertile of unemployment. Results stratified by educational level (Panels B and C) revealed no clear associations among men. Among women, unemployment rates in the year of leaving school were associated with more old-age limitations among middle- and higher-educated women, while there was no association for women with primary education.

Figure 2: Unemployment-deviations at time of leaving school and functional limitations at older age of men and women from 11 European countries, 2004-2007





Note: The lines show the relationship between the deviations in the unemployment rate (in terms of country-specific tertiles) at time of graduation and the predicted mean number of functional limitations. Means are adjusted by sex, year of birth and countries.

Table 8 shows estimates of the effect of an increase in unemployment in the year of leaving school on functional limitations, incorporating controls for confounders, country- and year-fixed effects. Among men (column 1), a one-point increase in the unemployment rate relative to the trend during the year of completing full-time education was associated with fewer functional limitations at ages 50-74 (RR=0.63, 95%CI=0.47-0.83). Column 2 shows estimates of a model that incorporates an interaction with educational attainment. Estimates suggest that the association between an increase in unemployment in the year of completing education and the risk of physical limitations for men does not differ significantly by educational attainment.

Table 8. Rate ratio: The association between unemployment rates at the time of completing full-time education and functional limitations in men and women from 11 European countries at ages 50-74

	Men				Women			
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Unemployment rate (deviation)	0.63	(0.47-0.83)	0.92	(0.49-1.71)	1.30	(1.13-1.50)	0.89	(0.77-1.03)
Year of birth	1.01	(0.97-1.06)	1.01	(0.97-1.06)	1.02	(0.98-1.06)	1.02	(0.98-1.06)
Childhood conditions								
Poor self-rated health	1.86	(1.50-2.29)	1.85	(1.51-2.27)	1.78	(1.47-2.17)	1.78	(1.48-2.15)
Mental condition diagnosis	1.23	(0.80-1.91)	1.24	(0.80-1.91)	1.87	(1.36-2.58)	1.88	(1.36-2.59)
Physical condition diagnosis	1.36	(1.07-1.72)	1.36	(1.07-1.73)	1.13	(0.99-1.30)	1.14	(0.99-1.31)
Infectious disease	0.73	(0.55-0.96)	0.73	(0.56-0.96)	0.84	(0.69-1.03)	0.84	(0.70-1.02)
Missed school for > 1 month	0.72	(0.58-0.89)	0.72	(0.58-0.89)	1.00	(0.80-1.24)	0.99	(0.80-1.24)
Lost parent before age 16	1.68	(0.88-3.20)	1.67	(0.87-3.23)	1.71	(1.02-2.87)	1.67	(1.02-2.73)
Childhood deprivation index	0.90	(0.86-0.93)	0.90	(0.86-0.93)	0.98	(0.94-1.02)	0.98	(0.94-1.03)
ISCO main breadwinner								
Low skilled blue collar		1.00		1.00		1.00		1.00
High skilled blue collar	0.89	(0.71-1.13)	0.88	(0.70-1.11)	0.85	(0.77-0.95)	0.86	(0.78-0.96)
Low skilled white collar	1.10	(0.78-1.57)	1.09	(0.77-1.54)	0.87	(0.62-1.22)	0.88	(0.63-1.22)
High skilled white collar	0.91	(0.62-1.34)	0.91	(0.62-1.34)	1.14	(0.87-1.50)	1.15	(0.87-1.52)
Number of books when ten								
None or very few (0-10 books)		1.00		1.00		1.00		1.00
Enough to fill one shelf (11-25 books)	0.85	(0.71-1.01)	0.85	(0.71-1.02)	0.97	(0.80-1.18)	0.98	(0.81-1.20)
Enough to fill one bookcase (26-100 books)	1.02	(0.87-1.20)	1.02	(0.87-1.20)	0.94	(0.79-1.12)	0.94	(0.79-1.11)
Enough to fill two bookcases (101-200 books)	1.13	(0.77-1.65)	1.13	(0.78-1.64)	1.00	(0.91-1.11)	1.00	(0.90-1.11)
Enough to fill two or more bookcases (more than 200 books)	0.88	(0.53-1.45)	0.87	(0.53-1.44)	0.97	(0.84-1.12)	0.98	(0.85-1.12)

Education								
Primary								
Secondary	1.07	(0.83-1.38)	1.06	(0.83-1.36)	0.87	(0.68-1.13)	0.87	(0.67-1.14)
Post-secondary	0.72	(0.58-0.89)	0.71	(0.57-0.88)	0.88	(0.78-1.00)	0.88	(0.78-1.00)
Unemployment deviation*secondary education			0.62	(0.31-1.24)			1.77	(1.35-2.31)
Unemployment deviation*post-secondary education			0.66	(0.25-1.74)			1.56	(1.14-2.13)

Abbreviations: RR, rate ratio; ISCO, International Standard Classification of Occupations; CI, 95% confidence interval of double-sided test.

Note: All models include also fixed effects for country, year of completing full-time education and year of first interview

Corresponding estimates for women are presented in columns 3 and 4 of Table 8. A one-point increase in the unemployment rate in the year of completing school was associated with more physical functioning limitations at old age (RR=1.30, 95%CI=1.13-1.50). There was a significant interaction with educational attachment, suggesting that an increase in the unemployment rate in the year of completing school was associated with increased number of functional limitations for women with secondary (RR for interaction=1.77, 95%CI=1.35, 2.31) and post-secondary education (RR for interaction=1.56, 95%CI=1.14, 2.13), but not for lower-educated women.

4.4.2 Selection models

As mentioned above, a key concern with regard to our identification strategy is selection bias. The key concern is that some individuals may systematically decide to remain longer or shorter in school depending on the state of the economy. For example, some individuals may remain longer in school if they expect to complete their education in a year of poor economic conditions or reduced labour market opportunities. Alternatively, some individuals may leave school earlier if the economy is good because the opportunity costs of remaining in school are higher in good economic times. Another possibility is that individuals from less well-off families are 'forced' to leave full-time education and start working in hard economic times to support their households. It is difficult to determine in which direction these selection mechanisms would bias our results, but below we discuss several possibilities.

As such, individuals with more resources (e.g., higher socio-economic status) may delay leaving full-time education until a better economic climate, while those with fewer resources may have less control on the timing of the year in which they leave school and start working. This effect, however, would bias our results in the opposite direction than observed in our results for men. If men from better-off families (and a larger ´health stock´) delay graduation until the economy improves, cohorts graduating in good economic times would be a selection of the healthiest and would have better health outcomes at old age than those graduating in poor economic times. As a result, this

selection mechanism cannot explain why we find that men graduating in good economic times have worse health outcomes than those graduating in poor economic times.

A second possibility is that men from less well-off families are over-represented in the cohorts leaving full-time education in poor economic times, because they may be more likely to decide leaving school and start working to support their households in these periods. Again, this would bias our results in the opposite direction than observed in our results for men. Men graduating in poor economic times would be a selection of the less well-off, and would therefore be more likely to have poorer health outcomes at old age. This mechanism, therefore, is unlikely to explain our findings.

A final mechanism refers to the fact that men from less well-off families may be more likely to leave school when the economy is good because the 'opportunity costs' of not working are high for them, while richer individuals, who have less budget constraints, may be less likely to condition their educational choices on the economy. As a result, poorer individuals may be more likely to leave school in good economic times than their richer counterparts. This could explain our results: if individuals from less-well off families are more likely to leave school to enter work because the economy is good, the less well-off would be overrepresented in those leaving school in good economic times, generating a spurious negative association between economic conditions during school-leaving age and late-life physical functioning.

To assess if early life factors influenced whether individuals left school in good or poor economic times, Table 9 shows odds ratios of leaving school during a recession (defined as the highest quartile of country-specific annual unemployment rate deviations) according to childhood characteristics and educational attainment. Men who missed school for at least one month due to illness and women who had an infectious disease during childhood were more likely to have left school during a recession. However, most other associations were not significant, suggesting that individuals that were disadvantaged or less healthy during childhood were no more likely to have left school during a recession than their more advantaged and healthier counterparts.

Table 9. Logistic regression: Association between childhood circumstances status and the likelihood of graduating during a recession for men and women graduating between 1956 and 1986 in 11 European countries

	Men		Women	
	OR	**95% CI**	**OR**	**95% CI**
Year of birth	0.98	(0.96-1.01)	0.97	(0.94-1.01)
Poor self-rated health	0.82	(0.56-1.20)	1.12	(0.75-1.66)
Mental condition diagnosis	1.36	(0.67-2.78)	1.17	(0.66-2.05)
Physical condition diagnosis	1.09	(0.94-1.26)	0.86	(0.66-1.12)
Infectious disease	1.03	(0.77-1.39)	1.52	(0.99-2.34)
Missed school 1 month+	1.71	(1.27-2.29)	1.19	(0.85-1.66)
Parent died before age 16	1.72	(0.64-4.60)	1.73	(0.38-7.76)
Childhood deprivation index	1.01	(0.98-1.04)	0.99	(0.93-1.05)
ISCO main breadwinner				
Low skilled blue collar	1.00		1.00	
High skilled blue collar	0.93	(0.69-1.26)	0.94	(0.75-1.18)
Low skilled white collar	0.91	(0.47-1.75)	1.00	(0.66-1.52)
High skilled white collar	1.20	(0.71-2.03)	0.80	(0.52-1.25)
Number of books when ten				
None or very few (0-10 books)	1.00		1.00	
Enough to fill one shelf (11-25 books)	1.09	(0.93-1.29)	0.95	(0.74-1.22)

	Men			Women	
	OR	**95% CI**		**OR**	**95% CI**
Enough to fill one bookcase (26-100 books)	1.22	(0.90-1.65)		1.12	(0.85-1.47)
Enough to fill two bookcases (101-200 books)	0.69	(0.52-0.92)		0.93	(0.62-1.40)
Enough to fill two or more bookcases (more than 200 books)	0.95	(0.64-1.42)		1.10	(0.86-1.40)
Education					
Primary	1.00			1.00	
Secondary	0.80	(0.58-1.11)		1.27	(0.99-1.62)
Post-secondary	0.78	(0.51-1.19)		1.01	(0.69-1.46)

Abbreviations: OR, odds ratio; CI, 95% confidence interval of double-sided test.

Note: The Table shows the odds ratios of leaving school during a recession, defined as the highest quartile of country-specific annual unemployment rate deviations according to childhood characteristics and educational attainment. All models include also fixed effects for country, year of completing full-time education and year of first interview.

To account for potential selection, we implemented two complementary approaches: A Heckman-type selection correction and a Propensity Score Matching (PSM) approach. For the reasons explained below, we selected a Heckman selection correction as the most robust approach to account for selection in our paper.

Heckman selection correction is typically used in instances with missing data on the outcome variable, because the latter is only observed in a subset of the total population. We adapted the rationale to first model selection into further education (primary vs. (post-) secondary education) and, in a second step, included the selection-probability (so-called inverse Mills ratio) as an independent variable in the regression of functional limitations on unemployment rates at graduation. In accordance with the Heckman selection model, the second-step regression thereby only uses the sample of those who completed (post-) secondary education and disregards those who only completed primary education.

Following this rationale, results in Table 10 show the coefficients from a probit model with the probability of having (post-) secondary education as outcome. Better health, higher parental occupation, lower deprivation index and better mathematical and language skills all predicted higher probabilities of having secondary or post-secondary education. Table 11 shows coefficients from models for the association between unemployment-deviations at school-leaving age and functional health in the sample of men and women with secondary or post-secondary education, incorporating the Mills ratio to control for selection into higher education. Estimates are very similar to those presented in Table 8, suggesting that selection into higher education based on measured childhood conditions did not explain results.

Table 10: Association between childhood-characteristics and likelihood of obtaining (post-) secondary education for men and women graduating between 1956 and 1986

	Men			Women	
	Coeff.	**95% CI**		**Coeff.**	**95% CI**
Year of birth	-0.26	(-0.33, -0.20)		-0.35	(-0.43, -0.28)
Poor self-rated health	0.32	(-0.06, 0.69)		-0.08	(-0.38, 0.22)
Mental condition diagnosis	-0.45	(-0.99, 0.08)		0.37	(-0.24, 0.99)
Physical condition diagnosis	-0.00	(-0.10, 0.10)		0.09	(-0.01, 0.19)
Infectious disease	-0.16	(-0.32, -0.00)		-0.15	(-0.31, 0.01)
Missed school for > 1 month	0.03	(-0.16, 0.21)		0.09	(-0.08, 0.25)
Lost parent before age 16	-0.00	(-0.82, 0.82)		0.21	(-0.59, 1.01)
Comfort of childhood home index	0.05	(0.01, 0.09)		0.06	(0.03, 0.10)
ISCO main breadwinner					
Low skilled blue collar	1.00			1.00	
High skilled blue collar	0.05	(-0.06, 0.17)		0.05	(-0.09, 0.20)
Low skilled white collar	0.43	(0.22, 0.64)		0.12	(-0.08, 0.32)
High skilled white collar	0.41	(0.22, 0.60)		0.18	(-0.00, 0.37)
Number of books when ten					
None or very few (0-10 books)	1.00			1.00	
Enough to fill one shelf (11-25 books)	0.22	(0.05, 0.39)		0.30	(0.04, 0.55)
Enough to fill one bookcase (26-100 books)	0.25	(-0.03, 0.53)		0.28	(0.02, 0.53)
Enough to fill two bookcases (101-200 books)	0.23	(-0.01, 0.47)		0.56	(0.14, 0.98)
Enough to fill two or more bookcases (more than 200 books)	0.45	(0.21, 0.70)		0.30	(0.05, 0.55)
Relative position to others mathematically					
Much better	1.00			1.00	
Better	-0.20	(-0.38, -0.01)		-0.09	(-0.60, 0.42)
About the same	-0.22	(-0.49, 0.05)		-0.17	(-0.76, 0.41)
Worse	-0.43	(-0.70, -0.16)		-0.38	(-0.93, 0.17)
Much worse	-0.97	(-1.67, -0.28)		-0.62	(-1.07, -0.17)
Relative position to others language					
Much better	1.00			1.00	
Better	-0.12	(-0.37, 0.13)		0.03	(-0.09, 0.16)
About the same	-0.10	(-0.28, 0.09)		-0.15	(-0.34, 0.04)
Worse	-0.19	(-0.51, 0.12)		-0.21	(-0.73, 0.32)
Much worse	-0.51	(-1.05, 0.04)		-0.46	(-0.94, 0.01)
Pseudo R-squared	0.42			0.41	

Note: The Table shows the coefficients from a probit model regressing the likelihood of having (post-) secondary education vs. only primary education on various childhood-characteristics. All models include also fixed effects for country, year of completing full-time education and year of first interview.

Table 11: Selection model: The association between unemployment rates at the time of completing full-time education and functional limitations for men and women from 11 European countries at ages 50-74

	Men			Women	
	RR	**95% CI**		**RR**	**95% CI**
Unemployment rate (deviation)	0.56	(0.39-0.81)		1.77	(1.31-2.40)
Year of birth	1.03	(0.99-1.07)		0.99	(0.97-1.02)
Poor self-rated health	2.05	(1.51-2.79)		1.60	(1.23-2.09)
Mental condition diagnosis	0.90	(0.65-1.24)		1.87	(1.18-2.96)
Physical condition diagnosis	1.31	(1.04-1.65)		1.21	(1.02-1.43)
Infectious disease	0.69	(0.56-0.86)		0.75	(0.58-0.97)
Missed school for > 1 month	0.72	(0.60-0.87)		1.02	(0.85-1.23)
Lost parent before age 16	1.99	(1.20-3.32)		0.94	(0.31-2.88)
Childhood deprivation index	0.90	(0.85-0.94)		0.98	(0.91-1.06)
ISCO main breadwinner					
Low skilled blue collar	1.00			1.00	
High skilled blue collar	0.86	(0.68-1.09)		0.96	(0.84-1.08)
Low skilled white collar	0.95	(0.72-1.26)		0.82	(0.64-1.07)
High skilled white collar	0.83	(0.55-1.25)		1.10	(0.82-1.50)

	Men			Women	
	RR	**95% CI**		**RR**	**95% CI**
Number of books when ten					
None or very few (0-10 books)	1.00			1.00	
Enough to fill one shelf (11-25 books)	0.90	(0.76-1.06)		0.95	(0.84-1.08)
Enough to fill one bookcase (26-100 books)	1.08	(0.92-1.27)		0.98	(0.67-1.43)
Enough to fill two bookcases (101-200 books)	1.15	(0.81-1.62)		1.05	(0.88-1.26)
Enough to fill two or more bookcases (more than 200 books)	0.81	(0.55-1.20)		0.98	(0.72-1.32)
Education					
Secondary	1.00			1.00	
Post-secondary	0.70	(0.58-0.85)		0.96	(0.81-1.14)
Inverse Mills ratio	0.81	(0.38-1.75)		1.20	(0.55-2.61)

Abbreviations: RR, rate ratio; CI, 95% confidence interval of double-sided test.

Note: The models only include the sample of (post-) secondary educated men and women respectively. Both models thereby control for the inverse Mills ratio obtained from a probit model which regressed the likelihood of having (post-) secondary education on the full set of childhood-characteristic as well as self-rated language and mathematical skills at age ten (see Table 10). All models include fixed effects for country, year of completing full-time education and year of first interview.

Our second approach used propensity-score matching to explore the issue of selection into further education. Propensity-score matching addresses selection by directly comparing the outcome of a group who received the 'treatment' (i.e., leaving school in a recession) and another who did not receive the treatment (i.e., leaving school in a boom), after matching on observed characteristics. Thereby, assignment into treatment is considered to be 'random' after controlling for a set of characteristics. In the present application, treatment refers to the macroeconomic conditions around graduation, i.e. whether an individual graduated in good or bad economic times. Following this rationale, we used a propensity-score matching-approach which defined treatment as graduating in a recession (i.e. in a year in which the annual deviation from the national unemployment rate fell into the highest country-specific quartile) versus graduating in times of average or good economic times (i.e. in a year in which the annual deviation from the national unemployment rate fell into the first, second or third country-specific quartile). We implemented a Kernel-based matching estimator using a subset of the SHARELIFE childhood characteristics judged to be potentially relevant for health.

Interestingly, the results of the first step of the PSM-approach suggest that childhood characteristics are only weak predictors of whether an individual left school in a boom or a recession. With the exception of having a physical medical condition during childhood, no other variable predicted whether an individual left school in a boom or recession. Accordingly, the second stage of the PSM model suggests that selection does not account for our findings: We find that men who graduated in a recession had on average a lower score on the index of functional limitations, although the estimate was not significant on the 5%-level (Average Treatment Effect on the Treated): Among men, the difference in the mean number of functional limitations between the treatment and control group was -0.142 and the associated value of the t-test was -1.83. A key concern with this approach is that matching restricts the analysis to only a selection of the sample that could be matched. In our case, the matching estimator was based only on 3,825 men and 2,900 women respectively. As a result, standard errors were very large and results were inconclusive.

4.4.3 Mechanisms

Table 12 shows selected results from models examining the association between economic conditions at the time of leaving school with labour market outcomes 10 years later as well as marriage- and fertility-histories.

Among lower-educated men, higher unemployment rates at graduation were associated with higher odds of having had an unemployment spell immediately after leaving school, but lower odds for (post-) secondary educated men. Higher unemployment at graduation was also associated with fewer work-time fluctuations in the 10 years after leaving school among (post-) secondary educated men. Furthermore, for men with post-secondary education higher unemployment rates at graduation were associated with lower ages at first childbirth.

Among women with (post-) secondary education, increases in the unemployment rate at graduation were associated with lower age at first childbirth. Thereby, for women with lower education, higher unemployment at graduation was associated with higher ages at first marriage whereas for (post-) secondary educated women it was associated with lower ages.

No significant associations were found for the relationship between unemployment rates at graduation and health behaviours (excessive drinking or current smoking) for either men or women.

Table 12: Associations between unemployment rates at graduation and labour market outcomes (10 years after graduation) as well as marital- and childbirth-histories

			Men			Women	
			OR	**95% CI**		**OR**	**95% CI**
Non-employed (yes)		Unemployment deviation (primary education)	1.03	(0.47-2.25)		0.88	(0.48-1.64)
		Unemployment deviation*(post-) secondary education	0.63	(0.27-1.45)		1.50	(0.96-2.32)
Laid-off/plant-closures (yes)		Unemployment deviation (primary education)	0.62	(0.30-1.27)		1.28	(0.45-3.63)
		Unemployment deviation*(post-) secondary education	0.62	(0.30-1.30)		0.89	(0.29-2.69)
Work fluctuations (yes)		Unemployment deviation (primary education)	1.21	(0.61-2.40)		0.98	(0.74-1.30)
		Unemployment deviation*(post-) secondary education	0.41	(0.17-0.96)		1.15	(0.77-1.71)
Working part-time (yes)		Unemployment deviation (primary education)	0.74	(0.38-1.47)		1.21	(0.91-1.62)
		Unemployment deviation*(post-) secondary education	1.14	(0.40-3.25)		0.92	(0.65-1.30)
Unemployment gap after graduation (yes)		Unemployment deviation (primary education)	3.91	(1.44-10.62)		0.75	(0.12-4.55)
		Unemployment deviation*(post-) secondary education	0.16	(0.04-0.67)		1.28	(0.09-18.50)
			Coeff.	**95% CI**		**Coeff.**	**95% CI**
Age at first marriage		Unemployment deviation (primary education)	0.36	(-0.38, 1.10)		1.03	(0.41, 1.66)
		Unemployment deviation*(post-) secondary education	-0.57	(-1.49, 0.35)		-1.68	(-2.80, -0.55)
Age at first child		Unemployment deviation (primary education)	0.83	(-0.10, 1.75)		0.33	(-0.70, 1.36)
		Unemployment deviation*(post-) secondary education	-1.44	(-2.43, -0.45)		-0.05	(-1.40, 1.30)

Abbreviations: OR, odds ratio; Coeff, coefficient; CI, 95% confidence interval of double-sided test.

Despite these associations, Table 13 shows that associations between unemployment rate deviations in the school-leaving year and physical functioning at ages 50-74 remain largely unchanged in models that control for potential mechanisms such as unemployment-spells or experience of an unemployment-gap immediately after graduation.

Table 13. Rate ratio: The association between of unemployment rates at the time of completing full-time education and functional limitations in men and women from 11 European countries at ages 50-74 (including controls for experience of non-employment or unemployment)

Table 13.1: Unemployment gap after graduation

	Men				Women			
	RR	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**
Unemployment rate (deviation)	0.63	(0.49-0.80)	0.66	(0.54-0.81)	1.21	(1.02-1.44)	0.80	(0.70-0.92)
Unemployment deviation*secondary education			0.84	(0.58-1.22)			1.89	(1.44-2.48)
Unemployment deviation*(post-) secondary education			1.16	(0.83-1.62)			1.60	(1.26-2.02)
Unemployment gap after graduation	1.10	(0.84-1.45)	1.10	(0.84-1.43)	1.30	(1.04-1.63)	1.29	(1.01-1.64)

Table 13.2: Non-employed (>=1 year) in 10 years after graduation (yes)

	Men				Women			
	RR	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**	**RR**	**95% CI**
Unemployment rate (deviation)	0.63	(0.47-0.84)	0.92	(0.49-1.73)	1.28	(1.12-1.47)	0.90	(0.78-1.03)
Unemployment deviation*secondary education			0.62	(0.31-1.24)			1.72	(1.32-2.24)
Unemployment deviation*(post-) secondary education			0.66	(0.25-1.75)			1.51	(1.11-2.06)
Non-employed (>=1 year) in 10 years after graduation	1.03	(0.93-1.13)	1.03	(0.93-1.13)	1.32	(1.20-1.46)	1.32	(1.19-1.46)

Abbreviations: RR, rate ratio; CI, 95% confidence interval of double-sided test.
Note: All models include the same covariates as shown in Table 8 and also fixed effects for country, year of completing full-time education and year of first interview but results are not shown.

4.5 Discussion

We found that leaving school during economic contractions was associated with better physical functioning at old age among men, while among women it was associated with worse functional health. Effects among women were primarily concentrated among women of secondary or tertiary education. We found no evidence that selection into higher education explained these associations. Economic conditions at the age of leaving school were associated with several labour market, marriage, fertility and health behaviour outcomes, but controlling for these factors did not attenuate associations. While selection remains a possible explanation, findings may indicate that economic conditions during the transition from school to work may trigger both health-preserving and health-damaging mechanisms.

4.5.1 Data assessment and limitations

Some limitations should be considered in our study. A potential limitation is that countries differ significantly in terms of their histories, institutions or other unmeasured characteristics. However, we used country-fixed effects that controlled for cross-country differences in these unobserved variables, so that estimation relied solely on within-country variation across cohorts. Although differences between cohorts within each country may remain, our results were robust to controls for a wide variety of childhood and adult health and socio-economic indicators.

Participation in SHARE was dependent on survival to middle- or old-age, potentially leading to survival bias. To address this, our models included weights that controlled for sampling, mortality selection and attrition across waves (Mannheim Research Institute for the Economics of Ageing 2011). Furthermore, when restricting the sample to a younger age-group (50-64) (Table 14), for which the risk of mortality is relatively small, we obtained similar results to those for ages 50-74. Thus, although mortality selection may play a role, it is unlikely to account fully for our results.

Table 14: Rate ratio: The association between unemployment rates at the time of completing full-time education and functional limitations in men and women from 11 European countries at ages 50-64

	Men					Women				
	RR	**95% CI**		**RR**	**95% CI**	**RR**	**95% CI**		**RR**	**95% CI**
Unemployment rate (deviation)	0.61	(0.49-0.76)		0.73	(0.42-1.27)	1.30	(1.12-1.51)		0.76	(0.45-1.28)
Unemployment deviation*secondary education				0.73	(0.38-1.41)				2.09	(0.89-4.92)
Unemployment deviation*(post-) secondary education				1.00	(0.42-2.35)				2.02	(1.47-2.77)

Abbreviations: RR, rate ratio; CI, 95% confidence interval of double-sided test.

Note: All models include the same covariates as shown in Table 8 and also fixed effects for country, year of completing full-time education and year of first interview but results are not shown.

Information on year of graduation and early life variables was self-reported and may be susceptible to recall bias. Nevertheless, studies indicate a level of agreement of around 80-90% between data from life-history event questionnaires and population registries for major life events such as unemployment, health and marriage with a relatively small effect on estimates (Courgeau and Lelievre 1992).

4.5.2 Interpretation

Our study was motivated by previous research showing that graduating from school during a recession has negative permanent effects on earnings and labour market outcomes (Genda et al. 2010; Kahn 2010; Kondo 2007; Oreopoulos et al. 2012). Therefore, we expected cohorts graduating in less favourable times to end up in worse health than those graduating in good economic times. Notwithstanding potential limitations, our results suggest that recessions experienced around graduation may affect later life outcomes differently for men and women as well as for individuals with different educational level.

Permanent changes in lifestyle as a result of an economic contraction in early adulthood could provide an explanation for the finding that among men, adverse economic conditions around the time of graduation were associated with better functional health in later life. Such an interpretation would be in agreement with Elder's study of children growing up during the Great Depression showing that children from the most deprived families were characterized by a strong motivation for achievement and early economic independence which altogether contributed to greater job-mobility and few traces of disadvantage in their careers (Elder 1974). Other studies have reported temporary reductions in smoking, drinking and body weight (Ruhm 2005; Ruhm and Black 2002), paired with rising leisure physical activity during economic contractions. Given that the age around the transition from school to work is a critical period for initiation or cessation of behaviours such as smoking (Johnson and Gerstein 1998; Swan, Creeser and Murray 1990; Zanjani, Schaie and Willis 2006), recessions around this period may not only have temporary effects, but also delay or prevent initiation of these behaviours altogether (Ruhm 2000). In addition, leaving school during a period of high

unemployment may also delay entrance into the labour market (Raaum and Røed 2006), reducing the likelihood of entering jobs with hazardous working conditions at young age, particularly for lower-educated men.

On the other hand, findings for women with secondary or post-secondary education are in agreement with previous reports of negative long-run and permanent effects of unfavourable conditions at graduation on life-time income and labour market outcomes, dimensions often associated with health (Genda et al. 2010; Kahn 2010; Oreopoulos et al. 2012). These studies have observed permanent earning losses particularly for those with higher education, while less-educated workers suffer smaller losses and recover relatively quickly (Genda et al. 2010). Previous research has shown that, as compared to men, women's labour force participation is more influenced by unemployment rate fluctuations (Ferber and Lowry 1975; O'Donnell 1984). We did not find evidence of differences in labour market outcomes between women leaving school in economic contractions and expansions. However, we found that women with secondary or post-secondary education leaving school in a year of economic contraction had their first marriage earlier than those leaving school during an economic expansion, a potential indication that the former developed a weaker attachment to the labour market.

Economic contractions may have encouraged men with higher socio-economic status to remain longer at school until the economy improved, leading to positive selection into leaving school in good economic times. This mechanism, however, would result in a larger share of better-off individuals leaving school in good economic times and would therefore not explain why this group ended up in worse health than men living school in poor economic times. On the other hand, low unemployment rates may have encouraged poorer men to leave school and enter the labour market, which would lead to selection of the less well-off into leaving school in good economic times. Based on a Heckman approach, we found that this selection mechanism did not account for our results. However, we cannot discard that more complex selection mechanisms due to factors unmeasured in our study may account for our results. The fact that the most consistent negative effects of leaving school during contractions was observed for women of post-

secondary education, for which selection into further education is likely limited, suggests that results for the less-well educated cohorts may partly reflect selection.

4.5.3 Conclusions

Leaving school during economic contractions was associated with better physical functioning in old age among men but worse physical functioning among women. Results for men may reflect either selection effects or the direct impact of economic conditions on the adoption of behaviours. Among women, poor economic conditions in the year of leaving school may have negatively influenced their income and career prospects, leading to poor health. In 2011, 82% of women aged 25 to 34 in the European Union had secondary or tertiary education (Eurostat 2012a). If results for women prove to be causal, recent increases in unemployment may lead to increases in functional limitations decades alter among affected cohorts. Policies to prevent these negative effects on women may translate into long-term gains in health.

Chapter 5 The Long-Term Effects of Recessions During Early and Mid-Adulthood on Functional Health in Europe

5.1 Abstract

Several studies suggest that health improves during recessions, but these short-term improvements may be offset by lung-run cumulative negative effects of economic downturns on health. Linking data on macroeconomic fluctuations over the period 1946-2006 in 11 countries to individual-level data from three waves of the Survey of Health, Ageing and Retirement in Europe (SHARE) we examine whether recessions experienced at multiple periods during adulthood have long-lasting cumulative effects on health in later life. We estimate a country-fixed effect model to assess the impact of recessions experienced each decade of life at ages 16-49 on prevalence and longitudinal changes in limitations in Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) and low grip strength (GS) at ages 50-74. Contrary to previous research suggesting temporary improvements in health during recessions, results suggest that additional recessions experienced during adulthood are associated with increased risk of disability in later life.

5.2 Introduction

Over the last century, European populations have witnessed marked fluctuations in the economy including several major expansions and contractions. The recent recession has sparked interest in how these fluctuations in economic output affect population health. Up till now, no consensus exists on how economic cycles affect health with evidence for both a procyclical (increased mortality and worse health during good economic times) as well as a countercyclical effect (Catalano et al. 2010).

At the individual level, studies suggest that adverse events such as unemployment, job-loss and job-insecurity are associated with increased risk of depression and anxiety (Catalano et al. 2000; Dooley et al. 2000; Ferrie et al. 2001; Thomas et al. 2005), substance abuse (Eliason and Storrie 2009b; Falba et al. 2005; Gallo et al. 2001a; Janlert and Hammarström 1992), suicide (Fergusson et al. 2007; Kposowa 2001) cardiovascular disease (Gallo et al. 2004; Gallo et al. 2006) and obesity (Deb et al. 2011). In contrast, studies using population-level data have found economic contractions to be associated with decreases in substance use (Freeman 1999; Ruhm 1995) and violent behaviour (Catalano, Novaco and McConnell 1997), declines in suicide (Barstad 2008; Neumayer 2004), decreases in cardiovascular disease (Ruhm 2007) as well as in general mortality (Gerdtham and Ruhm 2006; Neumayer 2004; Ruhm 2000).

A common feature of these studies is that they focus on the short-term effects of economic conditions on health. Although some studies have shown negative effects of job displacement (Eliason and Storrie 2009a; Sullivan and von Wachter 2009), unemployment (Lundin et al. 2010) or economic insecurity (Ferrie et al. 1998) on health up to several years after exposure, very little attention has been paid to the potential cumulative effect of life-course experiences of recessions on late-life health. One exception are some studies analysing the effects of economic conditions around birth on subsequent mortality, generally showing that being born under adverse economic conditions may have long-lasting negative effects on health (van den Berg et al. 2011;

van den Berg et al. 2009). In these studies, birth or early childhood is mostly understood as a critical period in an individual's life with a particular biological sensibility to external influences and circumstances. One example is the so-called Barker-hypothesis (Barker 1998), which argues that reduced foetal growth as a result of maternal malnutrition during pregnancy may lead to increased risk of chronic conditions in later life. However, there is limited knowledge on critical periods beyond birth and how they may influence health outcomes later in life.

It has been argued that the determinants of health at old age need to be conceptualized in a life-course perspective (Bartley et al. 1997). This view, known as the accumulation hypothesis, postulates that risks gradually accumulate over the life-course, so that life-time experiences shape health and mortality outcomes at old age (Hallqvist et al. 2004; Wunsch et al. 1996). By focusing only on short-term effects, most previous studies on the effects of macroeconomic conditions on health ignore that most diseases in adulthood take years to develop and have complex aetiologies involving exposure over the entire life-course (Bartley et al. 1997), with clinical manifestations only evident at relatively old age. For example, risk factors such as tobacco and alcohol consumption have cumulative effects on chronic disease and may result in disability and poor health at old age, without any clinical manifestation during young and middle adult life.

As such, macro-economic conditions throughout the years of productive life, after school graduation and before retirement, may be crucial for the accumulation of an individual's health stock in later life. Moreover, economic recessions experienced around the early career years after entering the labour market, may have profoundly different effects than economic shocks experienced during mid-life or as individuals approach retirement age. For example, recent evidence suggests that cohorts that experience a major recession in the year of graduation from college experience less favourable career trajectories, higher job-instability, reduced earnings and less favourable working conditions in mid-life (Kahn 2010; Oreopoulos et al. 2012). Job-loss, job-insecurity and earnings are associated with increased risk of poor physical and mental health at old age (Gallo et al., 2004; Gallo et al., 2006), so that cohorts experiencing a recession leading to these outcomes may be at increased risk of disability

at old age. Similarly, recessions experienced in the years prior to retirement can affect labour force status and social security entitlements at ages 55-59, leading to lower incomes at age 70 and beyond (Coile and Levine 2011a).

This study aims to bridge the gap between studies focusing on the short-term effects of economic cycles on population-health on the one hand and those studies on long-term health-effects of individual experiences of unemployment or job loss on the other hand. Linking data on macroeconomic cycles during the period 1946-2006 to individual data for 11 countries participating in the Survey of Health, Ageing and Retirement in Europe (SHARE), we examine whether cumulative exposure to economic recessions during early and middle age (16-49 years) has long-lasting effects on health at ages 50 to 74. This exposure period covers major critical life-course events potentially influenced by macroeconomic shocks including entrance into the labour market, leaving the parental home, the establishment of own residence, family formation and the transition into parenthood (Bartley et al. 1997). We focus on an extensive set of measures of old-age physical disability and functioning, including grip strength as an objective measure of health at old age. These measures form the basis for measuring disability free-life expectancy and are key indicators in studies assessing the expansion of morbidity theory (Vita et al. 1998). They are also of crucial importance for policy-making as disability trends are an integral part of social care need assessments. In addition, we examine longitudinal changes in these outcomes over the follow-up period. Finally, we also explore the relationship between recessions experienced during adulthood and potential mechanisms linking the former with later life health such as labour market trajectories, marital status and health behaviours. Our dataset allows us to control for a broad range of potential cofounders and mediators such as childhood health and socio-economic circumstances, educational attainment, income, wealth and health behaviour.

5.3 Methods

5.3.1 Individual-level data

SHARE is a longitudinal survey designed to provide comparable information on the health, employment and social conditions of Europeans aged 50+. Detailed information

about the methodology is available elsewhere (Börsch-Supan and Jürges 2005; Börsch-Supan and Schröder 2011a; Börsch-Supan and Schröder 2011b; Schröder 2011). Nationally representative samples in 13 European countries were drawn either from national or regional population registries, or from multi-stage sampling in Northern Europe (Sweden and Denmark), Western Europe (Austria, France, Germany, Switzerland, Belgium, and the Netherlands), Southern Europe (Spain, Italy and Greece) and Eastern/Central Europe (Poland and the Czech Republic), as well as Ireland and Israel. Participants in each country were interviewed in 2004/05 and subsequently re-interviewed in 2006/07 and 2008/09. With the exception of Austria and the Dutch-speaking part of Belgium, the second wave in 2006/07 also included a refresher sample. Interviews were face-to-face and took place in the household using structured computerized questionnaires. Expert agencies translated items, with extensive pre-testing to ensure comparability. Response rates varied from country to country, but overall household response at enrolment was 62% (Börsch-Supan and Jürges 2005; Börsch-Supan and Schröder 2011a; Börsch-Supan and Schröder 2011b; Schröder 2011).

We included respondents who completed the retrospective life-histories expanding through early childhood until last interview assessed in 2008/09, and who had enrolled in the study in either 2004/05 or 2006/07. Data from the Czech Republic and Poland were not included due to lack of comparable data on GDP before 1990. In addition, Ireland and Israel were excluded because they did not participate in the life history interview. The total sample included 20,780 participants in 11 Western European countries. We restricted the sample to participants aged 50 to 74 years at study entry and born between 1930 and 1956 (N=14,754) and excluded individuals with missing information on relevant health outcomes (n=4), childhood-health (n=188), socio-economic conditions (n=321), sampling weights (n=41) or control variables (n=267). The final sample included 13,933 men and women from 11 countries.

5.3.2 Health outcomes

5.3.2.1 Physical functioning and disability

Measures of functional status (Tsae-Jyy 2004) and disability included the following indicators: the Katz Activities of Daily Living (ADL) scale assessed difficulties with six basic self-care tasks (bathing, dressing, toileting, transferring, continence, and eating) (Katz et al. 1970); the index of Instrumental Activities of Daily Living (IADL) assessed difficulties with more advanced activities (using a map, preparing hot meals, shopping, telephone use, taking medications, housekeeping tasks, and managing money) (Lawton and Brody 1969). To identify individuals who were functionally disabled we derived two binary variables, indicating whether an individual suffered from one or more limitations in ADL or IADL. Measures were taken from the first interview; for longitudinal analyses, measures in the first (2004/05) and second (2006/07) interview waves were used.

5.3.2.2 Maximum hand grip strength

Hand grip strength (GS) is an objective measure of physical performance measure that is less susceptible to the biases inherent to self-reports (Rantanen et al. 1999), and it is a strong predictor of disability (Rantanen et al. 1999), morbidity (Kuh et al. 2005; Milne and Maule 1984) and mortality (Gale et al. 2007) at older ages. We used the maximum value (measured in kilogram) of all measurements of grip strength in both hands (Survey of Health Ageing and Retirement in Europe 2006). To adjust for country and gender differences in GS, we calculated country and gender specific quartiles of GS. To identify disabled individuals we derived a binary variable indicating whether individuals' GS fell in the lowest quartile or in a higher one. 564 individuals in our sample had missing or invalid data on GS. Therefore, we applied multiple imputation methods (Rubin 1987; Yuan 2000) to impute GS based on a model that regressed GS on all available covariates.

5.3.2.3 Individual level controls

All models include controls for sex, age, country of birth and if a respondent was born before or after 1945, the end of the Second World War (WWII). We furthermore control

for childhood socio-economic status using two measures: (a) the number of books in the parental home at age 10; and (b) the occupation of the main breadwinner at age 10, collapsed into four major categories of the International Standard Classification of Occupations (ISCO) (low skilled blue collar-, high skilled blue collar-, low skilled white collar- and high skilled white collar-worker). In addition, we incorporate two measures of childhood health: (a) self-rated health (SRH) during childhood based on a binary variable distinguishing fair/poor from excellent/good/very good; (b) self-reported diagnosis of major childhood-illnesses, reclassified into two binary indicators capturing whether the respondent suffered any major infectious or non-communicable condition as a child. The choice of controls was mainly based on the idea that they are strong predictors of health at later-life, but largely determined before the start of the exposure.

In additional models, we also control for socio-economic status and health behaviours in later life, including: (a) educational attainment, based on three broad categories from the International Standard Classification of Education (ISCED); (b) country-specific quartiles of households net wealth; (c) being a heavy drinker (drinking $\geq$2 glasses a day); (d) current smoking; and (c) body mass index (BMI), estimated based on self-reported body weight divided by the square of self-reported height (kilograms/meters^2).

Table 15. Descriptive statistics

Variable	n [mean]	% [SD]	Variable	n [mean]	% [SD]
N=13,933					
Health outcomes			Education		
ADL (>=1 limitations)	657	4.72	Primary education	5,961	42.78
IADL (>=1 limitations)	1106	7.94	Secondary education	4,287	30.77
Grip strength (Kg)			Post-secondary education	3,685	26.45
Men	[46.73]	[9.24]	Current smoker (yes)	3,284	23.57
Women	[28.63]	[6.65]	Drinking ≥2 glasses a day (yes)	1,471	13.49
Sex			Household net wealth (Euro/PPP)	[141,977]	[181,682]
Male	6,374	45.75	BMI	[25.61]	[5.97]
Female	7,559	54.25	Major injury during adulthood (yes)	1,726	12.39
Age	[62.87]	[6.17]	Experience of periods of financial hardship during adulthood (yes)	4,625	33.19
Age 50-54	1,300	9.33	Country (at birth)		
Age 55-59	3,447	24.74	Austria	465	3.34
Age 60-64	3,494	25.08	Belgium	1,713	12.29
Age 65-69	3,119	22.39	Denmark	1,432	10.28
Age 70-74	2,573	18.47	France	1,225	8.79
WWII (born after 1945)	6,438	46.21	Germany	1,217	8.73
Bad SRH as child (yes)	1,104	7.92	Greece	1,815	13.03
Childh. infectious diseases (yes)	11,917	85.53	Italy	1,654	11.87
Childh. physical injuries (yes)	3,764	27.02	Netherlands	1,434	10.29
No. of books at home			Spain	1,104	7.92

Variable	n [mean]	% [SD]	Variable	n [mean]	% [SD]
N=13,933					
None or very few (0-10 books)	5,687	40.82	Sweden	1,119	8.03
Enough to fill one shelf (11-25 books)	3,160	22.69	Switzerland	738	5.30
Enough to fill one bookcase (26-100 books)	3,152	22.62	Non-employed (once btw. ages 16-49)	6,406	45.98
Enough to fill two bookcases (101-200 books)	961	6.90	Working part-time (once btw. ages 16-49)	2,539	18.22
Enough to fill two or more bookcases (200+ books)	973	6.98	Laid-off/Plant closure (once btw. ages 16-49)	959	6.88
Main breadwinner ISCO			Work fluctuated (once btw. ages 16-49)	2,611	18.74
Low skilled blue collar	3,809	27.34	Married (at time of interview)	7,780	55.84
High skilled blue collar	6,249	44.85			
Low skilled white collar	1,997	14.34			
High skilled white collar	1,878	13.48			

Abbreviations: SD, standard deviation; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; GS, grip strength; Kg, kilogram; ISCO, International Standard Classification of Education; SRH, self-rated health; BMI, body mass index; PPP, purchasing power parities.

5.3.3 Potential mechanisms

To explore potential mechanisms which could explain the effects of recessions on health in later life, we assessed whether recessions at ages 16 to 49 were related to a series of unfavourable labour market outcomes, health behaviours as well as marital status, which have been previously linked to health outcomes. Data on employment histories were derived from the 2008/09 wave (SHARELIFE) and covered the entire adult life starting from age of leaving full-time education until year of interview or exit from the labour market. Using this life-grid History Event Calendar, individuals were asked to report each paid job that lasted for 6 months or more. For each job, participants reported the year the job started; the occupation that best described the job based on the ISCO-88; whether job was part- or full-time; changes between part- and full-time during each job spell, and year and reason the job ended. We constructed a database indicating for every age between 16 and 49 whether an individual was working, and, across different age categories, indicators of (a) multiple changes between full-time and part-time in a single job spell (as opposed to permanently working full- or part-time); (b) permanently working part-time in a given job; (c) job loss due to lay-off or plant/office being closed down at least once; (d) employment gaps due to reasons other than lay-off or plant/office being closed down. We furthermore included measures of current status at baseline including information on whether respondents were currently married, currently smoked or were heavy drinkers (drinking $\geq$2 glasses a day) at the time of interview. We then linked this information with data on the number recessions individuals experienced every decade of life.

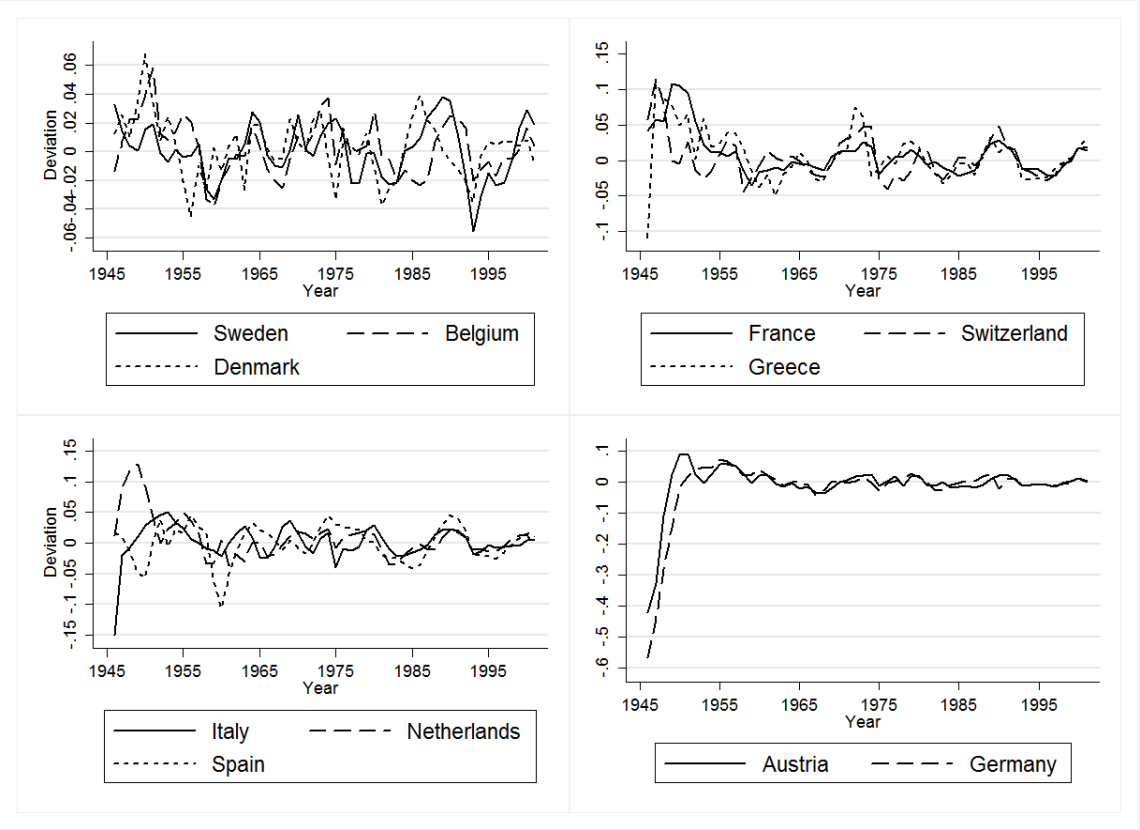
5.3.4 Data on economic cycles

Studies typically use Gross Domestic Product (GDP) or unemployment rates to measure business cycles. Although it would be desirable to use both indicators, comparable information on unemployment rates for the relevant countries is only available from the year 1956 onwards, while relevant exposure typically started decades before this period. Therefore, we focus on GDP as indicator of the business cycle because comparable data are available for extended series covering the entire 20th century.

We use historical time-series data on annual GDP and GDP per capita in constant prices obtained from 'The World Economy: A Millennial Perspective' studies (Maddison 2006; Maddison and Centre 2003). This database was constructed by Angus Maddison for the Organisation of Economic Cooperation and Development (OECD) and covers the last 2000 years up to the year 2006, providing the most comprehensive dataset of historical trends in GDP (Federico 2002).

For cohorts aged between 50 and 74 in 2004-2007, the relevant lifetime period of exposure to economic fluctuations covers the years 1930-2006, although the earliest exposure of any respondent to the business cycle at age 16 was the year 1946. Since then, GDP has been steadily increasing in the European countries included. However, our exposure of interest is the business cycle, namely the repeated sequences of economic expansions and recessions. Therefore, we separated the cyclical component from the increasing secular trend in the log of GDP per capita for each country using a Hodrick-Prescott Filter (HP) (Hodrick and Prescott 1997), an approach widely applied in the analysis of business cycles. The HP-Filter separates the cyclical component of a time-series from its general trend by estimating the annual deviation from a smoothed curve that captures the trend. We used a smoothing parameter of 100, but results were very robust to alternative parameters. A positive deviation from the smoothed trend indicates an increase in the log of GDP with respect to the smoothed trend, while a negative deviation signals the reverse. Figure 3 shows the deviations from the trend in the 11 European countries included in our sample.

Figure 3: Deviations from the trend in (log) GDP per capita in 11 European countries since 1945



Note: The Figure shows the deviations from the smoothed trend in (log) GDP per capita.

To derive information on individual exposure to recessions over the life-course, we implemented the following steps: Based on the approach previously used by Doblhammer et al. (2011), we converted the cyclical component for each country into quartiles distinguishing different stages of the business cycle. For each country, a year in which the annual deviation from the trend in GDP fell in the lowest quartile was classified as a recession. Since the quartiles apply to the years 1946-2006. Table 16 shows the country-specific minimum and maximum deviations from the trend in (log) GDP per capita to be counted as a recession.

Table 16: Country specific descriptives

Country		ADL (>=1)		IADL (>=1)		GS (low)		Recessions (deviations)	
		n	*%*	*n*	*%*	*Mean*	*SD*	*Min.*	*Max.*
Austria		30	6.45	46	9.89	37.91	11.20	-0.420	-0.012
Belgium		112	6.54	160	9.34	37.72	12.12	-0.038	-0.012
Denmark		65	4.54	95	6.63	38.71	12.33	-0.046	-0.009
France		72	5.88	80	6.53	36.50	11.91	-0.035	-0.013
Germany		59	4.85	71	5.83	39.00	12.00	-0.565	-0.011
Greece		57	3.14	137	7.55	35.64	11.69	-0.109	-0.020
Italy		74	4.47	125	7.56	34.36	11.50	-0.150	-0.012
Netherlands		49	3.42	144	10.04	38.83	11.95	-0.037	-0.011
Spain		72	6.52	133	12.05	32.05	11.41	-0.107	-0.019
Sweden		37	3.31	74	6.61	37.95	12.03	-0.055	-0.015
Switzerland		30	4.07	41	5.56	38.01	11.47	-0.044	-0.017

Abbreviations: ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; GS, grip strength; SD, standard deviation.

Note: Recessions were defined as deviations from the trend in (log) GDP per capita which fell in the lowest country-specific quartile over the period 1946-2001.

We then linked this information to individual records from SHARE based on the year at every age since birth and the country of birth. The result was a dataset indicating whether an individual experienced a recession at every single age 16 up to age 49. We choose this upper age bound because SHARE participants enrolled at age 50 or older, and because the series stopped in 2006, so that 49 was the highest age for which comparable information on GDP was available for most individuals.

We used yearly information on life-time exposure to the business cycle to create a variable measuring exposure to recessions during consecutive decades of life from age 16 until age 49. For this purpose, we created a set of variables each indicating the number of recessions an individual experienced at ages 16-24, 25-34 and 35-44. The last interval, 45-49, was included as a separate period. The maximum number of recessions experienced during the first three intervals is thus 10 and 5 for the last interval (45-49).

Age 16 was chosen as lower limit as it is widely considered as the beginning of early-adulthood. As such, it is generally the earliest age at which individuals usually enter the labour market and leave the parental home. The classification of the specific age-intervals was done in order to identify age-periods of particular sensitivity to macro-economic conditions as well as to distinguish between early- and later-adulthood.

5.3.5 Statistical analysis

We used logistic regression to model the probability of reporting one or more limitations with ADL and IADL and the probability of falling in the lowest country- and sex-specific quartile of GS. In sensitivity analyses we also estimated all models using Poisson and negative binominal models for ADL as well as IADL but found qualitatively similar results. To control for constant differences across countries that could bias estimates, we estimated a country-fixed effect model exploiting within-country variation across cohorts. The basic model was of the following form:

$$\log\left[\frac{P(Y_i=1)}{1-P(Y_i=1)}\right]=\alpha_i+\overline{X}_i\beta_1+\overline{R}_{ct}\beta_2+C_c\beta_3+\varepsilon_i$$

Where $P(Y_i=1)$ is the probability of having one or more limitations in ADL or IADL, two or more mobility limitations or for falling in the lowest sex- and country-specific quartile of GS for individual *i*, α_i is the intercept, $\overline{X}_i$ is a matrix of individual-level controls, $\overline{R}_{ct}$ is a matrix of indicators for the number of recessions at each age interval in country *c* experienced at age *t*. The country-fixed effect C_c controls for all unmeasured differences across countries such as institutional characteristics, economic development or levels of health and ε_i is the error term.

One assumption of our identification strategy is that the prevalence of functional limitations and GS change linearly in the age interval from 50 to 74. Although prevalence of disabilities has been shown to increase exponentially after age 75, until this age, it increases very linearly by age (Beckett et al. 1996; Manton, Stallard and

Corder 1997). Accordingly, differences in functional status between older individuals, for which the time-interval between exposure to the business cycle (at ages 45-49) and health-assessment is longer, and younger individuals, for who the interval is shorter, should be captured by this term. To check the sensitivity of the results to this specification we also entered age as an exponential term as well as in the form of 5-year age-splines but found that the main results were qualitatively similar.

Our sample combines individuals interviewed for the first time in 2004/05 and around 25% interviewed in 2006/07. Having first-time respondents interviewed in these two waves means that we observe individuals from the same country with the same age who experienced different stages of the business cycle at different points of the life-course. This is an improvement over an approach based only on a cross-sectional sample for each country. The advantage of this approach is that the number of recessions experienced at specific ages is not fully determined by the year of birth.

Analyses were first conducted for the entire sample and subsequently stratified according to gender to examine differential effects for these groups. Regression estimates were exponentiated to obtain odds ratios (OR).

The primary analysis focused on disability outcomes as measured at study enrolment. In addition, we examined whether recessions experienced at ages 16-49 were associated with longitudinal changes in disability outcomes and GS over a two-year follow-up period. Changes were defined as the onset of a new limitation with ADL or IADL between waves 1 and 2. For GS, change was defined as the probability of moving to a lower country- and sex-specific quartile during the follow-up.

A potential concern is non-response and sample attrition bias. Therefore, all analyses were conducted using calibrated sampling weights to account for the potential selectivity bias generated by unit nonresponse and sample attrition (De Luca and Claudio 2011). Based on the procedure by Devile and Sarndal (1992), weights were designed to match the size of national populations of individuals born in 1956 or earlier that survived up to 2008 (De Luca and Claudio 2011). Weights also accounted for mortality of the target

population between the second and the third waves by using estimates of mortality rates obtained from life tables.

5.4 Results

Table 15 shows basic characteristics of the sample for the European countries included. Mean age was 63 and 54% of the sample was female. 43% of the sample had only primary education, while 26% had post-secondary education. 5% had experienced at least one limitation with ADL and 8% with IADL. Mean GS (in kg) was 46.7 for men and 28.6 for women. Table 16 also shows the country-specific prevalence of limitations in ADL, IADL as well as low GS at ages 50-74.

Table 17 shows odds ratios of the impact of experiencing an additional recession during each decade of life, controlling for sex, age, being born before or after WWII, educational attainment, childhood health and socio-economic conditions during childhood. The number of recessions experienced at any age period between ages 25 and 49 were associated with poorer health for at least one of the outcomes examined. For example, each additional recession experienced at ages 35 to 44 was associated with a 26% increase in the odds of having at least one limitation with ADL, a 18% increased odds of reporting one or more limitations in IADL as well as a 4% increased odds of falling in a lower GS quartile at ages 50-74. Furthermore, each additional recession experienced at ages 25-34 was associated with an average increased risk of reporting limitations in IADL (OR=1.12). At ages 45-49 each additional recession were associated with an increased risk of limitations in ADL (OR=1.33) as well as for low GS (OR=1.01). Negative effects for at least one outcome were observed in all age-periods from 25 to 49, suggesting that recessions experienced at any age during this period can have long-run cumulative effects on functional health.

Table 17: Exposure to recessions during early- and late-adulthood and later life physical functioning for men and women in 11 western European countries

	ADL (>=1)	IADL (>=1)	Low GS
	OR		
Recessions 16-24	1.026	1.086	1.044
Recessions 25-34	1.047	1.121**	0.994
Recessions 35-44	1.260**	1.187**	1.041*
Recessions 45-49	1.330*	1.062	1.016*
Female	0.857	1.733*	1.238***
Age	1.019	1.060***	1.128***
WWII (born before 1945)	1.016	0.677	0.811*
Education (ref.: primary)			
Secondary education	0.664***	0.698*	0.819**
Post-secondary education	0.344**	0.411***	0.780**
Bad SRH as child	2.022***	1.951***	1.230*
Childhood infectious diseases	0.686**	0.762	0.840
Childhood physical injuries	1.463	1.253***	1.127***
No. of books at home (ref.: None or very few (0-10 books)			
Enough to fill one shelf (11-25 books)	0.651	0.858	1.005
Enough to fill one bookcase (26-100 books)	1.134	0.879	0.971
Enough to fill two bookcases (101-200 books)	1.851*	1.217	0.893*
Enough to fill two or more bookcases (more than 200 books)	1.06	0.921	0.847*

	ADL (>=1)	IADL (>=1)	Low GS
Main breadwinner ISCO (ref.: low skilled blue collar worker)			
High skilled blue collar worker	0.722	0.878	0.969
Low skilled blue white worker	0.693	0.754	1.045
High skilled blue white worker	0.540***	0.922	1.074

* p<0.05, ** p<0.01, *** p<0.001

Abbreviations: OR, odds ratio; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; GS, grip strength; ISCO, International Standard Classification of Occupations.

Note: All models include country fixed effects but estimates are excluded from the table.

Table 18 shows estimates from a model that further incorporates potential explanatory variables associated with disability at old age. Current smoking was significantly associated with lower odds of having low GS, while being a heavy drinker (drinking $\geq$2 glasses a day) was not significantly associated with any disability outcomes. Higher financial wealth protected against limitations with all activities and was associated with lower odds of having low GS. Higher BMI was associated with more limitations with ADL and IADL. Major injuries and periods of financial hardship experienced during adult life were strongly associated with more disability limitations old age. Nevertheless, including these additional controls did not attenuate most estimates for the association between recessions and functional health.

Table 18: Exposure to recessions during early- and late-adulthood and later life physical functioning for men and women in 11 Western European countries (including additional controls)

	ADL (>=1)	IADL (>=1)	Low GS
		OR	
Recessions 16-24	1.025	1.099	1.046
Recessions 25-34	1.034	1.202	1.034
Recessions 35-44	1.265***	1.187	1.098**
Recessions 45-49	1.349*	1.038	0.992
Female	1.044	1.837*	1.224***
Age	1.016	1.033*	1.114***
WWII (born before 1945)	1.205	0.908	0.914
Education (ref.: primary)			
Secondary education	0.808	0.703	0.875*
Post-secondary education	0.429***	0.482***	0.885*
Bad SRH as child	1.847**	1.467**	1.152
Childhood infectious diseases	0.755*	0.835	0.816*
Childhood physical injuries	1.192	1.255***	1.058
No. of books at home (ref.: None or very few (0-10 books)			
Enough to fill one shelf (11-25 books)	0.724	0.813	0.911
Enough to fill one bookcase (26-100 books)	1.113	0.811	0.926*
Enough to fill two bookcases (101-200 books)	1.204	0.829	0.660***
Enough to fill two or more bookcases (more than 200 books)	0.757	0.822	0.747***

	ADL (>=1)	IADL (>=1)	Low GS
Main breadwinner ISCO (ref.: low skilled blue collar worker)			
High skilled blue collar worker	0.808	0.882	0.896***
Low skilled blue white worker	0.579***	0.595**	1.012
High skilled blue white worker	0.823	1.017	1.080
Currently smoking (yes)	1.515	1.056	0.896*
Heavy drinker (drinking ≥2 glasses a day)	1.132	0.897	1.041
Household net wealth (ref.: 1st quartile)			
2nd quartile	0.562***	0.810*	0.748***
3rd quartile	0.566***	0.723***	0.695***
4th quartile	0.665	0.640*	0.672***
BMI	1.098***	1.031**	0.988
Major injury during adulthood	2.666***	2.415***	1.271**
Experience of periods of financial hardship during adulthood	1.041	0.986	1.107*

* p<0.05, ** p<0.01, *** p<0.001

Abbreviations: OR, odds ratio; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; GS, grip strength; ISCO, International Standard Classification of Occupations.

Note: Odds ratios are from a single model controlling for all covariates listed and including country fixed effects but estimates are excluded from the table.

Table 19 presents results stratified by sex. For all age periods between ages 25-49, each additional recession was associated with at least one worse health outcome among men. Among women, associations of recessions with at least one health outcome were observed at all ages from 16 to 49. Overall, the stratified results suggest that recessions experienced in adult life had an effect on late-life health among both men and women. However, the negative long-term effect of recessions on health appears to be more consistent for women than for men.

Table 19: Exposure to recessions during early- and late-adulthood and later life physical functioning for men and women in 11 western European countries (for men and women separately)

	Men		
	ADL (>=1)	**IADL (>=1)**	**Low GS**
	OR		
Recessions 16-24	0.903	1.029	0.976
Recessions 25-34	1.240**	1.303*	0.974
Recessions 35-44	1.368**	1.302	1.023
Recessions 45-49	1.336	0.896	1.011*
	Women		
	ADL (>=1)	**IADL (>=1)**	**Low GS**
	OR		
Recessions 16-24	1.180***	1.102	0.999
Recessions 25-34	1.191*	1.179***	1.056
Recessions 35-44	1.273**	1.141*	1.037
Recessions 45-49	1.379*	1.144	1.023*

* p<0.05, ** p<0.01, *** p<0.001

Abbreviations: OR, odds ratio; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; GS, grip strength.

Note: All models include the same covariates as included in Table 17 as well as fixed effects for country but estimates are excluded from the table.

5.4.1 Longitudinal changes in functional health

Table 20 shows the effect of economic recessions at ages 16-49 on the onset of a new limitation and a decline in GS over a two-year follow-up. Overall, longitudinal results for recessions support findings based on assessments at enrolment. For at least one outcome, recessions experienced at ages 16-24, 35-44 and 45-49 increased the onset of a new limitation at old age over a two-year follow-up. There was a particularly strong relationship between recessions in late adulthood and later life physical limitations. For example, each additional recession at ages 35-44 increased the odds of a new ADL limitation over a two-year period by 26%, and by 48% if experienced at ages 45-49.

Results for grip strength suggest that recessions experienced at ages 16-24 are also associated with increased risk of declining GS function. We explored to what extent these results may be due to changes in the distribution of country- and sex-specific quartiles of GS across waves rather than individual-level declines in function using changes in z-scores of GS (in kg) calculated using baseline means and standard deviations (results not shown). Although confidence intervals were wider, results from this analysis generally showed the same pattern as for changes in the probability of falling in the lowest quartile of GS.

Table 20: Recessions during early- and late-adulthood and worsening of physical health for men and women in 11 western European countries

	ADL(+)	IADL(+)	GS(-)
		OR	
Recessions 16-24	1.138	1.142*	1.131*
Recessions 25-34	0.985	0.969	1.053
Recessions 35-44	1.262***	1.192***	1.047
Recessions 45-49	1.478***	1.277**	1.036

* p<0.05, ** p<0.01, *** p<0.001

Abbreviations: OR, odds ratio; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; GS, grip strength.

Note: The table shows the OR associated with increases in limitations in ADL or IADL between wave 1 and wave 2. For GS the table shows the OR for being in a lower country- and sex-specific quartile at wave 2 compared to wave 1. Individuals who already reported the highest number of limitations at wave 1 or who were in the lowest quartile of GS were excluded from the analysis. All models include controls for time elapsed between wave 1 and 2 and the first and second observation (for GS) respectively, the same covariates as included in Table 18 as well as fixed effects for country but estimates are excluded from the table.

5.4.2 Exploration of mechanisms

Table 21 shows the results of separate regressions using various potential mechanisms as outcomes and the number of recessions experienced at ages 16-49 as main predictor. All models thereby include the same controls as shown in Table 18.

The results show that recessions are linked to a number of unfavourable labour market outcomes. For example, each additional recession at ages 45-49 increases the risk of being non-employed during at least one spell at ages 45-49. Furthermore, recessions at ages 35-44 as well as at ages 45-49 significantly increase the likelihood of working part-time as well as experiencing fluctuations in the working time for at least one spell during the respective age-interval. We also find evidence that recessions experienced at ages 35-44 increase the risk of being laid-off or experiencing a plant-closure during the same age-interval.

Looking at the relationship between the number of recessions at ages 16-49 and current status at the time of interview (ages 50-74), the results suggest that each additional recession at ages 35-49 significantly decreases the likelihood of being married. Regarding health behaviours, we find evidence suggesting that recessions at ages 35-44 increase the risk of being a heavy drinker at ages 50-74, whereas recessions at ages 16-24 appear to significantly reduce the risk of smoking at ages 50 to 74.

Table 21: Recessions during early- and late-adulthood and labour market outcomes, marital status and health behaviours for men and women in 11 western European countries

	Age-bracket	OR
Non-employed (at least one spell)	16-24	0.99
	25-34	0.96
	35-44	0.99
	45-49	1.15*
Working part-time (at least one spell)	16-24	1.01
	25-34	1.10
	35-44	1.19**
	45-49	1.22***
Laid-off/Plant-closure (at least one spell)	16-24	0.96
	25-34	0.93
	35-44	1.18*
	45-49	1.09
Work-time fluctuations (at least one spell)	16-24	1.00
	25-34	1.05
	35-44	1.19*
	45-49	1.16*
Married (current)	16-24	1.03
	25-34	1.06
	35-44	0.94*
	45-49	0.88**
Heavy drinking (current)	16-24	0.99
	25-34	0.98
	35-44	1.08**
	45-49	1.19
Smoker (current)	16-24	0.93*
	25-34	1.00
	35-44	0.96
	45-49	0.95

* p<0.05, ** p<0.01, *** p<0.001
Abbreviations: OR, odds ratio.

Note: All models include the same covariates as included in Table 17 as well as fixed effects for country but estimates are excluded from the table.

5.5 Discussion

5.5.1 Summary

Some studies suggest that, on the population-level, health temporarily improves during recessions while deteriorating during economic upturns. Our findings are in sharp contrast with these findings and suggest that any short-term positive effects of recessions are offset by negative long-run effects manifesting at old age. Based on macro-economic data linked to representative surveys for 11 European countries, we were able to show that each additional recession experienced at any age period between 16 and 49 years is associated with worse health outcomes in old age. Results were consistent for both self-reported disability as well as objectively measured GS, and for disability levels as well as longitudinal changes. While these effects exist for men and women, economic recessions were particularly harmful for the long-term health of women. Our findings support the hypothesis that accumulated experiences of economic downturns over the life-course can have long-lasting effects leading to poor health at old age, raising important questions on the potential mechanisms linking the economy to health in the long-run.

5.5.2 Limitations

A strength and innovation of this study is the focus on long-run health effects of recessions experienced over a critical period of adult life. The rich individual data from SHARE also allowed us to control for a broad set of individual-level socio-economic characteristics as well as potential mechanisms linking economic cycles to health. Despite these strengths, some limitations and potential sources of bias should be considered.

Recall bias on early life variables is a potential concern. Respondents may inaccurately report on events that occurred several decades earlier, and recall bias may be differential. Although retrospective information on complex behaviours such as diet may indeed be inaccurate, studies indicate a level of agreement of around 80-90% between data from life-history event questionnaires and population registries for the timing of major events related to employment, health and marriage (Blane et al. 1990; Blane 1996; Courgeau

and Lelievre 1992). These errors have been shown to have a relatively minor effect on estimates (Blane 1996; Courgeau and Lelievre 1992). In addition, business cycles, our main variable of interest, were assessed using external data and were therefore not influenced by recall bias.

Another concern is non-response and sample attrition bias. We conducted all analyses using calibrated sampling weights that account for nonresponse, attrition and mortality between waves (De Luca and Claudio 2011). Nonetheless, selective mortality associated with experiences before enrolment is of potential concern, as those suffering most from the negative impact of economic downturns may not have survived to old age. Although we have no direct ways to account for this in our data, mortality selection is likely to be most important at relatively old ages. In supplementary models, therefore, we estimated effects for the age-group 50 to 64 only, which would presumably be less affected by premature mortality than older age groups. Results for this group were very consistent and showed the same pattern as for ages 50 to 74, suggesting that selective survival may not fully account for our results.

Our approach assumes that macroeconomic conditions are exogenous to the health of individuals. However, bias would occur if cohorts were different in other aspects other than their life-time experiences of recessions. We therefore conducted supplementary analysis additionally including fixed-effect for single years of birth or 5-year birth cohorts to the models presented in Table 17. Although the effects of recessions on GS were not significant anymore, the results for ADL as well as IADL revealed a pattern consistent with our main results shown in Table 17 (Table 22). Although we cannot control for all differences across cohorts within each country, these findings suggest that our results are not explained by differences that have affected cohorts in all countries.

Table 22: Sensitivity analyses including year of birth and cohort fixed-effects

	ADL	IADL	Low GS
Including fixed effects for single years of birth		OR	
Recessions 16-24	1.040	1.073	1.018
Recessions 25-34	1.050	1.161**	0.958
Recessions 35-44	1.295**	1.181*	1.020
Recessions 45-49	1.373*	1.059	1.008
Including fixed effects for 5-year birth cohorts			
	ADL	**IADL**	**Low GS**
Recessions 16-24	1.040	1.088	1.020
Recessions 25-34	1.058	1.178***	0.955
Recessions 35-44	1.316**	1.167*	1.033
Recessions 45-49	1.443***	1.031	1.040

* p<0.05, ** p<0.01, *** p<0.001
Abbreviations: OR, odds ratio; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; GS, grip strength.

Note: All models include the same covariates as included in Table 17 as well as fixed effects for country of birth but estimates are excluded from the table.

We use a non-parametric approach to identify recessions, based on previous studies using quartiles of deviations or their sign to determine the state of the business cycle (van den Berg et al. 2011; van den Berg et al. 2009). However, this approach does not make it possible to distinguish the exact magnitude of a recession, and treats every recession equally as long as it fell in the lowest or highest country-specific quartile of deviations from the national trend in GDP. On the other hand, our approach clearly identifies those periods which were economically less favourable.

To further assess the robustness of our results, we also conducted an extensive set of analysis with additional controls and alternative specifications. To check the sensitivity of the results to the classification of age-intervals, we used recessions at single ages as well as recessions experienced during 5-year age-periods as alternative indicators. To check the sensitivity of our results to the use of logistic regression models, we re-estimated all models using a Poisson model for ADL and IADL and a linear model for GS. To assess whether health was affected by current economic conditions or conditions before age 16, we also controlled for the existence of a recession at the time of interview as well as recessions at ages 0 to 15. Finally, to relax the assumption of a linear age-trend in the prevalence of functional disability, we also estimated models using 5-year age-splines as well as an exponential age-term instead of the linear term. In all these specifications, the overall pattern was very similar to that observed in our main models.

5.5.3 Explanation of results

To our knowledge, this is one of the first studies to examine the long-term effects of macroeconomic conditions in early- and middle-age on late-life health. Our findings are in agreement with previous studies suggesting that individual factors associated with economic recessions, particularly job loss and job insecurity, are associated with poor health outcomes in later life (Catalano 1991; Eliason and Storrie 2009a; Lundin et al. 2010; Sullivan and von Wachter 2009). In addition, our results might also reflect the influence of economic downturns via mechanisms other than unemployment, including influences on health-related behaviours such as smoking and alcohol use; increased

chronic stress associated with economic uncertainty; and reduced life-time opportunities for income and wealth accumulation as well as occupational upward mobility.

Although the size of our sample prevents us from a detailed analysis of the relationship between recessions and potential mechanisms, several pieces of existing evidence suggest that behavioural mechanisms may offer a partial explanation. Previous studies suggest that adverse financial circumstances and job loss can decrease resources for healthy behaviours such as exercise and nutrition, and may trigger use of alcohol or drugs as a coping mechanism to face adversity (Catalano et al. 2010). Evidence also suggests that higher unemployment rates are associated with increased substance use (Gascon and Spiller 2009). The impact of risk factors such as smoking and alcohol use on chronic disease risk is cumulative, operating over long aetiological periods with clinical outcomes manifesting relatively late in life (Kuh and Ben-Shlomo 2004; Wadsworth 1997). Repeated exposures to economic downturns may ultimately lead to poorer behavioural outcomes, which in the long-run may lead to faster health deterioration in old age.

Previous studies suggest that health and mortality temporarily improves during economic downturns, while worsening during economic upturns (Barstad 2008; Freeman 1999; Neumayer 2004; Ruhm 1995). Some studies suggest that economic downturns may lead to positive changes in health-related behaviour by temporarily reducing obesity, smoking and physical inactivity (Ruhm 2005). In addition, economic downturns may also reduce the risk of working in hazardous conditions, working extended hours and job-related stress (Catalano et al. 2010). Our results suggest that the potential temporary positive health effect of economic downturns may be largely offset by the cumulative detrimental effect of repeated experiences of economic downturns over the life-course. For instance, excessive drinking may temporarily decrease during economic downturns. However, over the long-run, the social and economic cost associated with a life-time of difficult macroeconomic circumstances may lead to higher risk of chronic excessive alcohol consumption. Given the complex aetiology of chronic diseases (Bartley et al. 1997) likely to lead to disability, it is likely that health in later life will be determined more by permanent behaviours than short-term fluctuations in behaviour. A

similar argument can be made with regard to the effect of cyclical upturns on working conditions. While economic booms may temporarily increase the fraction of the population working and therefore potentially exposed to hazardous working conditions, over the long-run, the benefits of job tenure may offset these effects and result in better late-life outcomes for those who experienced lives under more favourable job market conditions.

Another important explanation lies in the relationship between permanent income and wealth effects of recessions and health. Each additional recession experienced over the life-course may reduce life-time earnings by directly influencing job opportunities or the number of hours worked. A macroeconomic shock experienced at middle-ages can also lead to substantial drops in housing wealth, influencing life-time accumulation of financial resources to finance consumption at old age and maintain living standards (Banks et al. 2012; Gist, Figueiredo and Verma 2012). Over the long-run, reduced earnings and wealth may trigger several mechanisms potentially harmful to health (Holland et al. 2000; Lynch et al. 1994b; Lynch, Kaplan and Shema 1997; Smith 1999; Wunsch et al. 1996), contributing to the poorer disability outcomes for cohorts that experienced less favourable economic conditions over their adult life.

Finally, economic downturns experienced at critical periods in the life-cycle may have long-term effects that persist many decades after exposure. Example of this is recent evidence that less favourable economic conditions at the time of college graduation may lead to less favourable career prospects and long-term income-losses over several years or decades (Kahn 2010; Oreopoulos et al. 2012). Economic conditions in the period of transition into the labour market may also delay marriage and limit the range of potential partners (McDonough et al. 1997). Evidence also suggests that individuals entering in less well-paid jobs are more likely to experience job insecurity or physical or chemical hazards at work during their working life (Goddard 1988). Thus, exposure to adverse economic conditions earlier in life may set individuals into less favourable life-course trajectories (Bartley et al. 1997) leading to increased risks of chronic illnesses (Bartley and Plewis 2002).

5.5.4 Conclusions

Results from our study suggest that each additional recession experienced at ages 16 to 49 is associated with worse health at old age. Economic downturns experienced during early- and middle age may trigger a life-time of cumulative disadvantage which may outweigh any temporary improvements in health during recessions. Our results highlight the need to examine the multiple behavioural, work and financial mechanisms linking economic fluctuations to health in the long-run. If replicated in future studies, our findings suggest that policies to mitigate the impact of economic recessions on some of these mechanisms may contribute to better health in later life.

Chapter 6 Do Economic Recessions During Early and Mid-Adulthood Influence Cognitive Function in Older Age?

6.1 Abstract

Fluctuations in the national economy shape labour market opportunities and outcomes, which in turn may influence the accumulation of cognitive reserve. This study examines whether economic recessions experienced in early- and mid-adulthood are associated with later life cognitive function. Data came from 12,020 respondents in 11 countries participating in the Survey of Health, Ageing and Retirement in Europe (SHARE). Cognitive assessments in 2004/05 and 2006/07 were linked to complete work histories retrospectively collected in 2008/09, and to historical annual data on fluctuations in Gross Domestic Product (GDP) per capita for each country. Controlling for confounders, we assessed whether recessions experienced at ages 25-34, 35-44 and 45-49 were associated with cognitive function at ages 50-74. Among men, each additional recession at ages 45-49 was associated with worse cognitive function at ages 50-74 (b_{45-49}=-0.06, 95% Confidence Interval [CI] -0.11, -0.01). Among women, each additional recession at ages 25-44 was associated with worse cognitive function at ages 50-74 (b_{25-34}=-0.03, CI -0.04, -0.01; b_{35-44}=-0.02, CI -0.04, -0.00). Among men, recessions at ages 45-49 influenced risk of being laid-off, whereas among women, recessions at ages 25-44 led to working part-time and higher likelihood of downward occupational mobility, which were all predictors of worse later life cognitive function. Recessions at ages 45-49 among men and 25-44 among women are associated with later life cognitive function, possibly via more unfavourable labour market trajectories. If replicated in future studies, findings may indicate that policies that ameliorate the impact of recessions on labour market outcomes may promote later life cognitive function.

6.2 Introduction

Mid-life labour market outcomes and working conditions have been shown to predict cognitive function and decline at older age. Occupational class (Dartigues et al. 1992; Li, Wu and Sung 2002), longer working hours (Virtanen et al. 2012), occupational solvent exposures, career trajectories (Andel et al. 2006; Bickel and Kurz 2009), and occupational complexity at work (Finkel et al. 2009; Stern et al. 1995), are all strong predictors of later life cognitive function. Based on the cognitive reserve framework (Stern 2002), these studies hypothesize that working conditions influence the potential to build up cognitive reserve, which in turn influences cognitive performance at later ages. The results of such studies are, however, prone to selection bias, because higher cognitive function may select individuals into more favourable occupations and working environments. For example, previous research suggests that subtle differences in cognitive function early in life may lead to divergent career trajectories (Richards and Sacker 2003). A way to address this bias is to examine how macro-economic 'shocks', which can be viewed as largely exogenous to cognitive function of the working population, relate to later life cognitive outcomes. The rationale for this approach is that cohorts affected by negative, unanticipated macro-economic shocks at vulnerable points in their life-course may endure permanent scars in cognitive function manifesting later in life. These effects, however, would be unrelated to their early life-characteristics or other individual factors that affect their individual labour market and cognitive function trajectories.

The hypothesis that macroeconomic 'shocks' have a negative effect on cognitive functioning is supported by evidence that economic hardship during early childhood is associated with lower cognitive function in older age, in particular if additional disadvantages come into play (van den Berg et al. 2010). Similarly, recent evidence suggests that being born during a recession is significantly associated with lower later life cognitive function (Doblhammer et al. 2011). No studies have yet explored whether recessions experienced during working ages may have cumulative effects on cognitive

function at older ages. To our knowledge, this is the first study to adopt a life course perspective to assess whether macroeconomic fluctuations experienced during working ages are associated with cognitive function in later life, and to investigate some of the potential labour market mechanisms that may explain this association.

Macro-economic conditions during working ages may influence the accumulation of cognitive reserve via unfavourable working conditions and opportunities in terms of social mobility. In support of this view, evidence indicates that economic recessions experienced in the year of transition from school to work are associated with less favourable career trajectories, higher job instability, reduced earnings and less favourable working conditions in mid-life (Kahn 2010; Oreopoulos et al. 2012). So far, no studies have examined whether these working conditions affected by labour market fluctuations around these vulnerable ages may also have long-lasting and permanent negative associations with cognitive function at older age.

In this paper, we examine whether economic recessions experienced in early and mid-adulthood are associated with cognitive function at older age. We assessed exposure to recessions during early (ages 25-34), mid-age (35-44) and late middle adulthood (45-49) covering the years prior to retirement and related this to cognitive assessments at ages 50-74 in a sample of Europeans in 11 countries. Based on the life-course accumulation of advantages and disadvantages framework (Ben-Shlomo and Kuh 2002), we hypothesize that each additional recession experienced during working ages is associated with worse later life cognitive function. In addition, we expect recessions experienced during early adulthood to have a stronger association with cognitive function than recessions experienced later in life. To shed light on the potential mechanisms, we also linked data on economic recessions to individual-level data on full employment histories covering occupational and labour market conditions throughout adulthood. To our knowledge, our study provides the first assessment of how macroeconomic fluctuations during adult life relates to cognitive function in older age.

6.3 Methods

6.3.1 Data

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a nationally representative survey which has been designed to provide cross-sectional as well as longitudinal information on the health, employment and social conditions of Europeans aged 50+. Specific details on the survey are available elsewhere (Börsch-Supan et al. 2013; Börsch-Supan and Jürges 2005; Börsch-Supan and Schröder 2011a; Börsch-Supan and Schröder 2011b).

This study is based on data from three waves of SHARE, the last of which contains detailed individual work histories retrospectively collected using the life-grid method. The total sample included 19,473 participants who had enrolled in the study in either 2004/05 or 2006/07 and completed the life-history interview in 2008/09 from 11 countries (Sweden, Denmark, Austria, France, Germany, Switzerland, Belgium, the Netherlands, Spain, Italy, Greece) and had worked at least once during their working life. Respondents from Czech Republic and Poland were not included due to lack of comparable data on GDP before 1990. We further restricted the sample to individuals aged 50 to 74 at the time of first interview to prevent selective attrition due to higher prevalence of cognitive impairment at higher ages (n=14,765). We excluded individuals with missing information on two or more of the cognitive measures (n=1,345), childhood health, education (n=292), or sampling weights (n=37) and those respondents who never worked (n=1,071). The final sample included a total of 12,020 men and women in 11 countries (Table 23).

Table 23: Sample characteristics

	Men			Women	
	N=5,891			*N=6,129*	
	N (mean)	% (SD)		N (mean)	% (SD)
Age					
Age	(63.24)	(6.04)		(62.68)	(5.95)
Age (50-54)	395	6.71		497	8.11
Age (55-59)	1,497	25.41		1,622	26.46
Age (60-64)	1,480	25.12		1,640	26.76
Age (65-69)	1,360	23.09		1,362	22.22
Age (70-74)	1,159	19.67		1,008	16.45
WWII (born before 1945)	2,822	47.90		2,711	44.23
Early-life socio-economic characteristics					
1st occupation ISCO					
Low skill blue	22	22.27		966	15.76
High skilled blue collar	1,100	18.67		2,884	47.05
Low skilled white collar	1,868	31.71		617	10.07
High skilled white collar	1,611	27.35		1,662	27.12
Education					
Primary	2,170	36.84		2,600	42.42
Secondary education	1,982	33.64		1,908	31.13
Post-secondary education	1,739	29.52		1,621	26.45
Bad SRH as child (yes)	431	7.32		544	8.88
Childhood infectious diseases (yes)	4,925	83.60		5,441	88.77
Childhood physical injuries (yes)	1,584	26.89		1,771	28.90
Childhood mental condition (yes)	73	1.24		115	1.88
No. of books at home during childhood					
None or very few (0-10)	2,449	41.57		2,165	35.33
Enough to fill one shelf (11-25)	1,311	22.24		1,467	23.93
Enough to fill one bookcase (26-100)	1,305	22.16		1,538	25.09
Enough to fill two bookcases (101-200)	404	6.86		479	7.81
Enough to fill two or more bookcases (more than 200)	422	7.16		481	7.84
Main breadwinner ISCO during childhood					
Low skilled blue collar	1,562	26.50		1,680	27.41
High skilled blue collar	2,701	45.87		2,617	42.70
Low skilled white collar	845	14.34		901	14.70
High skilled white collar	784	13.30		931	15.18

	Men			Women	
Childhood math-skills					
Much better	782	13.28		591	9.65
Better	1,661	28.20		1,412	23.03
About the same	2,733	46.40		3,217	52.49
Worse	595	10.12		748	12.20
Much worse	119	2.01		161	2.63
Childhood language-skills					
Much better	536	9.10		794	12.96
Better	1,384	23.50		1,875	30.59
About the same	2,928	49.71		2,858	46.64
Worse	913	15.49		525	8.56
Much worse	129	2.19		77	1.26
Cognition					
Cognition Z-Score	(0.00)	(0.63)		(0.00)	(0.65)
Recessions					
Recessions 25-34	(1.31)	(1.27)		(1.32)	(1.28)
Recessions 35-44	(1.29)	(1.15)		(1.33)	(1.17)
Recessions 45-49	(0.73)	(1.31)		(0.77)	(1.36)

Abbreviations: SD, standard deviation; WWII, World War II; ISCO, International Standard Classification of Occupations; SRH, self-rated health.

Note: Derived from the Survey of Health, Ageing and Retirement (SHARE), unweighted.

6.3.2 Cognitive function

Cognitive function was assessed once at the first time individuals were interviewed based on the indicators *verbal fluency* (naming as many animals as possible in one minute), *immediate recall* (immediately recalling as many words as possible from a ten-word list that had been read out), *delayed recall* (recalling the ten-word list after a short delay), *orientation* (asking respondents the correct day of month, day of the week, month, and year), and *numeracy* (assessed by five arithmetical calculation tasks) (Dewey and Prince 2005; Lee et al. 2003; Ofstedal, Fisher and Herzog 2012). A summary score of cognitive functioning was built by averaging the z-scores of the five items.

6.3.3 Macroeconomic conditions

We use historical time-series data on annual Gross Domestic Product (GDP) per capita as indicators of economic conditions (Maddison 2003, 2006). Data used for the analysis comprised the years 1959 to 2006. We separated the cyclical component from the secular trend in the log of GDP per capita for each country using the Hodrick-Prescott Filter (HP) with a smoothing parameter of 100 (Hodrick and Prescott 1997). We converted the cyclical component for each country into quartiles of deviation from the GDP trend. To derive information on country-specific recessions over the study period, deviations from the trend in GDP falling in the highest quartile were classified as booms, while deviations falling in the lowest quartile were classified as recessions. This information was linked to individual records from SHARE based on the year at every age since birth and country of birth, resulting in a variable indicating the number of recessions at every single age from year of birth up to age 49, the age for which comparable information on GDP was available for most individuals. Our analysis focuses on exposure to recessions at ages 25 to 49, with the earliest exposure of any respondent at age 25 in the year 1959. Exposure to economic fluctuation was summarized based on the number of years lived in recessions at ages 25-34, 35-44, and 45-49.

6.3.4 Individual level controls

All models include a set of linear splines for 5-year age-groups from age 50 to 74 to relax the assumption of a linear aging-related decline in cognitive function. We furthermore included controls for being born before or after the Second World War in 1945 (WWII), country of residence, and measures of childhood conditions at age 10 to control for circumstances which may have influenced cognitive functioning independently of economic fluctuations, including: (a) self-rated health, (b) material deprivation based on items available at the parental home (e.g. a fixed bath, water supply or central heating), (c) self-reported diagnosis of major childhood illnesses, (d) occupation of main breadwinner, (e) the number of books at home and (f) self-rated mathematical and (g) language skills. We also controlled for educational attainment based on highest educational level (primary or less, secondary or tertiary) based on the

International Standard Classification of Education (ISCED) (UNESCO 2012). Finally, we controlled for respondents' first occupation, based on four major groups of the International Standard Classification of Occupations (ISCO-88) (ILO 2012).

6.3.5 Life-course occupational class mobility and working conditions

Data on employment histories came from the 2008/09 wave and covered the entire adult life starting from age of leaving full-time education (or age 15 for those without any schooling) until year of interview or exit from the labour market. Using the life-grid History Event Calendar, individuals were asked to report each paid job that lasted for 6 months or more. For each job, participants reported the year the job started; the occupation that best described the job based on the ISCO-88; whether job was part- or full-time; changes between part- and full-time during each job spell, and year and reason the job ended. We constructed a database indicating for every age between 25 and 49 whether an individual was working, and, across 10-year age categories, indicators of (a) downward occupational class mobility at least once; (b) multiple changes between full-time and part-time in a single job spell (as opposed to permanently working full- or part-time); (c) permanently working part-time in a given job; (d) job loss due to lay-off or plant/office being closed down at least once; (e) employment gaps due to reasons other than lay-off or plant/office being closed down. We then linked this information with data on the number of booms and recessions individuals experienced every decade of life.

6.3.6 Statistical analysis

All analyses were stratified by gender. We analysed the association between cognitive functioning at ages 50 to 74 and number of recessions during the age intervals 25-34, 35-44 and 45-49 using linear regression. This approach exploits the fact that economic conditions at ages 25 to 49 are to a large extent random since individuals have no direct influence on them. To control for differences across countries that could bias estimates, we estimated a country-fixed effect model exploiting within-country variation across cohorts. The country-fixed effect thus controls for all unmeasured differences across countries such as institutional characteristics, economic development or levels of cognitive functioning. Estimates can be interpreted as the association of an additional

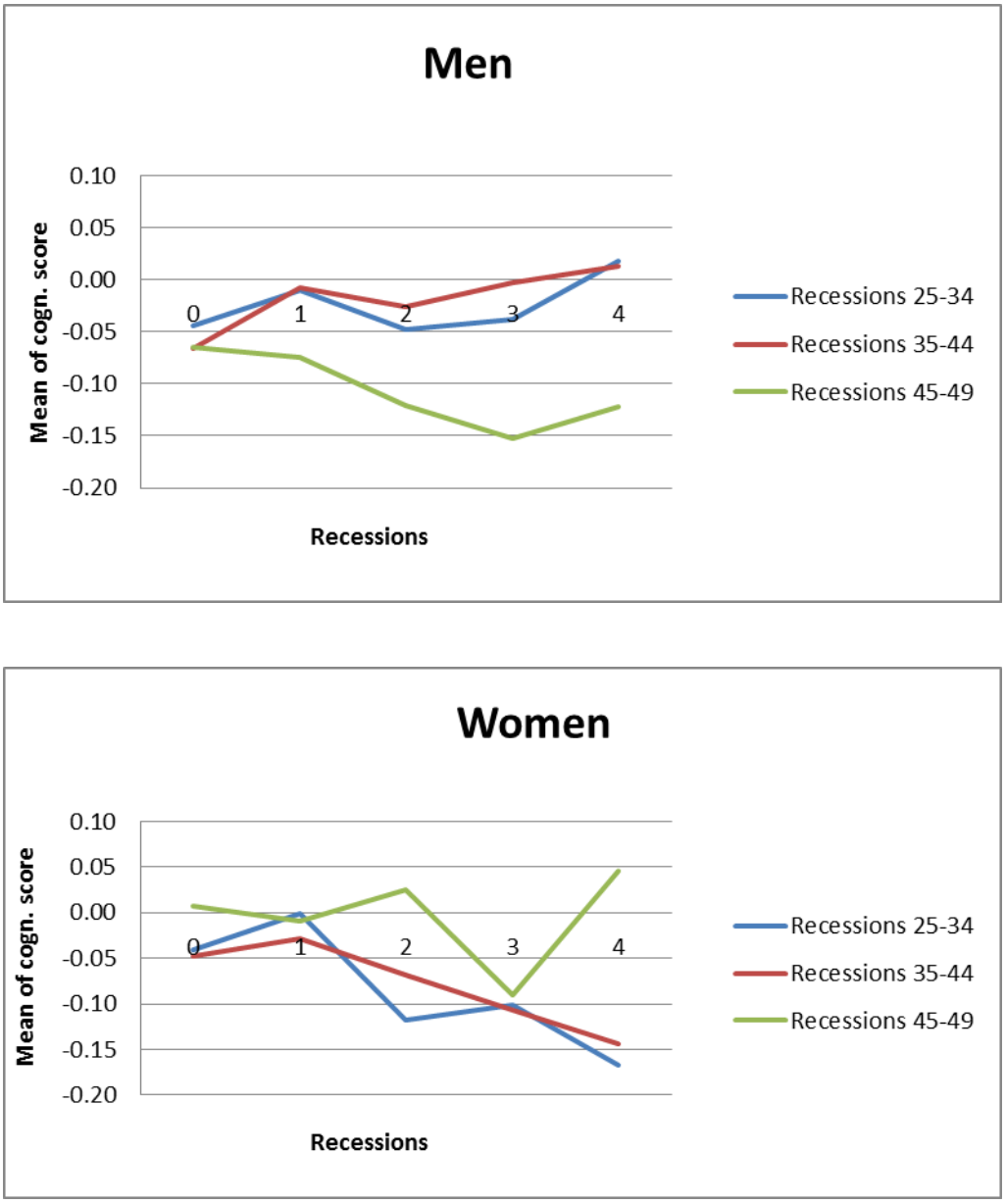
recession at each given age interval on cognitive functioning, controlling for differences across countries. To explore possible mechanisms between economic conditions and later cognitive function, we also used logistic regressions to model the association of economic booms and recessions with occupational class mobility and working conditions at every decade of life, adjusting for all confounders.

We report unstandardised regression coefficients and 95% confidence intervals (CI). All analyses were conducted using calibrated sampling weights to account for potential selectivity bias generated by unit nonresponse, sample attrition, and mortality. All analyses were conducted in Stata/SE 12.1.

6.4 Results

After excluding respondents with missing information, data of a total of 5,891 men and 6,129 women were included in the analyses. Figure 4 shows predicted means of cognitive function according to the number of recessions experienced at each decade of life, controlling for country dummies and age. Men experiencing no recession at ages 45-49 had a mean cognitive score of -0.07 at ages 50-74, compared to -0.12 for those who experienced 4 or more recessions at those ages. Similarly, women experiencing no recession at ages 25-34 had an average z-score of cognitive functioning of -0.05 at ages 50-74, whereas women having experienced four recessions in this age interval had an average z-score of -0.17.

Figure 4. Predicted means of cognitive function by number of recessions for men and women



Note: The two panels show the predicted z-score of cognitive functioning for men and women conditional on the number of recessions experienced at three different age-intervals. Models include dummies for the country of birth.

Table 24 shows estimates of the association between recessions at different decades of life and z-scores of cognitive function, along estimates for confounders. Being born before WWII is associated with better cognitive scores for women (b=0.09, p<0.01), but not for men. Higher occupational status of first job is associated with lower cognitive function for both men and women. Higher education is associated with better cognitive function for both sexes. Worse self-rated skills in language and mathematics as a child are associated with lower cognitive function in both men and women.

Analyses included an extensive set of confounders and 5-year age splines. Among men, controlling for all confounders, each additional recession during ages 45-49 was associated with worse cognitive function at ages 50-74 (b_{45-49}=-0.06, CI -0.11, -0.01), while recessions at earlier ages were not associated with cognitive function. Among women, each additional recession at ages 25-34 or 35-44 was associated with worse cognitive function at ages 50-74 (b_{25-34}=-0.03, CI -0.04, -0.01; b_{35-44}=-0.02, CI -0.04, -0.00).

Table 24: Number of recessions at ages 25-34, 35-44, and 45-49 and cognitive function at ages 50-74

	Men				Women		
	Coeff.	**95% CI**	**P**		**Coeff.**	**95% CI**	**P**
Recessions							
Recessions 25-34	0.009	(-0.023, 0.042)	0.538		-0.023	(-0.033, -0.013)	0.000
Recessions 35-44	-0.001	(-0.048, 0.047)	0.975		-0.019	(-0.036, -0.002)	0.033
Recessions 45-49	-0.046	(-0.089, -0.002)	0.041		-0.023	(-0.048, 0.003)	0.073
Age							
Age (50-54)	0.130	(-0.108, 0.368)	0.252		0.027	(-0.136, 0.190)	0.720
Age (55-59)	0.032	(-0.038, 0.102)	0.335		-0.023	(-0.095, 0.050)	0.502
Age (60-64)	-0.033	(-0.060, -0.006)	0.023		-0.011	(-0.041, 0.018)	0.417
Age (65-69)	-0.005	(-0.034, 0.025)	0.725		-0.037	(-0.047, -0.026)	0.000
Age (70-74)	-0.015	(-0.038, 0.009)	0.190		-0.012	(-0.029, 0.004)	0.133
WWII (born before 1945)	0.014	(-0.089, 0.117)	0.768		0.099	(0.027, 0.172)	0.012
Early-life socio-economic characteristics							
1st occupation ISCO (ref.: low skill blue)							
High skilled blue collar	0.024	(-0.016, 0.065)	0.206		-0.044	(-0.105, 0.016)	0.134
Low skilled white collar	-0.102	(-0.159, -0.045)	0.003		-0.165	(-0.237, -0.094)	0.000
High skilled white collar	-0.113	(-0.158, -0.067)	0.000		-0.155	(-0.213, -0.096)	0.000
Education (ref.: primary)							
Secondary education	0.159	(0.088, 0.230)	0.001		0.204	(0.155, 0.253)	0.000
Post-secondary education	0.286	(0.235, 0.336)	0.000		0.285	(0.225, 0.346)	0.000
Bad SRH as child (yes)	0.068	(0.017, 0.119)	0.015		-0.041	(-0.116, 0.034)	0.249
Childhood infectious diseases (yes)	0.045	(-0.009, 0.100)	0.093		0.031	(-0.033, 0.095)	0.307
Childhood physical injuries (yes)	-0.105	(-0.173, -0.037)	0.006		0.013	(-0.012, 0.038)	0.277
Childhood mental condition (yes)	-0.118	(-0.379, 0.143)	0.339		0.043	(-0.069, 0.156)	0.412

	Men				Women		
	Coeff.	**95% CI**	**P**		**Coeff.**	**95% CI**	**P**
No. of books at home (ref.: none or very few (0-10)							
Enough to fill one shelf (11-25)	0.100	(0.037, 0.163)	0.005		0.015	(-0.042, 0.072)	0.571
Enough to fill one bookcase (26-100)	0.088	(0.009, 0.168)	0.033		0.081	(0.048, 0.113)	0.000
Enough to fill two bookcases (101-200)	0.228	(0.106, 0.350)	0.002		0.093	(0.009, 0.177)	0.034
Enough to fill two or more bookcases (more than 200)	0.221	(0.143, 0.299)	0.000		0.103	(-0.028, 0.235)	0.110
Main breadwinner ISCO (ref.: low skilled blue collar)							
High skilled blue collar	-0.019	(-0.086, 0.048)	0.546		0.012	(-0.030, 0.054)	0.539
Low skilled white collar	-0.037	(-0.131, 0.057)	0.399		-0.010	(-0.067, 0.048)	0.713
High skilled white collar	0.029	(-0.096, 0.153)	0.619		0.039	(-0.003, 0.081)	0.068
Childhood math-skills (ref.: much better)							
Better	-0.041	(-0.080, -0.002)	0.043		-0.011	(-0.107, 0.084)	0.799
About the same	-0.146	(-0.200, -0.091)	0.000		-0.148	(-0.243, -0.054)	0.006
Worse	-0.308	(-0.433, -0.183)	0.000		-0.236	(-0.372, -0.099)	0.003
Much worse	-0.188	(-0.265, -0.110)	0.000		-0.373	(-0.433, -0.313)	0.000
Childhood language-skills (ref.: much better)							
Better	-0.014	(-0.073, 0.044)	0.594		-0.038	(-0.091, 0.015)	0.138
About the same	-0.060	(-0.120, 0.000)	0.050		-0.089	(-0.143, -0.036)	0.004
Worse	-0.076	(-0.165, 0.012)	0.084		-0.137	(-0.199, -0.076)	0.001
Much worse	-0.292	(-0.389, -0.194)	0.000		-0.282	(-0.416, -0.148)	0.001

Abbreviations: Coeff., regression coefficient; 95% CI, 95% confidence interval of double-sided test; P, p-value; WWII, World War II; ISCO, International Standard Classification of Occupations; SRH, self-rated health.

Notes: N=12,020. All models include dummies for the country of birth but results were omitted from the table.

Table 25 shows frequencies of selected working trajectories for men and women. Downward occupational mobility and job loss due to lay-off or plant closing is equally frequent in both men and women between ages 25 and 49 (for each decade less than 6%). Other changes in working conditions are more frequent for women than for men: multiple changes between full- and part-time work (men: <3% in each decade, women: 7.5 - 28.1%), working part-time (men: <3%, women: 21.7 - 27.8%), unemployment due to reasons other than lay-off or plant closing (men: 7.8 - 13.5%, women: 38.2 - 54.3%).

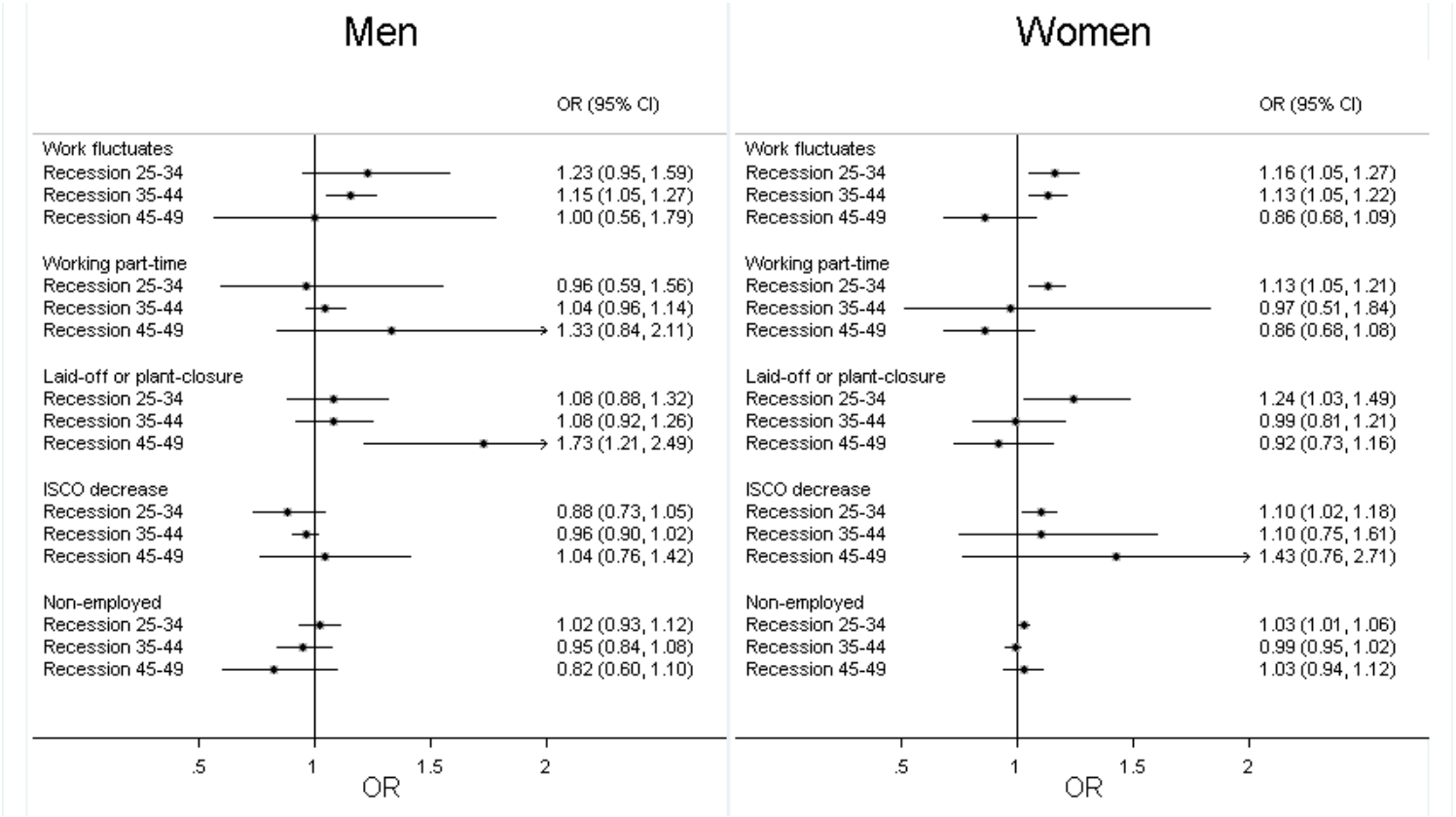
Table 25: Life-time occupational class mobility and working conditions at ages 25-34, 35-44, and 45-49

	Men (N=5,195)		Women (N=5,557)	
Age-interval	**n**	**%**	**n**	**%**
Downward occupational class (ISCO) mobility at least once				
25-34	293	5.64	250	4.50
35-44	174	3.34	194	3.49
45-49	100	1.92	108	1.95
Changed multiple times between full-time and part-time in a single job				
25-34	79	1.53	417	7.51
35-44	90	1.74	1,563	28.13
45-49	117	2.25	1,501	27.01
Worked part-time				
25-34	107	2.06	1,206	21.71
35-44	99	1.90	1,547	27.83
45-49	111	2.14	1,500	26.99
Job loss due to lay-off or plant/office being closed down at least once				
25-34	73	1.40	235	4.23
35-44	119	2.30	282	5.08
45-49	145	2.79	271	4.88
Employment gap due to reasons other than lay-off or plant/office being closed down				
25-34	699	13.45	3,017	54.30
35-44	406	7.81	2,625	47.23
45-49	428	8.23	2,124	38.23

Abbreviations: ISCO, International Standard Classification of Occupations.

We first report on the association between each additional recession experienced at each age interval and unfavourable working condition at that same age interval after adjusting for all confounders. Among men, an additional recession experienced at ages 25-34 was not associated with working conditions, while a recession at ages 35-44 was associated with an increased odds of multiple changes between full-time and part-time working in that decade (OR=1.15, CI 1.05, 1.27; Figure 5). A recession at ages 45-49 was associated with an increased odds of having lost a job due to lay-off or plant/office closure (OR=1.73, CI 1.21, 2.49). Among women, an additional recession at ages 25-34 was associated with worse labour market outcomes for all five indicators (Figure 5).

Figure 5: Associations of recessions with working conditions (occupational class mobility and working conditions)

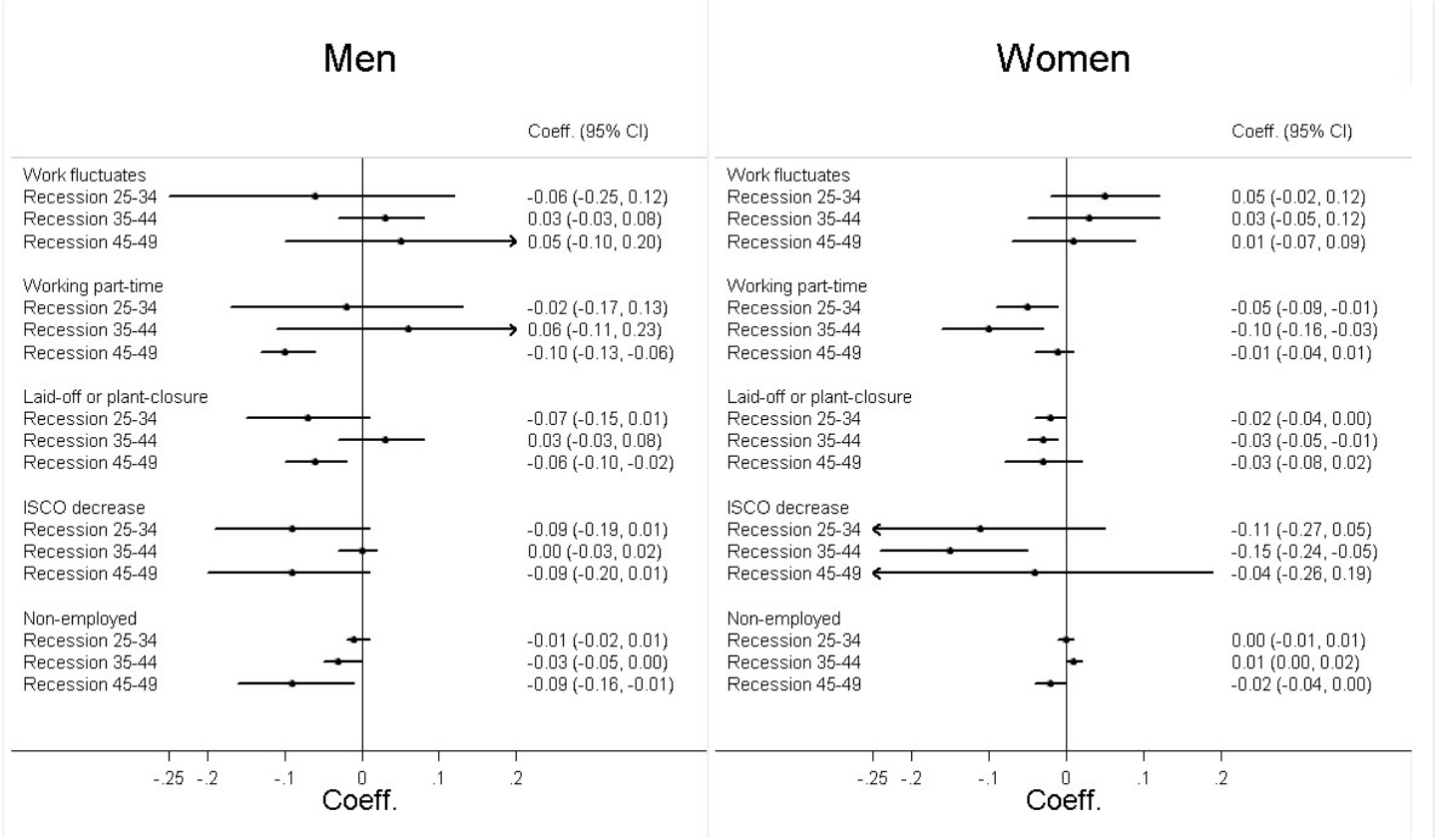


Abbreviations: OR, odds ratio; 95% CI, 95% confidence interval of double-sided test; P, p-value; ISCO, International Standard Classification of Occupations.

Notes: The graphs show the odds ratios of one recession experienced at each age interval on experiencing a respective working condition in this age interval for men and women, after adjusting for all confounders. Odds ratios on the right side of the vertical line indicate increased likelihood to have experienced one of the five working conditions. All models were run separately for each type of working condition and age-interval and include the same individual-level covariates as in Table 24 as well as dummies for the country of residence (results not shown).

Next, we report on the associations of unfavourable working conditions with (lower) cognitive function (Figure 6). For men, job loss due to lay-off or plant/office closure, which was associated with number of economic recessions in that interval, was also associated with worse cognitive function at older age ($b_{45\text{-}49}$=-0.06, 95% CI -0.01, -0.02; Figure 6). Among women, of the five indicators that showed an association of additional recessions at ages 25-34, two indicators – working part-time and job loss due to lay-off or plant closure – were in turn associated with significantly lower cognitive function at older age. At ages 35-44, an additional recession was also associated with more job instability as measured by higher odds of changing between full-time and part-time. Three of the labour market changes at ages 35-44 in women – working part-time, losing a job due to plant/office closure, and downward occupational mobility – were associated with worse late-life cognitive function.

Figure 6: Associations of working conditions and cognitive function for men and women at three age intervals



Abbreviations: Coeff., regression coefficient; 95% CI, 95% confidence interval of double-sided test; P, p-value; ISCO, International Standard Classification of Occupations.

Notes: The graphs show the regression coefficients associated with experiencing a respective working condition in this age-interval and cognitive functioning after adjusting for all confounders. All models were run separately for each type of working condition and age-interval and include the same individual-level covariates as in Table 24 as well as dummies for the country of residence (results not shown).

6.5 Discussion

Our study was motivated by previous evidence that working conditions are associated with later life cognitive function and decline. Our findings provide evidence that economic recessions experienced at vulnerable periods in mid-life are associated with decreased later life cognitive function, and that part of this association may operate through the link of recessions with working conditions and labour market trajectories. Men who experienced an additional economic recession at ages 45-49 fared worse cognitive outcomes later in life, which could potentially be due to higher likelihood of job loss due to lay-off or plant closure at these ages. Among women, experiencing an additional recession at ages 25-44 was also associated with poorer cognitive outcomes, which may be explained by their higher rates of job loss due to lay-off or plant/office closure, less stable job careers, and higher likelihood of downward occupational mobility associated with recessions.

6.5.1 Explanation of results

Life course theory suggests that individuals may be more susceptible to environmental influences during certain development stages (Ben-Shlomo and Kuh 2002). In this regard, our findings provide preliminary evidence on associations between macroeconomic shocks during working life and later life cognitive function, extending earlier studies on associations between cognitive function at older age and economic conditions during childhood (Doblhammer et al. 2011; van den Berg et al. 2010), and associations between later life cognitive function and contextual level information, such as neighbourhood socio-economic status (Aneshensel et al. 2011; Clarke et al. 2012), years of education (Glymour et al. 2008a), and retirement policies (Coe et al. 2012; Rohwedder and Willis 2010). Although more evidence is needed to assess whether associations observed in our study are causal, our findings suggest that potentially unanticipated macroeconomic shocks during vulnerable periods in mid-life may affect an individual´s potential to accumulate cognitive reserve. A possible explanation is that macro-economic conditions shape mid-life working conditions associated with late-life cognitive function. However, our results suggest that men’s susceptibility to macro-economic shocks may be larger at relatively late stages of the working career, while women are more susceptible to

long-run effects on cognitive function if experiencing recessions during early- and mid-adulthood.

Findings for women suggest that early and mid-adulthood recessions are associated with unfavourable changes in working conditions. If causal, this may suggest that the association between economic recessions and cognitive function may operate to some extent through fluctuations in working time, lay-offs and plant closures. Previous evidence suggests that labour market participation among women is strongly influenced by the economic climate, with women during economic downturns being significantly more likely to be out of the labour market (Thévenon 2009) or in non-standard employment (Leschke 2012), which may reduce their life-time exposure to cognitively stimulating work-related activities. For younger workers, transitions into non-standard employment during economic downturns are more likely than for older workers (Leschke 2012). This may account for the stronger association of early- and mid-life recessions with late-life cognitive function among women, while recessions experienced at ages 45 to 49 were not associated with cognitive function.

Our findings suggest that, among men, economic recessions in the later stages of mid-adulthood (ages 45-49) are critically linked to lower cognitive function after age 50, potentially due to the effect of recessions at these ages on the risk of job loss. Although young workers faced with a major recession may suffer long-lasting reductions in earnings and reduced labour market opportunities (Oreopoulos et al. 2012), they are likely to return to work as economic conditions improve (Leschke 2012). In contrast, for older workers job loss in the late stages of the working career may become an involuntary 'pathway to retirement', with older workers often leaving the labour market permanently during economic downturns (Coile and Levine 2007) or after involuntary job loss (Flippen and Tienda 2000) with reduced access to cognitively stimulating activities. This may explain why recessions in late-adulthood lead to larger reductions in cognitive function at older age, but not for early- and mid-adulthood recessions. An alternative pathway may lead from job loss to depressive symptoms and stress, which in turn are associated with reduced cognitive function in older ages (Chodosh et al. 2007). The fact that economic recessions in later stages of adulthood were linked to cognitive function in men, but

not in women, may stem from gender differences in occupational mobility. Previous research suggests that occupational mobility and associated wage gains are larger for men than for women (Fitzenberger and Kunze 2005). Mid-life working careers of women have been and still are largely different from those of men, and women during middle age may be out of the labor market more often than men for different reasons (Blossfeld and Hofmeister 2006). Thus, a potential explanation is that recession effects on occupational mobility affect men more than they affect women. As a result, men who experience less favourable economic conditions in late mid-adulthood may accumulate less cognitive reserve as they approach older age.

The association between one additional recessions and cognitive functioning (females: $b_{25\text{-}34}$ =-0.03; $b_{35\text{-}44}$ =-0.02; males: $b_{45\text{-}49}$ =-0.06) may seem relatively small compared to associations between cognitive function and other indicators, e.g. with higher education (females $b_{\text{secondary education}}$=0.22; males $b_{\text{secondary education}}$=0.18). However, the association between one additional recession and cognitive function has a similar magnitude as one additional year of age with cognitive decline after age 60 (both sexes after age 60: $b_{\text{age splines}}$ =-0.01 to -0.04).

6.5.2 Limitations

The main strength of our study was the linkage between individual-level data on work histories, cognitive function and macro-economic shocks across European countries. However, several limitations should be considered. The first and most prominent limitation of our study is the fact that the abatement of selection, which we addressed by investigating the relationship between macro-economic conditions and cognitive function, is no proof for causality. However, our results provide tentative support for the hypothesis that economic recessions are associated with cognitive function possibly through changes in working conditions.

We investigated several mechanisms by which economic recessions may influence later life cognitive function, however, more specific mechanisms such as reduced occupational complexity, social participation, or earnings could not be assessed. The strength of our study is the possibility to examine the role of national economic conditions on cognitive function on the basis of comparable data across countries. However, we were unable to appropriately assess potential differences across

countries in magnitude and societal impact of recessions. Our findings are only applicable for the cohorts working during the post-WWII period in the European countries under investigation. Part of our sample was born before WWII and has experienced a dramatic and highly adverse historical period during childhood and/or adolescence. This cohort may have been severely affected in terms of nutrition, parental affluence, family and social networks, and quantity and quality of education before entering the work force. We addressed this by including a dummy for being born before, during or after the WWII, thus controlling for the effect of this shock on cognitive outcomes. Nevertheless, future studies are necessary to assess whether associations observed in our study might differ for cohorts differently affected by WWII.

6.5.3 Conclusions

To our knowledge, this is the first study to show that economic recessions experienced at vulnerable ages in early and mid-adulthood are associated with lower cognitive function at older ages. Our findings also suggest that economic recessions during this period are associated with several adverse labour market outcomes. If replicated, policies that encourage women to enter and remain attached to the labour market through early- and mid-adulthood, such as policies on schooling, maternity leave and childcare support, may have unanticipated positive effects on female cognitive function. Similarly, policies that enable men to return to work or remain engaged in productive activities at age 45 and beyond may be important in accumulating cognitive reserve. Preliminary evidence presented in this paper suggests that for older men, the later stages of their career may be more prone to economic recessions and, in turn, offer great potential to increase cognitive reserve, than earlier stages. More evidence is needed to assess whether specific policies that buffer the impact of economic downturns on labour market outcomes bring benefits to cognitive functioning in older age.

Chapter 7 Do Recessions in the Pre-Retirement Years Affect Subsequent Risk of Cardiovascular Disease? Evidence from Cohorts Born Between 1922 and 1945 in the United States

7.1 Abstract

Previous studies have found higher unemployment rates to be associated with short-term reductions in cardiovascular mortality, especially among older individuals. However, almost no evidence exists on potential long-term health-effects of macroeconomic fluctuations. This study assesses whether state unemployment rates in the years nearing retirement are associated with subsequent risk of cardiovascular disease (CVD). Data came from the Health and Retirement Survey (HRS) for cohorts born between 1922 and 1945. We used Cox proportional hazards regressions to model the association between state unemployment rates experienced at ages 56-64 and the risk of CVD after age 64. We also explored long-term effects of local unemployment rates on a range of potential pathways including labour force participation, long-term care coverage as well as wealth. A one percentage increase in the state unemployment rate experienced at ages 60 as well as 63 were associated with an increase in the risk of strokes ($HR_{stroke\ 60}$ =1.022; CI=1.001-1.044 & $HR_{stroke\ 63}$ =1.036; CI=1.004-1.070). However, there is no strong evidence for a systematic effect of unemployment rates in the pre-retirement years on subsequent risk of CVD.

7.2 Introduction

Since the beginning of the 2008 Great Recession, the unemployment rate of older men and women has nearly doubled in the U.S. Although unemployment amongst older individuals has reached an unprecedented level in recent history, the recessions in the early 1980s and 1990s were also followed by a substantial surge in unemployment rates amongst older workers (Johnson 2012). Besides the direct labour market effects, the latest recession has also resulted in substantial losses in housing or social security wealth among individuals nearing retirement age (Gustman, Steinmeier and Tabatabai 2013; Hurd and Rohwedder 2010; Wolff 2011).

Individual experiences of adverse outcomes often linked to unfavourable macroeconomic conditions such as unemployment, job loss or job insecurity have repeatedly been linked to a worsening of health status (Browning and Heinesen 2012; Sullivan and von Wachter 2009), also amongst older workers (Deb et al. 2011; Gallo et al. 2004; Gallo et al. 2001a; Gallo et al. 2006). In contrast, several studies have found that at the population level, higher unemployment rates are associated with improvements in health status and lower mortality for most causes (Gerdtham and Johannesson 2005; Ruhm 2000), including cardiovascular (CVD) mortality (Edwards 2008; Ruhm 2007). Recent evidence suggests that much of the so-called pro-cyclical relationship between business cycles and mortality, including CVD, is in fact driven by deaths amongst individuals aged 55 and above (Miller et al. 2009).

One common element of the majority of studies looking at the effects of macroeconomic conditions on health is their focus on short-term effects in the sense that the economic conditions in one year are generally related to health outcomes in the same year. A potential limitation of this approach is that it does not sufficiently take into account the fact that most diseases in adulthood take years to develop and involve exposures over longer periods of the life course (Bartley et al. 1997), with clinical manifestations only evident at relatively higher ages. At the same time, it also does not take into account that many risks are potentially associated with unfavourable economic conditions and therefore may gradually accumulate over the life course (Ben-Shlomo and Kuh 2002). As a result, experiences of adverse events

such as unemployment or losses in wealth at an earlier life-course period may result in an increased risk of experiencing additional adverse events at a later stage.

Recently, a number of studies have investigated potential long-term effects of macroeconomic fluctuations on health, for example showing that being born or graduating during a recession may be associated with worse health many years after such exposure (Maclean 2013; van den Berg et al. 2011). In particular, one study uses aggregate data from the U.S. showing that cohorts experiencing higher state unemployment rates at ages 58-60 have lower survival probabilities at ages 62 and above than those cohorts experiencing more favourable economic conditions when they were nearing retirement (Coile et al. 2014).

In this study we assess whether state labour market conditions experienced in the years nearing retirement are associated with the risk of experiencing a stroke or heart attack after age 64, using individual-level data from the Health and Retirement Study (HRS). In addition, the use of individual-level survey data allows us to explore the role of potential mechanisms such as wealth, employment, health behaviours or healthcare coverage in altering the relationship between macroeconomic conditions and individual health-trajectories.

We argue that the years nearing retirement age are a potentially sensitive life-course period because older individuals are very constrained in their options to respond to a suddenly-changing economic climate, so that losses during this period may have a lasting effect on welfare throughout retirement (Gustman et al. 2013). On the one hand, older workers who lose their job or experience reductions in their wages may be forced to delay retirement in order to compensate for the losses in social security income. On the other hand, older workers may be encouraged to retire earlier given their disproportionally lower chances for being reemployed than their younger counterparts (Chan and Stevens 1999). Whereas the health-effects of earlier retirement are conclusively understood (Behncke 2012; Calvo, Sarkisian and Tamborini 2013; Midanik et al. 1995; Neuman 2008), studies have found self-reported losses in wealth during the recent recessions to be associated with increases in the planned retirement age (Hurd and Rohwedder 2010; McFall 2011). Another study suggests that higher state unemployment rates experienced at ages 62 and

above significantly increase the probability of withdrawing from the labour force (Coile and Levine 2011b). Besides the effects on labour supply, recessions generally result in significant losses in wealth (Gustman et al. 2013) and social security income (Coile and Levine 2011b; Hurd and Rohwedder 2010). Taken together, there are reasons to expect that such adverse experiences negatively affect socio-economic status and through this channel increase subsequent risks of cardiovascular disease, which has been documented repeatedly (Avendano and Glymour 2008; Avendano et al. 2006; Cesaroni et al. 2009; Loucks et al. 2009; Mackenbach et al. 2000).

We focus on cardiovascular diseases (CVD) as the outcome of interest. CVD represent a group of disorders of the blood and heart vessels. Strokes and heart attacks are normally acute events caused by blockages, which prevent the flow of blood to the heart or brain. Worldwide, as well as in the U.S., ischemic heart disease and strokes are the two most common causes of death (World Health Organization 2013). The lifetime risk of developing coronary heart disease for a man aged 40 is around 50% and 32% for a similarly-aged woman (Lloyd-Jones et al. 1999). It is estimated that around one in three adults in the U.S., thus about 70 million individuals, are affected by CVD (Mensah and Brown 2007). The prevalence of CVD increases with age and differs significantly by socio-demographic groups such as race, ethnicity, occupations or income-quartiles (Mensah and Brown 2007). Almost 90% of all strokes occur after the age of 65 (Centers for Disease Control 2005). Although the death rates for heart disease as well as strokes have been declining in recent years, the two disease categories still account for around 35% of all deaths in the U.S. (Mensah and Brown 2007). Besides age, sex and family history, the highest risk factors for CVD are smoking, high blood pressure, diabetes, high blood cholesterol, lack of exercise, obesity, stress, unhealthy diets as well as excessive alcohol consumption (Lloyd-Jones et al. 2006).

Cardiovascular disease has been widely studied using data from HRS. Researchers have used HRS to study the relationship between CVD and a number of variables such as falls, depressive symptoms, spousal smoking, life-course social conditions, racial disparities, job loss, gender as well as childhood-circumstance and CVD (Divani et al. 2009; Gallo et al. 2006; Glymour et al. 2010; Glymour et al. 2008b; Glymour et al. 2008c; O'Rand and Hamil-Luker 2005). The measures of CVD

collected in the framework of HRS have been shown to be comparable to other major sources of CVD prevalence in the U.S. such as the Rochester population studies, the Framingham Heart Study (FHS), the Greater Cincinnati/Northern Kentucky study (GCNKY), the Cardiovascular Health Study (CHS) and the Northern Manhattan Stroke Study (NOMASS) (Glymour and Avendano 2009). Studies using data from HRS have shown that lower income or wealth, as well as education, is associated with increased risk of strokes among individuals aged 50 and above (Avendano and Glymour 2008). Within the U.S. the stroke incidence rates also shows a geographical pattern with the south-eastern states, e.g. Louisiana, North Carolina or Virginia, often labelled as the 'Stroke Belt'. Explanations for the circumstance whereby the rates of stroke incidences are significantly higher in many south-eastern states than the national average include the higher concentration of African Americans among the population, poverty as well as a diet high in fat (Glymour, Avendano and Berkman 2007; Glymour, Kosheleva and Boden-Albala 2009).

7.3 Methods

7.3.1 Health and Retirement Study

HRS is a longitudinal panel survey of individuals aged 50 and above and their spouses residing in the U.S. (Juster and Suzman 1995; Karp 2007). Launched in 1992, HRS has collected detailed data on a wide range of topics including income, work, assets, pension plans, health insurance, disability, physical health and functioning, cognitive functioning, and health care expenditures on about 27,000 participants to date. HRS thereby began with the intention of providing a representative sample of the U.S. population aged between 51 and 61, as well as their spouses. The HRS core sample design consists of a multi-stage area probability sample of households. The core sample was supplemented with additional samples of African Americans, Hispanics as well as Floridians. The overall response rate as well as the re-interview response rate has generally been well above 80 per cent from the years 1992 to 1998.

The original target population of HRS in the first waves in 1992, 1994 and 1996 were those born between 1931 and 1941 and aged 51 to 61 at baseline. This sample was extended in 1993 and 1995 with an initially separate study, the Health Dynamics

among the Oldest Old (AHEAD) study, which included cohorts born in 1923 or earlier and aged 70 and above at baseline. In 1998 the sample was further expanded, including The Children of the Depression Age (CODA) sample comprising individuals born between 1924 and 1930 and aged between 68 and 74 at baseline. Also in 1998, the so-called War Babies (WB) cohort was included, comprising individuals born between 1942 and 1947 and aged 51 to 56 years at baseline. Finally, in 2004 the War Babies (WB) cohorts, comprising individuals born between 1948 and 1953 (aged between 51 and 56 at baseline), were included in the interview schedule.

For the present study we include all individuals aged 65 or above and interviewed in any wave between 1992 and 2010. In practice, this excludes the WB cohorts since the oldest cohort members will only reach age 65 in the year 2013. Our sample includes individuals born between 1922 and 1945, whereas the oldest cohorts reached age 65 in 1987 and the youngest cohorts in 2010. We chose the year of birth 1922 as the cut-off since information on state-level unemployment rates was available only from the year 1977 onwards and the cohort 1992 reaches age 55 in this year.

We started with a total of 15,652 age-eligible respondents born between 1922 and 1945. We only included individuals born in the U.S. (n=14,741) and deleted individuals with missing information on any of the covariates as well as on the state of residence at baseline (n=13,893). We used two separate analytical samples for the models using first stroke as outcome and those models using the incidence of first heart attack as outcome. For both samples separately, we excluded individuals who had experienced a stroke or heart attack before age 65 or before the first interview. The final sample comprised 12,206 individuals and the heart attack-sample of 11,941 individuals. Overall there were 1,204 first strokes and 1,027 first heart attacks occurring to sample members aged 65 and above.

7.3.2 Cardiovascular outcomes

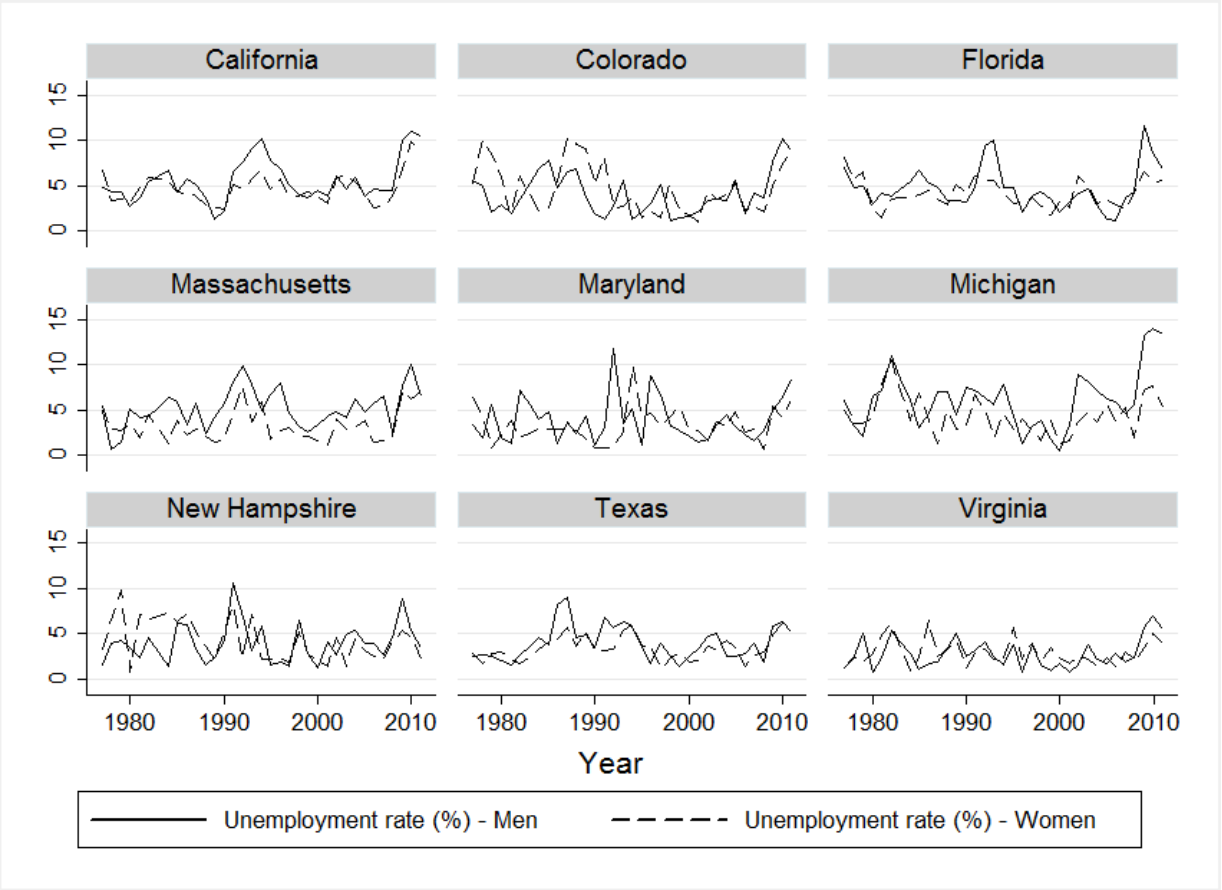
Incidence for stroke or heart attacks were defined as the year of the first fatal or non-fatal events reported either by the respondent or a proxy based on a doctor's diagnosis ("Has a doctor ever told you that you had a stroke/heart attack?").

7.3.3 State unemployment rates

Information on state-level unemployment rates was derived from the March Current Population survey (CPS) (U.S. Bureau of Labor Statistics 2009). The CPS, which is coordinated by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics (BLS), is the main source of labour market statistics in the U.S. including the unemployment rate. The CPS is a cross-sectional survey carried out on a monthly basis covering about 60,000 households and is representative of the civilian non-institutionalised population aged 16 and above. Individuals are classified as employed if they did "[…] any work for pay or profit during the survey reference week, did at least 15 hours of unpaid work in a family-owned enterprise operated by someone in their household or were temporarily absent from their regular jobs, whether they were paid or not." Individuals were classified as unemployed "[…] if they do not have a job, have actively looked for work in the prior 4 weeks, and are currently available for work" (U.S. Bureau of Labor Statistics 2011).

We calculated sex-specific unemployment rates for each state and year between 1977 and 2010 for individuals aged 50 to 65. As Figure 7 shows, the unemployment rates for individuals aged 50-65 show a substantial degree of variation within states over the respective time period, which is central for our identification strategy that uses variation across cohorts experiencing different unemployment rates when they near retirement age. Based on the year of birth and state of residence at first interview, we matched the state unemployment rates with the individual records from HRS. This resulted in a dataset including indicators of state- and sex-specific unemployment rates at each single age between 56 and 65. The average unemployment rate at these ages for the sample was 3.8% with a maximum of 15.5%.

Figure 7. Unemployment rates for ages 50-65 for six U.S. states: 1977-2011



Notes: Unemployment as percentage of civilian labour force, based on March Current Population Survey (CPS).

7.3.4 Covariates

All models include controls for sex, age as well as race. Furthermore, we include controls for employment status (employed or not) as well as marital status (married or not) at age 54 or at age 59. Because some individuals in the sample only joined HRS at ages above 54 or 59 respectively, we used an imputation method to derive labour market as well as marital status at these ages for those individuals (around 10% of the sample). The marital history was constructed using the combined information from version L of RAND-HRS, and the Core-HRS. The purpose of this procedure was to estimate the beginning and ending years of the first, second, third, or most recent marriage. These variables are already available in Core-HRS, or can be estimated using alternative information, such as the number of self-reported marriages, whether the marriage ended up in divorce, whether ever married, and current marital status. We inputted missing values for those individuals by using the length of longest marriage reported in RAND-HRS and the average age of first marriage of the cohort born in 1940. Information about job history is provided in RAND-HRS. However, it is not possible to construct complete trajectories of labour status for all respondents. Additional information was required to construct those trajectories. We combined variables from RAND and Core-HRS for that purpose. Two self-reported variables are key in this procedure; namely, the 'number of jobs respondent reports having through job history', and 'current job status at the time of interview'. If individuals reported having never worked, we assumed non-working status for the entire trajectory. If individuals reported to have had only one job and the year of start of the current job was available, we assumed that the respondent worked from that year until the year of first interview. Otherwise, we estimated the start year of the current work as the difference between the year of interview and the total years worked from self-report. If individuals were not currently working, the start year of the reported job was calculated as the difference between that year and the total years worked from self-report. Furthermore, we include fixed-effects for nine census divisions at birth: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain and the Pacific.

7.3.5 Potential mechanisms

To investigate the effects of state unemployment rates on potential mechanisms explaining the links between the former and cardiovascular outcomes, we derived a set of variables indicating individuals' status at single ages between 60 and 70 including: a) being employed; b) total wealth (log); c) coverage of long-term care (LTC) insurance; d) receiving social security income (SSI); e) regular physical activity; f) smoking and g) the number of alcoholic drinks consumed per day. With the exceptions of (log) wealth and the number of alcoholic drinks, all indicators were dichotomised.

7.3.6 Statistical analyses

The common approach of studies assessing the short-term effects of fluctuations in the unemployment rates on health and mortality in the U.S. is to use state-level unemployment rates as the central independent variable, while simultaneously including state-level fixed-effects. We build on this approach in applying an event-history approach using individual-level data and state-level unemployment rates at ages 56-64 as central independent variables, while also including fixed-effects for the state of residence. This approach thus uses within-state variation over time of unemployment rates experienced by different birth cohorts when they near retirement. Furthermore, this approach is based on the assumption that the state unemployment rates are largely exogenous to the individual and thus represent a quasi-natural experiment.

Using state unemployment rates at ages 56 to 64 as quasi-exogenous exposures, we implemented a Cox Proportional Hazard (PH) model of the following form:

$$h(t,X) = h_o(t)\exp\left[STATE_s\beta_1 + UNEMP_{sy}\beta_2 + \bar{X}_i\beta_3 + C_c\beta_4\right]$$

Whereas h_o is the hazard of experiencing a stroke or heart attack for individual *i* in state *s* and age *t*. $UNEMP_{sy}$ is a set of indicators of the state- and sex-specific unemployment rates at ages 56-64 in state *s* and year *y*. $STATE_s$ is a fixed-effect for

the state of residence and $\bar{X}_i$ is a matrix of time-invariant individual-level controls including sex, education, race and year of birth. All models also include a fixed-effect for the census region at birth (C_c). Standard errors were clustered on the state-level.

We tested the PH assumption for both outcomes based on the Schoenfeld residuals (Grambsch and Therneau 1994; Schoenfeld 1980) and found that all variables included in the models satisfy the assumption of proportionality.

In addition to the PH models, we also used logistic regressions to assess the relationship between unemployment rates experienced at ages 60-65 on a number of potential mechanisms assessed at single ages between 60 and 70. For this purpose we regressed each outcome (e.g. being employed) at every single age between 60 and 70 on the local unemployment rate at ages 60 to 65. For every outcome we estimated eleven separate models (for each single year of age between 60 and 70) and show the coefficients corresponding to the unemployment rates in Figure 9. For the outcomes number of alcoholic drinks as well as (log) wealth, we used ordinary least square (OLS) regressions. All models also include a fixed-effect for the census region at birth.

7.4 Results

7.4.1 Main effects

Table 26 shows the unweighted descriptive statistics for the entire sample. The average age for having a first stroke was 73.3 and 72.5 for a heart attack. About 45% of the sample was male and about 85% of the total sample was white. The average number of years of education was 12. The majority of the sample (65%) was born between 1931 and 1941.

Table 26. Descriptive statistics

	Stroke Sample				Heart Attack Sample		
	N	% (mean)	SD		N	% (mean)	SD
Age of first incident	1,209	(73.34)	5.52		1,027	(72.52)	5.22
Men	5,569	45.63			5,305	44.43	
Women	6,637	54.37			6,636	55.57	
Age	12,206	(70.34)	4.83		11,941	(70.77)	4.98
Sample cohort (year of birth)							
AHEAD (1923 or earlier)	1,288	10.55			1,286	11.05	
Coda (1924-1930)	2,003	16.41			1,911	16.42	
HRS (1931-1941)	8,074	66.15			7,640	65.64	
War Babies (1942-1947)	841	6.89			803	6.90	
Race							
White	10,300	84.38			10,025	83.95	
Black	1,739	14.25			1,750	14.66	
Others	167	1.37			166	1.39	
Employment status at age 59							
Employed	8,205	67.22			8,017	67.14	
Non-employed	4,001	32.78			3,924	32.86	
Marital status at age 59							
Not married	2,588	21.20			2,541	21.28	
Married	9,618	78.80			9,400	78.72	
Years of education	12,206	(12.34)	2.93		11,941	(12.34)	2.94

We first started assessing the effects of state unemployment rates on the risk of experiencing a stroke or heart attack at single ages between 56 and 64. However, we did not find any evidence of a significant relationship between state unemployment rates at ages below 60 on risk of CVD. We therefore decided to only include state unemployment rates at ages between 60 and 64.

Table 27 shows the results for the effect of state-level unemployment rates experienced at ages 60-64 on the risk of first strokes (left panel) as well as heart attacks (right panel) controlling for a core set of socio-demographic individual-level characteristics as well as labour market and marital status at age 59. All models include fixed-effects for state of residence as well as census region at birth. Being female, as well as having more education, is significantly related to lower risks for both outcomes. Compared to white individuals, black people have a significantly higher risk of experiencing a stroke whereas a higher age is associated with increased risks for both outcomes. Being in work at age 59 thereby is significantly associated with a lower risk of experiencing a stroke after age 64.

Table 27. Proportional hazard model: incidence of first stroke or heart attack at ages 65+

	Stroke				Heart Attack			
	HR	*LCI*	*UCI*	*p*	*HR*	*LCI*	*UCI*	*p*
Unempl. rate 60	1.022	1.001	1.044	0.040	1.012	0.974	1.050	0.550
Unempl. rate 61	0.998	0.966	1.032	0.930	1.026	0.992	1.060	0.130
Unempl. rate 62	0.983	0.959	1.009	0.190	1.015	0.979	1.052	0.430
Unempl. rate 63	1.036	1.004	1.070	0.030	0.997	0.968	1.028	0.860
Unempl. rate 64	0.985	0.949	1.022	0.420	1.002	0.959	1.047	0.940
Gender (ref.: male)	1	1	1	1	1	1	1	1
Female	0.754	0.690	0.823	0.000	0.572	0.492	0.664	0.000
Race (ref.: white)	1	1	1	1	1	1	1	1
Black	1.296	1.126	1.492	0.000	0.966	0.750	1.246	0.790
Others	0.843	0.428	1.660	0.620	0.998	0.580	1.716	0.990
Years of education	0.958	0.938	0.979	0.000	0.938	0.918	0.960	0.000
Year of birth	1.016	1.003	1.029	0.020	0.997	0.987	1.008	0.620
In work at age 59	0.869	0.771	0.980	0.020	0.982	0.821	1.175	0.840
Married at age 59	0.823	0.706	0.959	0.010	0.963	0.776	1.195	0.730

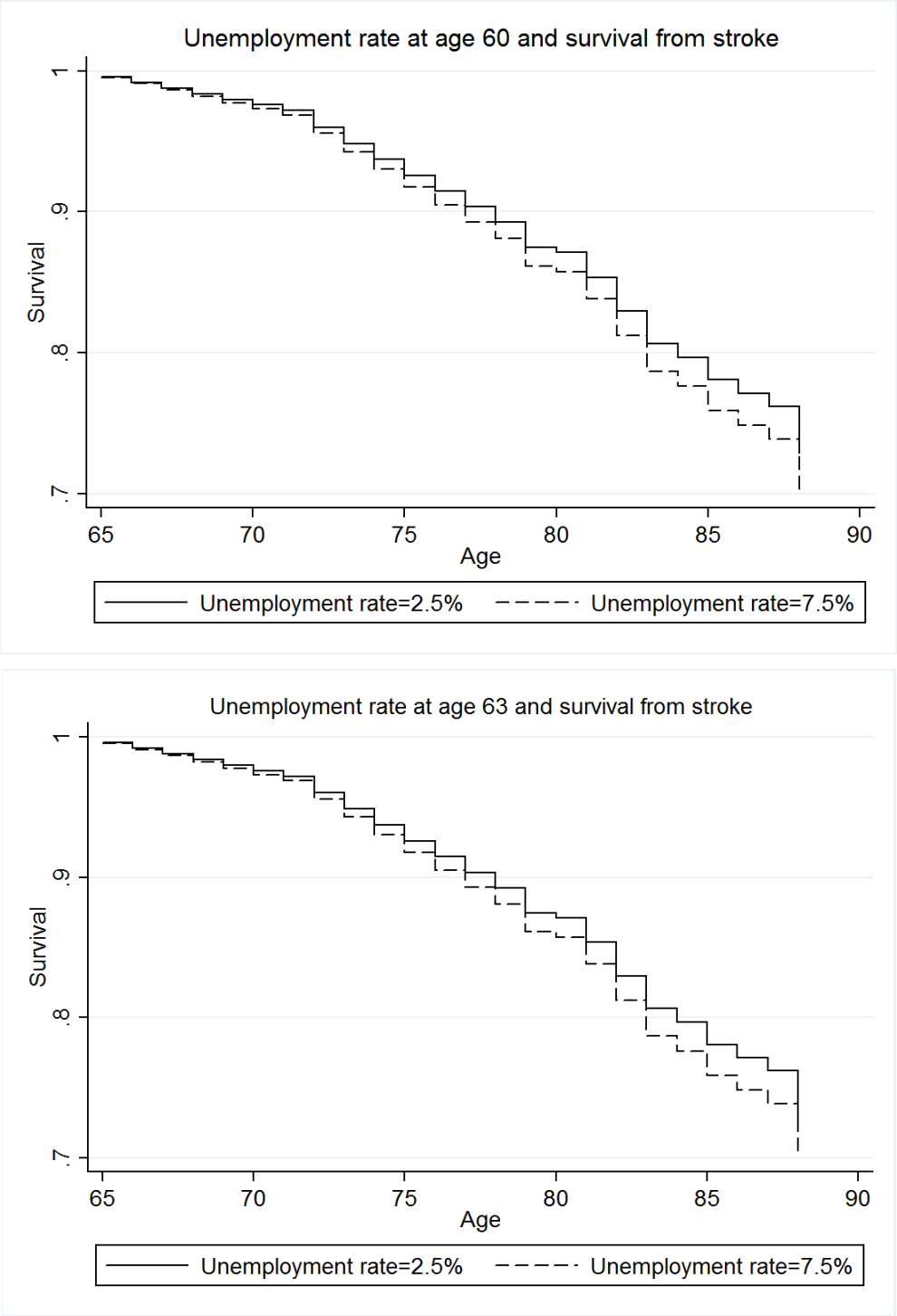
Notes: All models include fixed-effects for state of residence and census region at birth (results not shown). Standard errors are clustered on the state-level.

Looking at the results for state unemployment rates, the results suggest that higher unemployment rates at ages 60 as well as 63 are significantly related to higher risks of experiencing a stroke after age 64. Thus a one per cent increase in the state-level unemployment rates at ages 60 is associated with a 2.2% increase in the risk of experiencing a stroke ($HR_{stroke\ 60}$ =1.022; CI=1.001-1.044) whereas a one per cent increase in the state-level unemployment rates at ages 60 is associated with a 3.6% increase in the risk ($HR_{stroke\ 63}$ =1.036; CI=1.004-1.070). A test of significance for the state unemployment rates at ages 60-64 showed that they were jointly significant (p-value=0.0267).

We did not find evidence for a significant effect of state unemployment rates at ages 60-64 on subsequent risk of experiencing a heart attack.

Figure 8 shows the survival probabilities from stroke after age 65 for men and women who experienced either 2.5% or 7.5% unemployment at ages 60 and 63 respectively.

Figure 8: Survival from stroke after age 65 conditional on state unemployment rates at ages 60 and 63



Notes: The Figures show the survival probabilities after age 65 for men and women who experienced either 2.5% or 7.5% unemployment in their state of residence derived from the model presented in Table 27. All models control for education, age, race, census region at birth as well as state of residence.

We also included interactions between state unemployment rates at ages 60-64 with gender, education, race, employment and marital status at age 59. Whereas we did not find any significant interaction between unemployment rates at ages 60-64 with gender, education, marital status or employment status on the risk of CVD, the effect of unemployment rates differed by race. Hence the results suggest that a one per cent increase in the unemployment rate age 63 was associated with a significantly higher risk of experiencing a stroke among black individuals compared to white individuals ($HR_{interaction}$=1.357; CI=1.138-1.619).

Similar results were found when including the unemployment rates at ages between 56 and 64 instead of only including unemployment rates at ages 60-64 (Table 28). As a robustness analysis we also conducted the analyses using values of the state unemployment rates, which were de-trended using the Hodrick-Prescott filter (Hodrick and Prescott 1997). Whereas the results for the risk of stroke are in line with those obtained using the raw unemployment rates, when using the de-trended values of the unemployment rates, we found that increases in the unemployment rate relative to the trend experienced at age 61 are associated with an increased risk of stroke ($HR_{heart\ HP\ 63}$ =1.039; CI=1.004-1.076) (Table 29).

Table 28. Proportional hazard model: incidence of first stroke or heart attack at ages 65+ (unemployment rates at ages 56-64)

	Stroke				Heart Attack			
	HR	*LCI*	*UCI*	*p*	*HR*	*LCI*	*UCI*	*p*
Unempl. rate 56	1.003	0.974	1.033	0.830	0.961	0.923	1.001	0.050
Unempl. rate 57	1.003	0.970	1.038	0.850	1.012	0.985	1.040	0.400
Unempl. rate 58	0.985	0.957	1.013	0.280	0.997	0.961	1.035	0.890
Unempl. rate 59	0.999	0.972	1.027	0.960	0.968	0.935	1.003	0.070
Unempl. rate 60	1.023	1.001	1.046	0.040	1.019	0.980	1.059	0.340
Unempl. rate 61	0.998	0.965	1.032	0.920	1.021	0.986	1.056	0.240
Unempl. rate 62	0.983	0.958	1.009	0.200	1.011	0.975	1.048	0.570
Unempl. rate 63	1.036	1.004	1.069	0.030	0.996	0.965	1.027	0.780
Unempl. rate 64	0.984	0.948	1.020	0.380	0.999	0.957	1.043	0.960
Gender (ref.: male)	1	1		1	1	1		1
Female	0.745	0.672	0.826	0.000	0.540	0.464	0.629	0.000
Race (ref.: white)	1	1		1	1	1		1
Black	1.296	1.127	1.492	0.000	0.970	0.752	1.251	0.810
Others	0.843	0.429	1.653	0.620	0.998	0.587	1.698	1.000
Years of education	0.958	0.938	0.979	0.000	0.939	0.918	0.960	0.000
Year of birth	1.015	1.002	1.028	0.030	0.995	0.985	1.005	0.330
In work at age 54	0.872	0.774	0.983	0.030	0.997	0.837	1.188	0.970
Married at age 54	0.824	0.707	0.961	0.010	0.963	0.775	1.198	0.740

Notes: All models include fixed-effects for state of residence and census region at birth (results not shown). Standard errors are clustered on the state-level.

Table 29. Proportional hazard model: incidence of first stroke or heart attack at ages 65+ (HP filtered values)

	Stroke				Heart Attack			
	HR	*LCI*	*UCI*	*p*	*HR*	*LCI*	*UCI*	*p*
Unempl. rate 60 (deviation)	1.027	1.004	1.052	0.020	1.030	0.986	1.076	0.180
Unempl. rate 61 (deviation)	1.002	0.969	1.037	0.890	1.039	1.004	1.076	0.030
Unempl. rate 62 (deviation)	0.988	0.962	1.014	0.370	1.029	0.993	1.066	0.120
Unempl. rate 63 (deviation)	1.041	1.008	1.076	0.020	1.010	0.977	1.044	0.550
Unempl. rate 64 (deviation)	0.991	0.954	1.029	0.630	1.017	0.970	1.067	0.480
Gender (ref.: male)	1	1	1	1	1	1	1	1
Female	0.737	0.685	0.792	0.000	0.545	0.471	0.631	0.000
Race (ref.: white)	1	1	1	1	1	1	1	1
Black	1.296	1.126	1.490	0.000	0.965	0.747	1.246	0.780
Others	0.846	0.433	1.654	0.630	1.009	0.591	1.722	0.970
Years of education	0.958	0.938	0.979	0.000	0.939	0.918	0.960	0.000
Year of birth	1.014	1.002	1.026	0.020	0.995	0.986	1.005	0.310
In work at age 59	0.872	0.774	0.983	0.020	0.988	0.827	1.180	0.890
Married at age 59	0.824	0.706	0.961	0.010	0.965	0.778	1.198	0.750

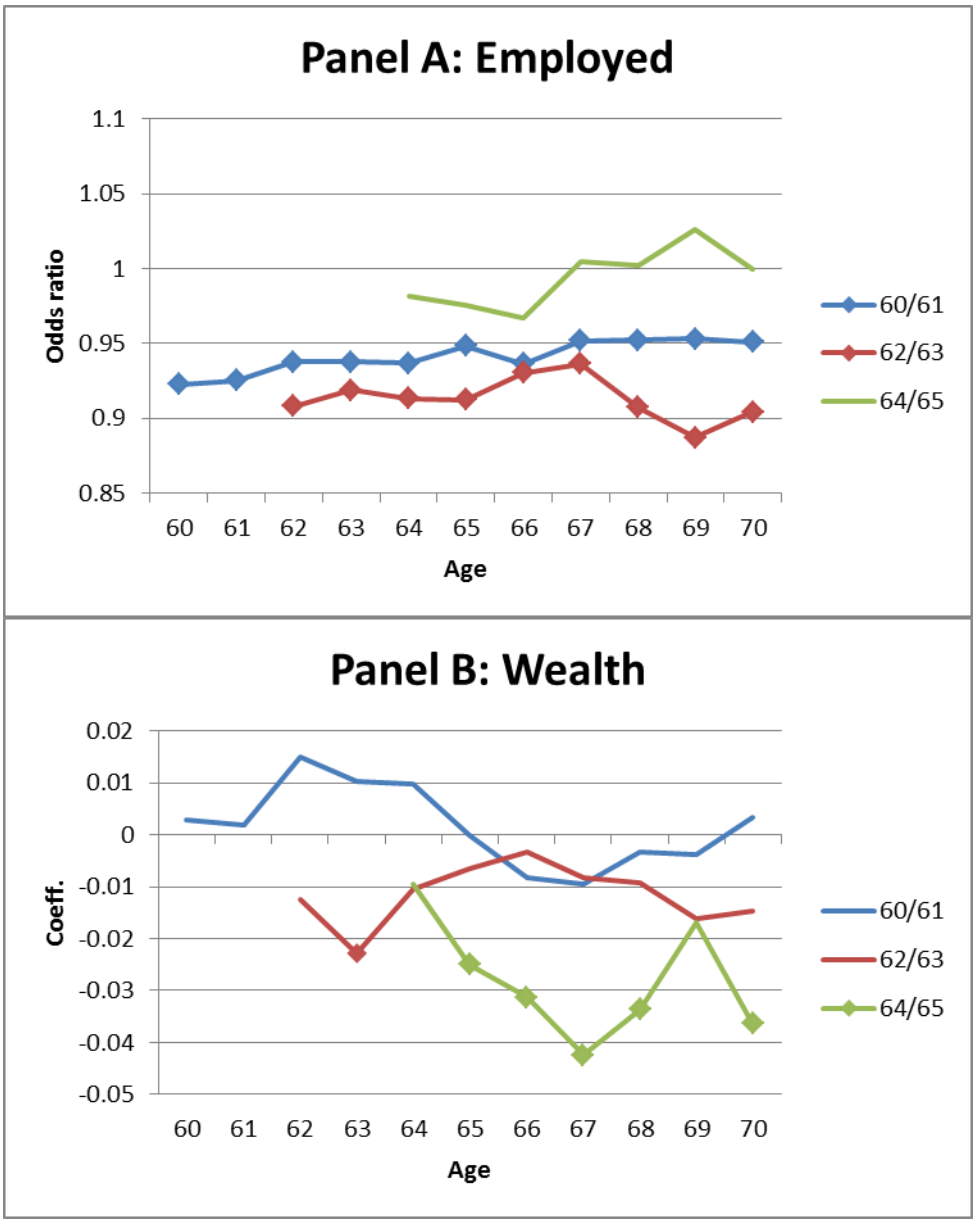
Notes: All models include fixed-effects for state of residence and census region at birth (results not shown). Standard errors are clustered on the state-level.

7.4.2 Effects of state unemployment rates on potential mechanisms

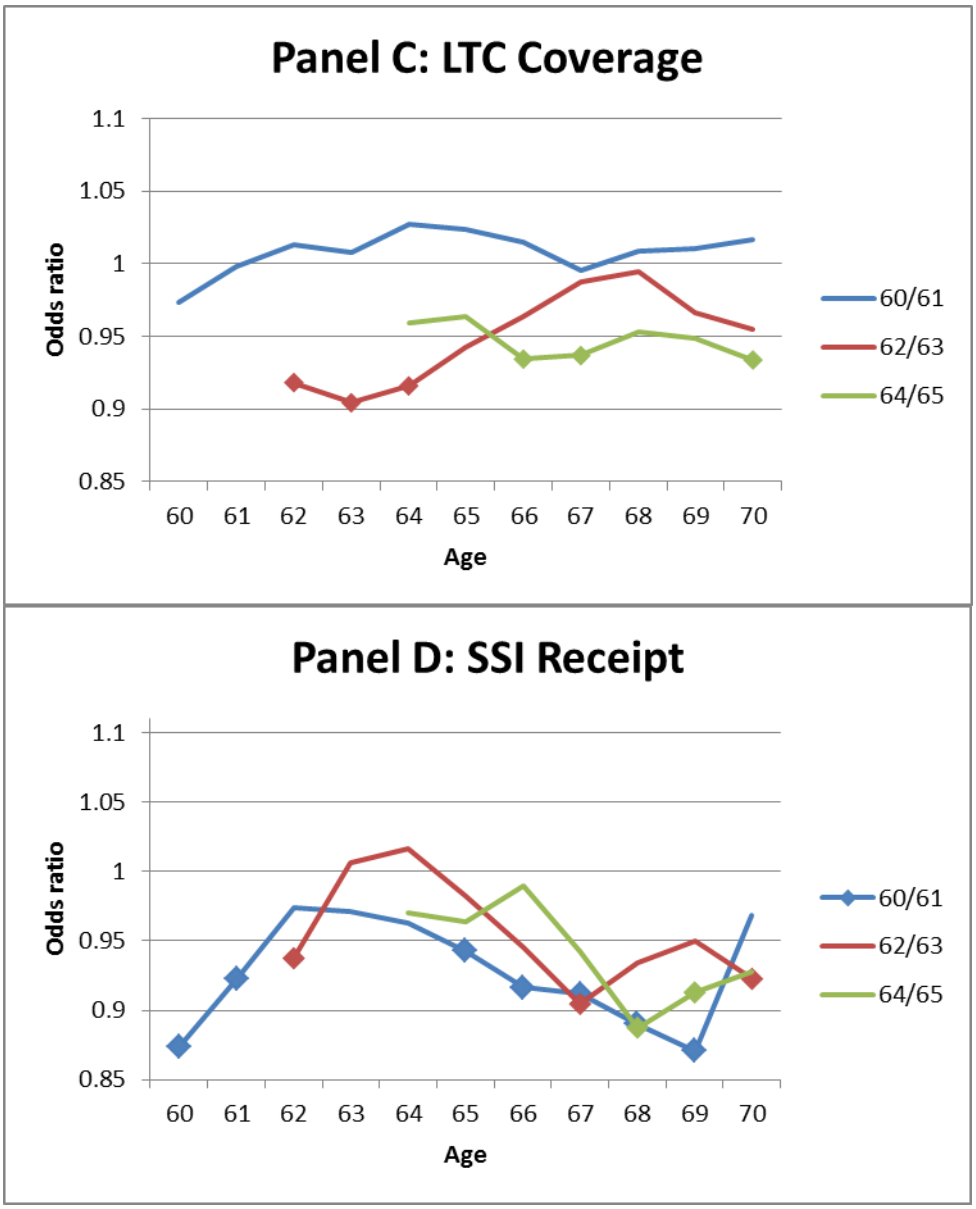
Figure 9 shows the results of models regressing the outcomes for potential mechanisms at single ages between 60 and 70 on unemployment rates at ages 60/61, 62/63 and 64/65 and the same covariates as presented in Table 27. For the purpose of presentation we chose to take averages of two years.

As the results suggest, higher local unemployment rates experienced at ages 60/61 as well as 62/63 are associated with lower chances of being employed at all ages between 60 to 70 and 62 to 70 respectively (Panel A). Furthermore, higher local unemployment rates experienced at ages 62/63 are associated with lower wealth at age 63, whereas higher local unemployment rates at ages 64/65 are significantly associated with lower wealth at ages 65-68 as well as age 70 (Panel B). We also found evidence that higher local unemployment rates at ages 62/63 are associated with lower chances of having LTC insurance at ages 62-64 and higher unemployment rates at ages 64/65 are associated with lower chances of having LTC insurance at ages 66-69 as well as 70 (Panel C). Experiencing higher local unemployment rates at ages 60/61 was associated with lower chances of receiving a SSI at ages 60-61 as well as 65-69 (Panel D). Also higher local unemployment rates at ages 64/65 are associated with lower chances of receiving a SSI at ages 68-69 (Panel D). With respect to health behaviours, higher local unemployment rates at ages 60/61 are significantly associated with lower chances of being physically active at ages 65-67 and higher unemployment rates at ages 62/63 are associated with lower chances of being physically active at ages 66-69 (Panel E). Results also suggest that higher unemployment rates at ages 62/63 decrease the chances of smoking at ages 67 and 68, whereas unemployment rates at ages 64/65 increase the probability of being a smoker at ages 68 and 69 (Panel F). Higher unemployment rates at ages 60/61 are associated with the consumption of fewer alcoholic drinks at ages 60-66, and higher unemployment rates at ages 62/63 are associated with the consumption of fewer alcoholic drinks at ages 63264, whereas higher unemployment rates at ages 64/65 are associated with the consumption of fewer drinks at ages 64-68 (Panel G).

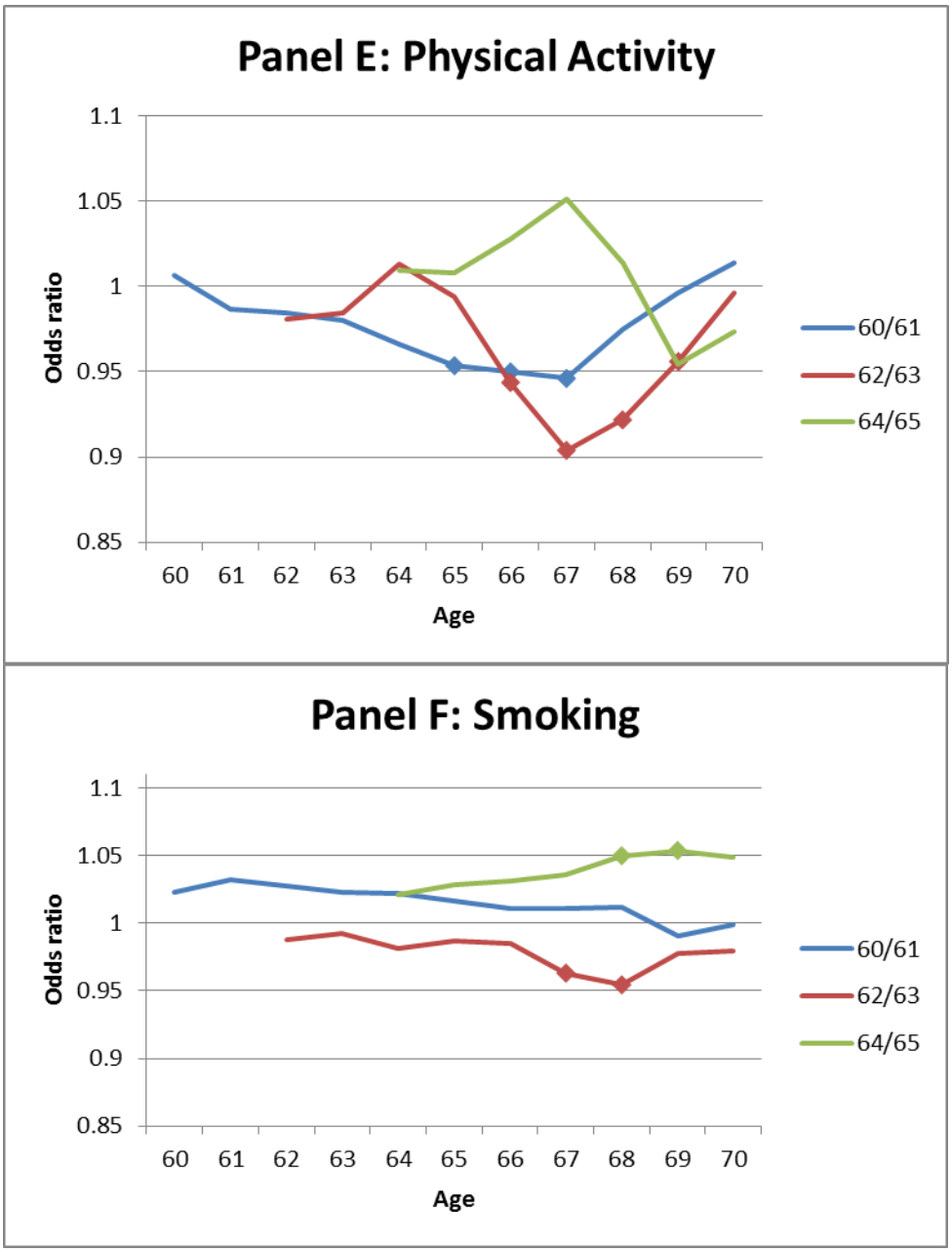
Figure 9. Effects of state unemployment rates in pre-retirement years on potential mechanisms at ages 60 to 70



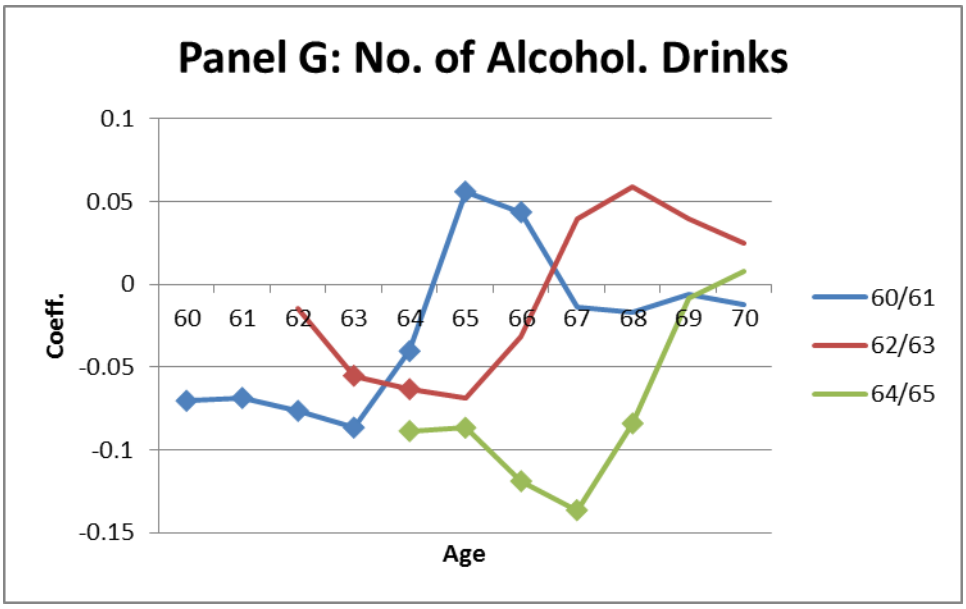
Notes: The figures show the regression coefficients or odds ratios derived from a set of regressions each regressing a respective outcome measured at a given age (e.g. age 65) on state-level unemployment rates experienced at ages 60/61, 62/63 and 64/65. All models include the same individual-level controls as shown in Table 27, as well as fixed-effects for state and census region at birth. Point-estimates significant on the 5%-level are marked with a diamond.



Notes: The figures show the regression coefficients or odds ratios derived from a set of regressions each regressing a respective outcome measured at a given age (e.g. age 65) on state-level unemployment rates experienced at ages 60/61, 62/63 and 64/65. All models include the same individual-level controls as shown in Table 27, as well as fixed-effects for state and census region at birth. Point-estimates significant on the 5%-level are marked with a diamond.



Notes: The figures show the regression coefficients or odds ratios derived from a set of regressions each regressing a respective outcome measured at a given age (e.g. age 65) on state-level unemployment rates experienced at ages 60/61, 62/63 and 64/65. All models include the same individual-level controls as shown in Table 27, as well as fixed-effects for state and census region at birth. Point-estimates significant on the 5%-level are marked with a diamond.



Notes: The figures show the regression coefficients or odds ratios derived from a set of regressions each regressing a respective outcome measured at a given age (e.g. age 65) on state-level unemployment rates experienced at ages 60/61, 62/63 and 64/65. All models include the same individual-level controls as shown in Table 27, as well as fixed-effects for state and census region at birth. Point-estimates significant on the 5%-level are marked with a diamond.

7.5 Discussion

7.5.1 Summary

The principal aim of this study was to assess whether macroeconomic conditions in the years nearing retirement have long-term effects on the risk of cardiovascular disease after age 65, using state-level unemployment rates at ages 56-64 as a quasi-exogenous exposure. The results suggest that cohorts who experience higher state unemployment rates at age intervals 60 and 63 have significantly higher risks of experiencing a stroke.

7.5.2 Limitations

A potential limitation is that we do not have information about the state of residence at ages 56 to 64 for all individuals. As a result, we assume that individuals were living in the same state at these ages as the one they were interviewed in the first time. If older workers moved from a state that experienced worse labour market conditions to one with more favourable conditions, this would bias our results, especially if this is particularly the case amongst healthier and better skilled workers. However, previous studies have shown that the geographical mobility of older workers is generally low (Coile et al. 2014). In this study, Coile et al. calculate outward migration rates for older workers since the 1960s using data from the Panel Study of Income Dynamics (PSID). Their finding suggest that about 5% of older workers move between states over a five-year period and, furthermore, that higher state unemployment rates do not significantly affect the probability of migrating to another state.

A potential concern is that the results may be driven by a specific cohort or state who experienced disproportionally adverse economic conditions when nearing retirement. The oldest individuals included in our sample, born in 1922, experienced the recession in the years 1980/81 around age 60. Furthermore, those individuals born between 1927 and 1928 experienced the recession of 1990/91 around age 63. Therefore, those individuals born in 1930 and 1931 experienced this recession at ages 60. At the same time, unemployment rates not occurring during these recessions

show significant differences between states. To assess to what extent the results may be affected by single cohorts or states, we used Stata's post-estimation option 'dfbeta' to derive the differences between the regression coefficient when the 'jth' observation is included and excluded. However, we found no evidence to suggest that either individual cohorts or states would disproportionally affect the estimates for the effects.

Although the negative effect of higher unemployment rates experienced at ages 60 as well as 63 on the risk of strokes appears to be robust to a number of alternative specifications, overall there is no strong evidence for a systematic effect of unemployment rates in the pre-retirement years on subsequent risk of CVD given that only two out of ten estimates of unemployment rates for the risk of stroke as well as heart attacks (Table 27) are significant at the 5% level. Further studies should assess if unfavourable economic times experienced at these particular ages affect specific pathways, which in turn lead to increased risk of experiencing a stroke.

7.5.3 Explanation of results

Our findings of negative long-term effects of higher state unemployment rates in the years nearing retirement on subsequent risk of cardiovascular disease are in general consistent with a number of studies. On the one hand, this finding is consistent with studies assessing the effects of job loss or unemployment on health of older workers (Gallo et al. 2004; Gallo et al. 2006). In this context, the results indicate that higher state unemployment rates are – as expected – related to individual risks of being unemployed in the years nearing retirement. On the other hand, the main finding is in agreement with studies showing increased mortality and morbidity due to income-shocks or losses in housing wealth, which may be caused by recessions (Adda, von Gaudecker and Banks 2009; Hamoudi and Dowd 2013).

In tendency, our findings are also consistent with that of a recent study assessing the effects of state unemployment rates in the years prior to retirement on cohort-survival probabilities (Coile et al. 2014). In their study, using aggregate data for US cohorts born between 1910 and 1929, Coile et al. (2014) found that higher state unemployment rates at ages 58 increase mortality rates from age 63 onwards. Also, higher state unemployment rates experienced at ages 60 increase mortality rates from

age 65 and above. Thereby, higher state unemployment rates at age 55 were associated with lower mortality rates at ages 56-60 and higher unemployment rates at age 65 were associated with lower mortality at ages 65-69. Overall the findings of this study suggest that unemployment shocks at ages 57-61 have the largest negative effect on subsequent survival probabilities and also that unemployment shocks beyond age 62 have no such negative effect. A potential explanation for this finding discussed by the authors may be the availability of SSI at age 62, which may compensate for income or wealth losses induced by unemployment. At the same time, in another study, Coile and Levine (Coile and Levine 2011b) found that the positive effect of higher state unemployment rates on the likelihood of claiming SSI is particularly strong at ages 62-64.

At first sight, our results seem to contrast with those of studies showing short-term reductions in CVD mortality in relationship to higher unemployment rates (Edwards 2008; Ruhm 2007). A central argument for why higher unemployment rates should lower CVD mortality rates is that the former leads to reductions in work-related stress and changes towards healthier behaviours such as reductions in smoking or drinking. Especially Miller et al. (2009) have shown that short-term reductions in mortality in times of higher unemployment are mostly not the result of job loss or unemployment, but rather the result of factors unrelated to the own labour force status. At the population-level, these more behavioural adjustments in times of higher unemployment in the short-term appear to outweigh any potentially adverse effects of job loss or unemployment.

Coile et al. (2014) argue that the negative long-run effects of higher unemployment rates in the pre-retirement years on subsequent cohort survival probabilities are likely driven by individual-level experiences of adverse events in relation to unfavourable economic conditions such as job loss, unemployment or losses in housing wealth. As such, several studies have shown that job loss can have significant negative long-term consequences on survival. For example, Sullivan and von Wachter (2009) found that workers who experienced a job loss during a mass layoff had higher chances of mortality up to twenty years after the event. This finding implies that recessions, even if they may lead to short-term reductions in mortality for the entire population, do still represent a significant long-run health risk for those individuals who are

adversely affected by an economic downturn. Sullivan and von Wachter (2009) therefore speculate that the negative long-run effects of recessions may well outweigh the positive short-term effects. In the present study we found no consistent evidence that higher unemployment rates in the pre-retirement years negatively affect wealth after age 65. However, we did find some evidence that higher unemployment rates negatively affect labour force participation around ages 60-64, which may offer a partial explanation for the observed effect of higher unemployment rates on the risk of stroke.

7.5.4 Conclusions

The central finding of this study is that higher state unemployment rates experienced at ages 60-63 have long-term negative effects on the risk of CVD at ages 65 and above. This finding is in contrast with the findings of previous studies showing reductions in CVD mortality associated with higher unemployment. Older workers aged between 60 and 63 may be particularly vulnerable to macroeconomic shocks because they have generally fewer options to make up for any losses experienced as a result of a recession. As a result, losses occurring at these ages may affect their welfare throughout retirement and restrict access to many material resources linked to health such as income, wealth or healthcare coverage.

Chapter 8 Conclusions

8.1 Summary of findings

The central aim of this thesis as set out in the introduction was to bridge the gap between studies looking at the short-term health-effects of economic fluctuations at the population-level and those studies looking at the long-term effects of individual experiences of adverse outcomes. To do so, we adopted a life-course perspective and assessed whether economic fluctuations experienced at earlier stages of the life course had a long-term effect on several measures of functional health as well as cognition. The life-course periods covered include the transition between education to the labour market, prime working ages (25-49) and the years approaching retirement. The empirical approach was based on a linkage of historical time series on GDP as well as unemployment rates with individual-level data for several Western European countries as well as the U.S.

The first paper analysed the effects of variations in the unemployment rates at the time of graduation on functional health in later life using data for eleven Western European countries from SHARE. This study was largely inspired by recent evidence showing that individuals who graduate during a recession may suffer significant reductions in terms of income as well as employment probabilities up to several years after. Against the background of studies showing that individuals' incomes as well as career trajectories can have causal effects on health, the central hypothesis of this study was that individuals leaving school in less favourable times may experience worse health in later life than their counterparts graduating during more favourable economic times, for example, due to reduced access to material resources linked with health such as income and health insurance. To empirically test this hypothesis, we linked data from SHARE-participants aged 50-74 who left school or college between 1956 and 1986 to country-specific unemployment rates obtained from the OECD. The results obtained suggest that higher unemployment rates during the school-leaving year were associated with fewer functional limitations at ages 50-74 among men, but more physical functioning limitations among women,

particularly with (post-) secondary education. Furthermore, the results also show that the economic conditions in the year of leaving school were associated with several labour market, marriage, fertility and health behaviour outcomes. For example, for lower-educated men, higher unemployment rates in the year of graduation were associated with higher risks of having a gap due to unemployment after graduation, but lower risks for men with (post-) secondary education. We also found evidence that for women with (post-) secondary education, less favourable economic conditions at graduation were associated with a lower age at first childbirth and lower ages of first marriage. No significant relationship existed between unemployment rates at graduation and alcohol or tobacco consumption in later life.

The second paper assessed the relationship between the number of recessions experienced at several age-intervals between ages 16 to 49 on functional health, also using data for eleven European countries included in SHARE. This paper extends the first paper by focusing on a longer period of exposure to economic downturns, namely during early and middle adulthood. This period covers several important life-course events such as the entrance into the labour market, leaving the parental home, the establishment of own residence, family formation and the transition into parenthood, which may be influenced by macroeconomic shocks. The health measures used as dependent variables are Activities of Daily Living (ADL) as well as Instrumental Activities of Daily Living (IADL). Furthermore, we also used handgrip strength as a quasi-objective indicator of health. Besides the direct effects of recessions on these outcomes, we also explored potential pathways linking recessions to health, including labour market and marital trajectories, as well as health behaviours. The results of this paper suggest that additional recessions experienced at most age intervals between ages 16 to 49 have negative long-run effects on functional health in later life. The results also show that recessions are linked to a number of unfavourable labour market outcomes. For example, we found that additional recessions experienced during several age intervals between ages 16 to 49 increase the chances of working part-time, being laid-off and being unemployed.

The third paper adopted a similar approach to the second paper, but used cognitive functioning as the outcome of interest. The findings suggest that economic recessions

during working ages are associated with cognitive function in late-middle and older age. Exploring mechanisms in the link between economic recessions and cognitive function, we found evidence that, especially for women, economic recessions during early adulthood lead to some extent to downward social mobility and to unfavourable changes in labour market involvement. For men, economic downturns during middle age were linked to risk of being laid off, which was in turn associated with worse cognitive function later.

The fourth paper used data from the HRS for the U.S. to assess the effects of state-level unemployment rates experienced in the years prior to retirement on the subsequent risk of experiencing a stroke or a heart attack. This paper focuses on the role of economic fluctuations in later adulthood and thereby adds to the first three papers which have focused on the period of early as well as middle adulthood. The years nearing retirement age can be regarded as a sensitive life-course period because older individuals are very constrained in their options to respond to a suddenly-changing economic climate, so that losses during this period may have a lasting effect on welfare throughout retirement. The results suggest that a one percentage increase in the state unemployment rate experienced at age 60 as well as 63 is associated with an increase in the risk of experiencing a stroke after age 65, whereas we found only very limited evidence of a relationship between unemployment rates in the pre-retirement years and an increased risk of heart attacks at ages 65+. However, taking into account the multitude of coefficients being estimated, further analyses need to determine whether this finding indeed is a robust effect or rather an incorrect failure to reject the null hypothesis (Type I error).

8.2 Implications for research

Overall, the findings of this study suggest that economic downturns experienced during early and middle age are associated with worse health and cognitive functioning in later life. As such, this implies that adverse economic conditions experienced at times other than around birth can have long-term effects on individuals' health.

One implication of the finding that macroeconomic conditions during life course periods beyond the time around birth can have considerable long-term effects on

health, which are likely driven by socio-economic mechanisms, is that there exists an opportunity for social policy interventions to mitigate these effects. Although it has been beyond the scope of this thesis to propose any specific policy interventions, the idea that policy interventions at individuals in middle or later adulthood can potentially have sizeable effects, to some degree counteracts the widespread argument that policies should be targeted predominantly towards children (Heckman 2006).

Another implication of the finding that recessions can have negative-long term consequences on health is that the latter should be taken into account in the general discussion about the health implications of economic downturns. Although the results presented in this thesis may not be regarded as directly opposing those studies showing improvements in population health during economic downturns (Ruhm 2000), they raise the question as to whether the negative health effects of recessions in the long run outweigh potential positive short-term effects.

An implication of the findings for the field of life-course research is that contextual factors are a potentially important factor in shaping individuals' health trajectories. It furthermore highlights that in many cases, many individual-level events or circumstances, such as job loss or poverty, do not occur in isolation but are embedded in a wider societal context. The state of the economy at different stages of the life course could be one important contextual factor, and which could be taken into account in future studies.

If macroeconomic conditions experienced during different life-course periods do have long-term consequences on socio-economic status as well as health, then the former may also be an important factor in the process of stratification. Hence, a particularly important question that could be addressed by further research is to what extent differential exposure to the business cycle during the life course can explain social inequalities in health in later life. The experience of less favourable macroeconomic conditions of one cohort could lead to an accumulation of disadvantage among the members of this cohort and shape their trajectory.

Several pieces of evidence suggest that women are disproportionally more negatively affected by economic downturns than men. Although it remains unclear what exactly causes this increased vulnerability among women, a potential explanation related to the different labour force attachment and trajectories of women compared to men. Especially among older European cohorts, who represent the largest share of the empirical sample used in chapters 4, 5 and 6, participation in higher education as well as the labour force was comparatively low. For example, in 1950 the labour force participation rate of women was only around thirty percent in many European countries (Enloe 1980; Simeral 1978). At the same time, women have historically often left the labour market when the state of the economy worsened in order to make available jobs for their husbands or partners. Also because of this phenomenon feminist scholars have labelled women as the 'reserve army of the labour force' (Enloe 1980; Simeral 1978). Because female labour supply has been particularly sensitive to macroeconomic conditions, women are also at increased risk of experiencing poverty and economic insecurity. One finding, particularly of chapters 4 and 6, was that women's health is particularly negatively affected by recessions in earlier-adulthood. An explanation for this finding may be that recessions at these earlier stages of their careers may have discouraged many women to re-enter the labour force or even prevented them from entering the labour force in the first place. What is interesting is that when looking at the results of economic fluctuations around retirement age on CVD in the US, there were no differences in the effect between men and women. A potential explanation for this finding may be that female labour force supply as well as educational achievement among older cohorts is much higher among women in the US than their European counterparts.

Besides the evidence that recessions may have negative long-term effects on health, the findings presented in Chapter 4 also suggest that adverse macroeconomic conditions experienced at specific, potentially sensitive periods, may potentially lead to better health in later life. With regard to the life-course perspective, the latter implies that exposure to circumstances generally regarded as adverse, such as high unemployment, may under certain conditions trigger behavioural or psychological changes, which make individuals more resilient towards additional experiences of adverse conditions. In other words, one could say that 'bad things do not always have to lead to bad consequences'.

8.3 Limitations

Notwithstanding its contribution to knowledge, this study has several limitations which are important to highlight and will be discussed in this section. Whereas each empirical chapter already includes a discussion of specific limitations, the following section aims to address the more general limitations.

A central question in relationship to the inherent complexity of the subject matter is how to measure business cycles or the state of the economy in more general terms. As such, indicators such as a countries' GDP or the unemployment rate are highly aggregated and may not be a good indicator for capturing the state of local economies or labour markets. For example, people living in urban areas may be less affected by economic downturns as a result of more flexible labour markets than people living in more rural areas, whereas information on regional GDP as well as unemployment rates would generally be a desirable alternative to the use of country-level indicators, or state-level in the case of the U.S. However, comparative historical information on regional GDP or unemployment rates is not readily available.

In general, the decision to use either unemployment rates or GDP was based on two factors. On the one hand, comparative data on unemployment rates are only available since around 1950, whereas data on GDP is available for the entire 20th century. Because the timing of exposure for the relevant cohorts used in the analyses for chapters 4 (year of completing full-time education) and 7 (years leading to retirement) occurs after 1950, unemployment rates were chosen as measure of economic conditions. On the other hand, using recessions defined based on quartiles of de-trended GDP time series has the advantage of being a good summary indicator for economic conditions over a longer period of the life-course (e.g. ages 20-49). Whereas GDP is a highly aggregated measure of economic production of an economy, the unemployment rate is a more specific indicator of labor market conditions. In general, there is a well-established relationship between GDP and the unemployment rate which, in most cases, follows the so called 'Okun's law' stating that a two percent increase in aggregate output corresponds to a one percent decline in cyclical unemployment (Prachowny 1993). Although the correlation between unemployment rate and GDP is usually high, the latter is often less the case in the

short-run as it often takes some time for the unemployment rate to increase after a decrease in GDP. As a result, the unemployment rate is usually considered a lagging indicator of the state of the economy. For example, employers may initially respond to an increase in demand by increasing the hours worked by current employees without hiring new workers. Similarly, when aggregate demand decreases, employees may not directly lay-off workers – which is often difficult due to employment protection regulations – but rather reduce their hours or pay. However, also because change in work hours will affect aggregate demand in an economy, employers usually respond to changes in aggregate demand by hiring new workers or by laying-off existing ones. In the US, the average response time between a drop in GDP and the unemployment rate has been around 8 months since the end of WWII (Levine 2013). However, it appears that the response time has increased substantially over time with the emergence of a phenomenon called 'jobless recovery' (Levine 2013). In particular, the 2001 and the 2007-09 recessions stand out because the unemployment rate did increase disproportionally less compared to the decrease in GDP. At the same time, there was a time-lag of 21 months after the 2001 recession and 12 months after 2009 recession between the start of the economic recovery and a decrease in unemployment (Levine 2013). A similar phenomenon has been observed in most European countries in the aftermath of the Financial Crisis (International Labour Organization (ILO) 2014). It remains unclear, however, why the more recent recessions have been characterized in many countries by jobless recoveries. One hypothesis is that the focus on fiscal consolidation, rather than economic stimulus, has been a key factor (International Labour Organization (ILO) 2014). The unemployment rate is probably a better indicator of labour market conditions and more closely related to several potential pathways linking business cycles and health, e.g. working hours or fear of job-loss. Because of existing time-lags between changes in GDP and the unemployment rate, it may therefore be preferable to use the latter if the intention is to measure the effect of business cycles during very specific life-course stages, e.g. the year of graduation. Because the correlation between GDP and unemployment rates has been generally high, despite small temporal lags, using recessions defined on the basis of GDP deviations should be an accurate approach when looking at longer exposure times, such as a five or ten year window (e.g. ages 20-29). Whereas the empirical analyses in this thesis do mostly cover business cycle events before 2001, the recent phenomenon of jobless recoveries raises important

questions about the adequacy of GDP as a good measure of economic conditions relevant to population health.

Several of the papers included in this thesis base the identification of business cycle information on deviations from a more general trend. Although this approach has become common practice in the literature, the latter raises some important questions about the relationship between deviations from a trend and levels economic conditions. The motivation for using deviations from a general trend rather than the levels of unemployment rates stems from the circumstance that there exist very clear secular trends in the time series of both GDP as well as unemployment rates. For example, overall levels of unemployment have increased in most European countries as well as the US since the end of WWII. As a result, an individual laid-off during the 1973-75 recession, on average, experienced a substantially lower unemployment rate than an individual being laid-off in the most recent recession. Using deviations from a trend rather than absolute values therefore aims to achieve comparability over time. The central assumption underlying this approach is that a one percent increase in the unemployment rate from one year to another has the same effect, irrespectively of whether it occurred in times of high or low levels of unemployment.

Although particularly severe recessions coinciding with high levels of unemployment could arguably have particularly negative effects on health and other social outcomes, which the approach using deviations from a trend does not distinguish, relatively small fluctuations in the business cycle may have significant long-term effects as a result of accumulative disadvantage. For example, Oreopoulos et al. (2012) found that a one percentage point increase in the unemployment rate in the year of graduating from college, on average, resulted in a reduction in wages by around two percent annually in the ten years after graduation. Although a two percent reduction in wages may seem small when only looking at a single year, the cumulative wage penalty over a ten year period totals twenty percent. Furthermore, the results of this thesis also suggest that relatively small deviations in economic conditions at potentially sensitive life-course stages, such as the year of completing full-time education or the years nearing retirement, may have substantial long-run effects on health.

Although it would be desirable to simultaneously account for the levels of unemployment or GDP, what should be noted is that the results obtained from using either deviations from the trend or actual unemployment rates (chapter 4 and 7) are substantially very similar. For example, the hazard rate for the effect of a one percent increase in the unemployment rate at age 63 on subsequent risk of stroke was 1.036 (p-value=0.030) (Table 27), whereas the corresponding estimate using deviations from the trend was 1.041 (p-value=0.020) (Table 29). A similar pattern was found when comparing the effects of unemployment rates or deviations in the year of completing full-time education on functional health at later-life (chapter 4, results not shown). A reason why the results of the two approaches are very similar may be due to the inclusion of fixed-effects for countries or states, which eliminate differences in the levels between the latter. At the same time, controls for year of birth likely accounts for some of the secular trends in macroeconomic conditions.

In general, the approach of using deviations from a trend and recessions defined as quartiles of the latter has a large degree of comparability with the approach of using levels. On the one hand, using the years falling into the lowest country-specific quartiles of deviations in GDP to identify recessions always includes the years in which there was a recession, defined as a negative growth in real GDP. Although some historical recessions were particularly pronounced, the empirical analyses included in this thesis – particularly those using quartiles in chapters 5 and 6 – clearly indicate that recessions have negative long-run effects on health. Because the recessions defined as years falling into the lowest country-specific quartiles of changes in GDP always include the very severe recessions, it seems reasonable to assume that this pattern would be similar when focusing particularly at the more severe recessions.

Although using deviations from a trend, and recessions defined on this basis, has advantages in terms of comparability across time and space, a major limitation is that this approach does not distinguish between types of recessions. Although recessions usually involve a slowing down of economic activity, increases in the unemployment rates and bankruptcies, at least four different types have been identified in the literature (Bernanke and Gertler 1989): 1) So called ‘boom and bust recessions’ usually follow after a period of rapid economic expansion which usually coincides

with an equally rapid increase in inflation, current account balance and consumer debt. When governments or central banks reduce the supply with money, e.g. through increases in interest rates or taxes, prices and aggregate demand for labour usually start falling. Examples for this type of recessions, which usually are relatively short, are the 1973-75 recessions in most Western European countries and the US as well as the 1990-02 recession, which both ended a period of rapid economic expansion. 2) So called 'balance sheet recessions' occur when private companies and banks witness a sudden and significant increase in debt, for example through increases in bad loans, resulting in a focus on saving and hence in a decline of economic growth. The decrease in availability of bank loans and refinancing options often leads to a spiral of falling demand, prices and increases in credit defaults. So called 'balance sheet recessions' often last for a comparatively long time and often involve a so called 'double dip recession' (Kyer and Maggs 2012), i.e. an instance in which the growth rate of real GDP becomes negative again after a period of recovery from an earlier recession. An example for this type of recession is the recent Financial Crisis starting in 2007, which followed a burst of the housing bubble in the US (Angelides and Thomas 2011). 3) A 'depression', which is a very rare and particularly severe form of recession, is an extended period of decreasing economic activity, investments and unusually high levels of unemployment. Although there is no scientific definition of the term, a depression usually involves a decline in real GDP by ten or more percent and duration of two or more years (The Economist 2008). The most prominent depression was the so called Great Depression in the US following the Wall Street Crash of 1929 and leading to a reduction in GDP by around 33% and an increase in the unemployment rate by 25%. A more recent example is the so called Greek Depression which resulted in a decrease in economic output by around 30% and unemployment rates of more than 25%. 4) So called 'supply side shocks' usually occur due to a sudden and unanticipated change in the price of an important product. Although 'supply side shocks' may not necessarily lead to a recession they may nevertheless cause a very sudden and significant decrease incomes as well as increases in unemployment. Although recessions caused by 'supply side shocks' are very rare in large developed economies, one example is the Oil Crisis of 1973 which was caused by a sharp increase in the oil price following an embargo of the Organization of Arab Petroleum Exporting Countries (OAPEC). What becomes clear from this discussion is that recessions, without doubt, can be

caused by different factors and also have different effects on the economy as such. Because both the causes as well as the effects of recessions have greatly varied over time and between countries, it is very difficult to empirically account for this circumstance. Whereas analyses which focus only on very specific historical recessions may suffer from limited generalisability, results from analyses based on several countries and different historical period – such as those included in this thesis – may not apply to all forms of recessions. Ideally, detailed analyses focusing on specific historical periods should complement studies including several countries and longer time periods.

Although the analyses presented in this thesis suggest that economic fluctuations at potentially sensitive life-course stages can have long-lasting effects on several socio-demographic outcomes, plausibly linked to health, those findings remain inconclusive. Whereas one of the reasons may be related to the limited sample size, another reason may be that the mechanisms linking business cycles and health over the long-run are more complex than the mechanisms linking business cycles and health in the short-run. Although also the short-run mechanisms remain poorly understood (Ruhm 2015), the literature has mainly quoted behavioural mechanisms as the principal explanation for the finding that recessions improve population health (Catalano et al. 2011). For example, several studies have shown that economic downturns lead to reductions in smoking or alcohol consumption and increases in healthy behaviours such as physical activity or dietary intake (Catalano et al. 2011). The generally shared interpretation is that the positive effect of recessions on health is mainly driven by behavioural adjustments among the employed population which, even in a severe recession, represent the by far largest share of people in working-age.

However, when looking at the long-run effects of economic fluctuation on health, as for example Coile et al. (2014) argue, it is more likely that the latter are driven by the negative long-run effects on wealth and income, particularly among individuals being laid-off or withdrawing from the labour force. This is in line with a wealth of studies which show that socio-economic conditions are linked to health, as well as the negative-health effects of unemployment. In the short-run, the negative effects of economic downturns on wealth and income may positively affect health-related

behaviours, e.g. in the form of reduced smoking as a result of reduced incomes. At the same time, reductions in working-time during an economic downturn, either in the form of reduced hours or unemployment, may increase the time people spend engaging in leisure activities or cooking healthy foods (Catalano et al. 2011) and through this pathway improve health. However, in the long-run it is possible that the accumulative effect of reduced income and access to material resources linked to health outweigh any positive short-term effects of economic downturns. For example, a two percent reduction in the average starting wage among college graduates as a result of a one percent increase in the unemployment rate, as found by Oreopoulos et al. (2012) for Canada, may not have a large immediate effect on health. However, the accumulative and persisting effect of this wage penalty may potentially lead to significant health disadvantages for those cohorts compared to cohorts graduating during more favourable economic conditions.

A limitation of those papers using data from SHARE is that they are largely based on cross-sectional data. In contrast to the study using data from HRS, the latter does not make it possible to use a longitudinal research design that follows individuals over time. An issue, particularly with the use of cross-sectional data for those cohorts included in SHARE, may be selection biased due to differential mortality according to socio-economic characteristics or directly related to the exposure to the business cycle. Whereas it is not possible to exclude this source of bias, sensitivity-analyses for comparatively younger cohorts, for which mortality-selection should be less pronounced, did generally confirm the results obtained for older cohorts. Another limitation with regard to the use of cross-sectional data is that the age at interview is defined by the year of age. As a result, every individual of a certain age living in a given country had the same exposure to the business cycle. The research design used in those studies using data from SHARE therefore assumes an age-related trend in health, which can be captured by controlling for the latter in some functional form. Based on this assumption, differences in health between individuals at different ages that are not captured by the age-trend are therefore attributed to differential exposure to the business cycle during their life-course. Whereas this circumstance certainly represents a general limitation, the fact that the second wave of SHARE includes a refreshment sample implies that age is not entirely defined by year of birth.

Another limitation of using cross-sectional data is the inability to distinguish between short-term effects of business cycles on health and long-term effects given that the health outcomes are only measured at the time of interview and thus after the exposure. For example, it is possible that a functional limitation existing in later life is the result of a workplace accident triggered by excessive working hours during a boom. At the same time, the functional limitation could be the result of an event occurring only several years after the exposure, but triggered by the latter. However, only a small percentage of people generally suffer from functional limitations before the age of 49, which was used as the cut-off point for the exposure to the business cycle in those papers using data from SHARE. Furthermore, information collected in SHARELIFE about the age of onset of existing functional limitations also confirmed that only a very small percentage of the limitations reported at ages 50 and above already existed before this age.

Whereas studies on the short-term effects of business cycles on mortality have generally found a pro-cyclical relationship for all causes of death except for suicides, the mechanisms behind each association may be very different. For example, increases in working hours may lead to increases in stress and an increase in CVD mortality. At the same time, increases in fatal traffic accidents may be driven by changes in the average use of motor vehicles in relationship to the general level of economic activity. As a result, whereas the mechanisms linking the business cycle to different health outcomes in the short-run appear to be very different, the same is likely true for the mechanisms linking business cycles and health in the long-run. Each individual paper included in this thesis has tried to identify specific mechanisms explaining the findings. However, the results do not suggest that there are individual mechanisms that would largely explain the findings. Whereas the latter represents a clear limitation, one reason for this circumstance may be the restricted sample size resulting in a lack of statistical power. Another explanation for the existing difficulty to identify specific mechanisms linking business cycles and health in the long-term may be the inherent complexity of this relationship. For example, it is likely that different socio-economic groups will respond differently to macroeconomic fluctuations, which would require analysing those groups individually. However, a major problem with this approach is that the membership to specific socio-economic groups, for example occupation or working status, is not

randomly assigned and may be directly affected by the business cycle itself. In consequence, any stratification based on socio-economic groups would be subject to this limitation.

Another limitation may be the choice of health outcomes used throughout this thesis. Three of the papers included in this thesis use measures of functional health as outcomes, one paper cognitive functioning and another paper uses fatal as well as non-fatal CVD as outcomes. Whereas the strength in using different outcomes is that it supports the general validity of the central findings, each outcome still represents only a specific aspect of health and therefore limits the degree to which the findings can be generalised. Another aspect of the included health outcomes, other than cognitive functioning, is that they are measures of morbidity. An exception is the study using data from HRS, which includes fatal strokes as well as heart attacks in addition to non-fatal events. Although functional limitations have been shown to be a strong predictor of survival (Rolland et al. 2006), the latter is different to the majority of studies assessing the short-term effects of business cycles on health, which predominantly use mortality as a proxy for population health (Gerdtham and Ruhm, 2006; Ruhm, 2000). Although it would have been desirable to use mortality as an alternative measure of health in the papers using data from SHARE, the latter was unfeasible due to the very small number of events as well as existing issues with regard to the data collection.

One of the principal aims of this thesis was to apply a life-course approach to the study of the relationship between business cycles and health. By applying life-course approach, the aim was to go beyond existing studies which had, in most cases, only looked at the short-term effects of economic fluctuations on population health. The life-course framework generally seems very well suited to assess the potential long-term effects of economic fluctuations on health for at least two reasons. First of all, the life-course framework emphasizes the importance of time and timing in the relationship between exposure and outcomes (Blane, Netuveli and Stone 2007; Lynch and Smith 2005). On the one hand, this is highlighted by the fact that many diseases have a long latency period. On the other hand, it is also highlighted by the existing evidence showing that there exist periods which are particularly sensitive to external influences (Lynch and Smith 2005). With regard to the potential effects of

economic fluctuations on health, there is good reason to assume that individuals are more sensitive to such fluctuations when coinciding with important life-course stages or transitions, e.g. the transition from education to the labour market. A second key element of the life-course framework is the concept of risk accumulation which states that (Ben-Shlomo and Kuh 2002). Inherent to the concept of risk accumulation is the empirical observation that the exposure to risks is connected in a cumulative fashion. For example, the exposure to a highly polluted environment during childhood is often highly correlated with a series of additional health risks such as material deprivation or low parental educational background. Furthermore, the exposure to unfavourable conditions at an earlier stage of the life-course often significantly increases the risks of being exposed to other unfavourable conditions at a later stage of the life-course (Ben-Shlomo and Kuh 2002). For example, low educational achievement may increase the risks of unemployment over the life-course.

Although this thesis makes an explicit attempt to take into account for the time and timing of the exposure, i.e. at what age an exposure to the business cycle occurred as well as the time-lag between exposure and outcome, it has been more in the form of the study design rather than an actual model (Ben-Shlomo and Kuh 2002). According to Ben-Shlomo and Kuh (2002), a life-course model should explicitly formulate and test pathways linking exposures and health, and also pay particular attention to the temporal ordering of events. The empirical chapters included in this thesis have made an attempt to assess the relationship between economic fluctuations and several potential pathways linking economic conditions and health at later-life. However, this attempt was not able to fully assess the degree to which risk accumulation occurs as result of an exposure to recessions. In particular, the analyses do not reveal whether the effects of recessions on health, which persist in later-life, are the result of factors coinciding with the exposure to the recession or rather the result of a cumulative disadvantage, such as a long-lasting increase in work-related stress. As highlighted by Lynch and Smith (2005), it is particularly difficult and ambitious to link individual-level exposures to population-health outcomes using a life-course framework. One of the key difficulties is that relatively broad measures of health, such as functional limitations, usually have very diverse and complex determinants, making it comparatively hard to "[…] map trends in a single exposure across

different birth cohorts onto trends in disease" (Lynch and Smith 2005). Against this background, the point of departure for the development of a persuasive life-course model relating macroeconomic conditions to health should be to theoretically derive and empirically test specific pathways using very specific health outcomes, potentially in the form of biomarkers.

8.4 Directions for further research

One central question which has hardly been addressed with regard to the relationship between economic cycles and health is the role of social policies and institutional arrangements. This represents a major gap in knowledge and should be addressed in future research and could help to better understanding of during which periods of the life course social safety nets matter most (Bartley et al., 1997). As such, several pieces of evidence suggest that policies or institutional arrangements may play a role in mediating the effects of business cycles on health. For example, using data for OECD countries, Gerdtham and Ruhm (2006) find that the pro-cyclical relationship is smaller among Western European countries than the U.S. and speculate that the latter may be due to generally shorter working hours, stricter employment protection laws and more generous social safety nets. Another study by Stuckler et al. (Stuckler et al., 2009), which used data on mortality and employment changes for European countries during the years 1970-2007, found that the negative effects of increases in unemployment on mortality were mitigated by active labour market programmes. Furthermore, a study which assessed the association between the generosity of unemployment insurance and changes in self-rated health among a sample of European countries found that more generous unemployment insurance mitigated the risk of a negative change in health (Ferrarini, Nelson and Sjöberg 2014). However, up-to-date no further evidence on the role of policies seems to exist. A fruitful further direction for research could be to pool the individual-level data from SHARE as well as HRS with time series on macroeconomic conditions on the one hand and information on the generosity of welfare programmes on the other hand. Doing so would make it possible to assess, for example, whether there exists an interaction with regard to its health effect between the generosity of unemployment insurance in a country or state at a specific point in time and a recession experienced during the transition from education to the labour market.

Another issue that has yet been unexplored concerns the role of mechanisms linking business cycles and health over the life-course. Evidence about the precise mechanisms would be of great value for the design of political interventions to eventually mitigate negative long-run effects of adverse economic conditions on health. As discussed in the previous section, the present study was only able to offer a preliminary insight in this regard. One potentially promising way to analyse mechanisms that may explain the relationship between business cycles and health in the long-term, could be to use longitudinal data and analyse trajectories for example with regard to health behaviours, employment or social mobility after an exposure to the business cycle at a specific period in the life course. Whereas HRS and SHARE, as well as ELSA only include longitudinal data for ages 50+, information on the latter trajectories can be derived based on the life event history questionnaires included in SHARE as well as ELSA. I addition, another alternative would be the use of cohort studies such as the National Survey of Health & Development (NSHD) or the National Child Development Study (NCDS). Furthermore, another alternative would be to use individual-level registry data from Nordic countries such as Finland or Denmark.

Another important question that could be addressed in further studies is to what extent a differential exposure to business cycles at an earlier stage of the life course affects individuals' vulnerability to adverse events that occur later in life. Such an approach would greatly contribute to a better understanding of the life-course processes leading to an accumulation of disadvantage (Hallqvist et al., 2004; Holland et al., 2000). For example, one could assess whether individuals who experience a recession during childhood are more negatively affected by the early loss of a parent or partner, unemployment or the onset of disease or disability, for example. At the same time, it would be of interest to assess in detail which individual-level risk factors make individuals most vulnerable with regard to the long-term effects of economic shocks. To date, only one study has looked at the interaction between the exposure to adverse economic conditions earlier in life and the vulnerability to adverse events later in life. In their study, van den Berg et al. (van den Berg et al., 2010) found that individuals who were born during a recession were showed a greater rate of cognitive decline after experiencing a stroke than their counterparts who were born during more favourable economic times. The authors also found

evidence that adverse economic conditions around birth exacerbate the negative effects of surgery, major illness and the death of a family member on cognitive functioning.

Ultimately, it would be desirable to develop a theoretical framework that relates business cycles and health over the life course, and from which one could derive specific hypotheses and predictions. Such a theoretical framework should integrate insights from life-course sociology and epidemiology as well as demography and economics.

References

Adda, J., von Gaudecker, H.M., and Banks, J. (2009). 'The Impact of Income Shocks on Health: Evidence from Cohort Data.' *Journal of the European Economic Association* 7(6), pp. 1361-1399.

Andel, R., Vigen, C., Mack, W.J. Clark, L.J. and Gatz, M. (2006). 'The effect of education and occupational complexity on rate of cognitive decline in Alzheimer's patients.' *Journal of the International Neuropsychological Society* 12(01), pp.147-152.

Aneshensel, C.S., Ko, M.J., Chodosh, J. and Wight, R.G.. (2011). 'The urban neighborhood and cognitive functioning in late middle age.' *Journal of Health and Social Behavior* 52(2), pp. 163-179.

Angelini, V. and Mierau, J.O. (2014). 'Born at the right time? Childhood health and the business cycle.' *Social Science and Medicine* 109(0), pp. 35-43.

Angelides, P.and B. Thomas. (2011). *The financial crisis inquiry report: Final report of the national commission on the causes of the financial and economic crisis in the united states (revised corrected copy)*: Government Printing Office.

Arulampalam, W., Gregg, P., and Gregory, M. (2001). 'Unemployment Scarring.' *The Economic Journal* 111(475), pp. 577-584.

Astell-Burt, T. and Feng, X. (2013). 'Health and the 2008 Economic Recession: Evidence from the United Kingdom.' *PLoS ONE*, 8(2):e56674. Available online at http://dx.doi.org/10.1371%2Fjournal.pone.0056674.

Avendano, M. and Glymour, M.M. 2008. 'Stroke Disparities in Older Americans: Is Wealth a More Powerful Indicator of Risk Than Income and Education?' *Stroke* 39(5), pp.1533-1540.

Avendano, M., Kawachi, I. Van Lenthe, F. Boshuizen, H.C., Mackenbach, J.P., Van den Bos, G.A.M., Fay, M.E., and Berkman, L.F. (2006). 'Socioeconomic Status and Stroke Incidence in the US Elderly: The Role of Risk Factors in the EPESE Study.' *Stroke* 37(6), pp. 1368-1373.

Bambra, C., Gibson, M., Sowden, A. Wright, K. Whitehead, M. and Petticrew, M. (2010). 'Tackling the wider social determinants of health and health inequalities: evidence from systematic reviews.' *Journal of Epidemiology and Community Health* 64(4), pp. 284-291.

Banks, J., Crawford, R., Crossley, T. and Emmerson, C. (2012). 'The effect of the financial crisis on older households in England.' *IFS Working Paper W12/09*. Available online at http://www.ifs.org.uk/wps/wp1209.pdf.

Barker, D.J.P. (1998). *Mothers, Babies, and Health in Later Life*. Edinburgh; New York: Churchill Livingstone.

Barnes, M.G. and Smith, T.G. (2009). 'Tobacco use as response to economic insecurity: Evidence from the National Longitudinal Survey of Youth.' *The BE Journal of Economic Analysis & Policy* 9(1).

Barr, B., Taylor-Robinson, D., Scott-Samuel, A. McKee, M. and Stuckler, D. (2012). 'Suicides associated with the 2008-10 economic recession in England: time trend analysis.' *BMJ: British Medical Journal*, 345:e5142. Available online at http://www.bmj.com/content/345/bmj.e5142%23ref-18.

Barstad, A. (2008). 'Explaining Changing Suicide Rates in Norway 1948–2004: The Role of Social Integration.' *Social Indicators Research* 87(1), pp. 47-64.

Bartley, M., Blane, D., and Montgomery, S. (1997). 'Socioeconomic determinants of health: Health and the life course: why safety nets matter.' *BMJ (Clinical Research Ed.)* 314(7088), pp. 1194.

Bartley, M. and Owen, C. (1996). 'Relation between socioeconomic status, employment, and health during economic change, 1973-93.' *BMJ (Clinical Research Ed.)* 313(7055), pp. 445-449.

Bartley, M. and Plewis, I. (2002). 'Accumulated labour market disadvantage and limiting long-term illness: data from the 1971–1991 Office for National Statistics' Longitudinal Study.' *International Journal of Epidemiology* 31(2), pp. 336-341.

Beckett, L.A., Brock, D.B., Lemke, J.H., de Leon, C.F.M., Guralnik, J.M., Fillenbaum, G.G., Branch, L.G., Wetle, T.T. and Evans, D.A. (1996). 'Analysis of Change in Self-reported Physical Function among Older Persons in Four Population Studies.' *American Journal of Epidemiology* 143(8), pp. 766-778.

Behncke, S. 2012. 'Does retirement trigger ill health?' *Health Economics* 21(3), pp. 282-300.

Ben-Shlomo, Y. and Kuh, D. (2002). 'A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives.' *International Journal of Epidemiology* 31(2), pp. 285-293.

Bender, K.A., Economou, A. and Theodossiou, I. (2012). 'The Permanent and Temporary Impact of the Unemployment Rate on Mortality: The European Experience.' *International Labour Review* 152(2), pp. 275-286.

Bernal, J.A.L., Gasparrini, A., Artundo, C.M., and McKee, M. (2013). 'The effect of the late 2000s financial crisis on suicides in Spain: an interrupted time-series analysis.' *The European Journal of Public Health* 23(5), pp. 732-736.

Bernanke, B.S.and M. Gertler. (1989). 'Agency Costs, Net Worth, and Business Fluctuations.' *American Economic Review* 79(1):14-31.

Bickel, H. and Kurz, A.. (2009). 'Education, occupation, and dementia: the Bavarian school sisters study.' *Dementia and Geriatric Cognitive Disorders* 27(6), pp. 548-556.

Black, P.H. and Garbutt, L.D. (2002). 'Stress, inflammation and cardiovascular disease.' *Journal of Psychosomatic Research* 52(1), pp. 1-23.

Blane, D. (1995). 'Social determinants of health--socioeconomic status, social class, and ethnicity.' *American Journal of Public Health* 85(7), pp. 903-905.

Blane, D., Hart, C.L., Davey Smith, G., Gillis, C.R., Hole, D.J., and Hawthorne, V.M. (1996). 'Association of cardiovascular disease risk factors with socioeconomic position during childhood and during adulthood.' *British Medical Journal* 313(7070), pp. 1434-1438.

Blane, D.B. 1996. 'Collecting retrospective data: development of a reliable method and a pilot study of its use.' *Soc Sci Med* 42(5):751-757.

Blane, D., G. Netuveli, and J. Stone. 2007. 'The development of life course epidemiology.' *Revue d'Épidémiologie et de Santé Publique* 55(1):31-38.

Blossfeld, H.P. 2005. *Globalization, uncertainty and youth in society*. London, New York: Routledge.

Blossfeld, H.P. and H. Hofmeister. 2006. *Globalization, Uncertainty and Women's Careers*. Cheltenham: Edward Elgar Publishing.

Böckerman, P. and P. Ilmakunnas. 2009. 'Unemployment and self-assessed health: evidence from panel data.' *Health Economics* 18(2):161-179.

Bolton, K.L. and E. Rodriguez. 2009. 'Smoking, drinking and body weight after re-employment: does unemployment experience and compensation make a difference?' *BMC Public Health* 9(1):77.

Börsch-Supan, A., M. Brandt, C. Hunkler, T. Kneip, J. Korbmacher, F. Malter, B. Schaan, S. Stuck, and S. Zuber. 2013. 'Data resource profile: the Survey of Health, Ageing and Retirement in Europe (SHARE).' *International Journal of Epidemiology* 42(4):992-1001.

Börsch-Supan, A. and H. Jürges. 2005. 'The Survey of Health, Ageing and Retirement in Europe - Methodology.' Available online at http://www.share-project.org/uploads/tx_sharepublications/SHARE_BOOK_METHODOLOGY_Wave 1.pdf.

Börsch-Supan, A. and M. Schröder. 2011a. 'Employment and Health at 50+: An Introduction to a Life History Approach to European Welfare State Interventions.' in *The Individual and the Welfare State. Life Histories in Europe*, edited by Börsch-Supan A and et al. Heidelberg: Springer.

Börsch-Supan, A. and M. Schröder. 2011b. 'Retrospective Data Collection in the Survey of Health, Ageing and Retirement in Europe.' *Retrospective Data Collection in the Survey of Health, Ageing and Retirement in Europe*. Available online at http://www.share-project.org/uploads/tx_sharepublications/FRB-Methodology_feb2011_color-1.pdf.

Brackbill, R.M., P.Z. Siegel, and S.P. Ackermann. 1995. 'Self reported hypertension among unemployed people in the United States.' *BMJ: British Medical Journal* 310(6979):568.

Brenner, M.H. 1973. *Mental illness and the economy*. Cambridge, MA: Harvard U. Press.

—. 1975. 'Trends in alcohol consumption and associated illnesses. Some effects of economic changes.' *American Journal of Public Health* 65(12):1279-1292.

—. 1979. 'Mortality and the national economy.' *The Lancet* 314(8142):568-573.

Broman, C.L., V.L. Hamilton, W.S. Hoffman, and R. Mavaddat. 1995. 'Race, gender, and the response to stress: Autoworkers' vulnerability to long-term unemployment.' *American Journal of Community Psychology* 23(6):813-842.

Brooker, A.-S., J.W. Frank, and V.S. Tarasuk. 1997. 'Back pain claim rates and the business cycle.' *Social Science and Medicine* 45(3):429-439.

Browning, M. and E. Heinesen. 2012. 'Effect of job loss due to plant closure on mortality and hospitalization.' *Journal of Health Economics* 31(4):599-616.

Brzinsky-Fay, C. 2007. 'Lost in Transition? Labour Market Entry Sequences of School Leavers in Europe.' *European Sociological Review* 23(4):409-422.

Burea of Labor Statistics (BLS). 2014. 'Labor Force Statistics from the Current Population Survey.' Available online at http://www.bls.gov/cps/lfcharacteristics.htm#unemp.

Burns, A.F. and W.C. Mitchell. 1946. *Measuring business cycles*. Chicago: The University of Chicago Press.

Calvo, E., N. Sarkisian, and C.R. Tamborini. 2013. 'Causal Effects of Retirement Timing on Subjective Physical and Emotional Health.' *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 68(1):73-84.

Case, A., A. Fertig, and C. Paxson. 2005. 'The lasting impact of childhood health and circumstance.' *Journal of Health Economics* 24(2):365-389.

Catalano, R. 1979. 'Health costs of economic expansion: the case of manufacturing accident injuries.' *American Journal of Public Health* 69(8):789-794.

—. 1991. 'The health effects of economic insecurity.' *American Journal of Public Health* 81(9):1148-1152.

Catalano, R., E. Aldrete, W. Vega, B. Kolody, and S. Aguilar-Gaxiola. 2000. 'Job loss and major depression among Mexican Americans.' *Social Science Quarterly* 81(1):477-487.

Catalano, R., S. Goldman-Mellor, K. Saxton, C. Margerison-Zilko, M. Subbaraman, K. LeWinn, and E. Anderson. 2010. 'The Health Effects of Economic Decline.' *Annual Review of Public Health* 32(1):431-450.

Catalano, R., R. Novaco, and W. McConnell. 1997. 'A model of the net effect of job loss on violence.' *Journal of Personality and Social Psychology* 72(6):1440-1447.

Centers for Disease Control. 2005. 'Disparities in deaths from stroke among persons aged <75 years–united states.' *Journal of the American Medical Association* 294:299–300.

Cesaroni, G., N. Agabiti, F. Forastiere, and C.A. Perucci. 2009. 'Socioeconomic Differences in Stroke Incidence and Prognosis Under a Universal Healthcare System.' *Stroke* 40(8):2812-2819.

Chan, S. and A.H. Stevens. 1999. 'Employment and Retirement Following a Late-Career Job Loss.' *The American Economic Review* 89(2):211-216.

Chang, S.-S., D. Stuckler, P. Yip, and D. Gunnell. 2013. 'Impact of 2008 global economic crisis on suicide: time trend study in 54 countries.' *BMJ: British Medical Journal*, 347. Available online at http://www.bmj.com/content/347/bmj.f5239.short.

Charles, K.K. and P. DeCicca. 2008. 'Local labor market fluctuations and health: Is there a connection and for whom?' *Journal of Health Economics* 27(6):1532-1550.

Chodosh, J., D.M. Kado, T.E. Seeman, and A.S. Karlamangla. 2007. 'Depressive symptoms as a predictor of cognitive decline: MacArthur Studies of Successful Aging.' *The American journal of geriatric psychiatry* 15(5):406-415.

Clarke, P.J., J.A. Ailshire, J.S. House, J.D. Morenoff, K. King, R. Melendez, and K.M. Langa. 2012. 'Cognitive function in the community setting: the neighbourhood as a source of 'cognitive reserve'?' *Journal of Epidemiology and Community Health* 66(8):730-736.

Claussen, B. 1999. 'Alcohol disorders and re-employment in a 5-year follow-up of long-term unemployed.' *Addiction* 94(1):133-138.

Coe, N.B., H.M. von Gaudecker, M. Lindeboom, and J. Maurer. 2012. 'The effect of retirement on cognitive functioning.' *Health Economics* 21(8):913-927.

Coile, C. and B.L. Levine. 2011a. 'Recessions, Retirement, and Social Security.' *American Economic Journal* 101(3):23-28.

Coile, C.C. and P.B. Levine. 2007. 'Labor market shocks and retirement: Do government programs matter?' *Journal of Public Economics* 91(10):1902-1919.

—. 2011b. 'Recessions, Retirement, and Social Security.' *The American Economic Review* 101(3):23-28.

Coile, C.C., P.B. Levine, and R. McKnight. 2014. 'Recessions, Older Workers, and Longevity: How Long Are Recessions Good For Your Health?' *American Economic Journal: Economic Policy*.

Colman, G. and D. Dave. 2013. 'Exercise, physical activity, and exertion over the business cycle.' *Social Science and Medicine* 93(0):11-20.

Cook, D., M. Bartley, R. Cummins, and A. Shaper. 1982. 'Health of unemployed middle-aged men in Great Britain.' *The Lancet* 319(8284):1290-1294.

Cook, P.J. and G.A. Zarkin. 1986. 'Homicide and economic conditions: A replication and critique of M. Harvey Brenner's new report to the US Congress.' *Journal of Quantitative Criminology* 2(1):69-80.

Courgeau, D. and E. Lelievre. 1992. *Event History Analysis in Demography*. Oxford: Clarendon Press.

Craik, F.I. and T.A. Salthouse. 2011. *The handbook of aging and cognition*: Psychology Press.

Dannefer, D. 2003. 'Cumulative Advantage/Disadvantage and the Life Course: Cross-Fertilizing Age and Social Science Theory.' *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 58(6):S327-S337.

Dartigues, J.-F., M. Gagnon, L. Letenneur, P. Barberger-Gateau, D. Commenges, M. Evaldre, and R. Salamon. 1992. 'Principal lifetime occupation and cognitive impairment in a French elderly cohort (Paquid).' *American Journal of Epidemiology* 135(9):981-988.

Dave, D.M. and I.R. Kelly. 2012. 'How does the business cycle affect eating habits?' *Social Science and Medicine* 74(2):254-262.

De Luca, G. and R. Claudio. 2011. 'Weights in the first three waves of SHARE.' in *SHARE Release Guide 2.5.0 Waves 1 & 2*, edited by Mannheim Research Institute for the Economics of Aging.

De Vogli, R., M. Marmot, and D. Stuckler. 2013. 'Excess suicides and attempted suicides in Italy attributable to the great recession.' *Journal of Epidemiology and Community Health* 67(4):378-379.

Deb, P., W.T. Gallo, P. Ayyagari, J.M. Fletcher, and J.L. Sindelar. 2011. 'The effect of job loss on overweight and drinking.' *Journal of Health Economics* 30(2):317-327.

Dee, T.S. 2001. 'Alcohol abuse and economic conditions: evidence from repeated cross-sections of individual-level data.' *Health Economics* 10(3):257-270.

Dewey, M.E. and M.J. Prince. 2005. 'Cognitive function.' Pp. Börsch-Supan A, et al. in *Health, Ageing and Retirement in Europe - First Results from the Survey of Health, Ageing and Retirement in Europe*, edited by Börsch-Supan A. et al. Mannheim: MEA.

DiPrete, T.A. and G.M. Eirich. 2006. 'Cumulative advantage as a mechanism for inequality: A review of theoretical and empirical developments.' *Annual Review of Sociology*:271-297.

Divani, A.A., G. Vazquez, A.M. Barrett, M. Asadollahi, and A.R. Luft. 2009. 'Risk factors associated with injury attributable to falling among elderly population with history of stroke.' *Stroke* 40(10):3286-3292.

Doblhammer, G., G.J. van den Berg, and T. Fritze. 2011. 'Economic Conditions at the Time of Birth and Cognitive Abilities Late in Life: Evidence from Eleven European Countries.' *IZA Discussion Paper No. 5940*. Available online at http://www.iza.org/en/webcontent/publications/papers/viewAbstract?dp_id=5940.

Dooley, D., J. Prause, and K.A. Ham-Rowbottom. 2000. 'Underemployment and Depression: Longitudinal Relationships.' *Journal of Health and Social Behavior* 41(4):421-436.

Dustmann, C. and F. Windmeijer. 2000. 'Wages and the demand for health-A life cycle analysis.' *IZA Discussion Paper No. 171*. Available online at ftp://repec.iza.org/pub/SSRN/pdf/dp171.pdf.

Economou, M., M. Madianos, L.E. Peppou, C. Theleritis, A. Patelakis, and C. Stefanis. 2013. 'Suicidal ideation and reported suicide attempts in Greece during the economic crisis.' *World Psychiatry* 12(1):53-59.

Edwards, R. 2008. 'Who is hurt by procyclical mortality?' *Social Science and Medicine* 67(12):2051-2058.

Elder, G.H. 1974. *Children of the Great Depression: social change in life experience*. Chicago: University of Chicago Press.

—. 1999. *Children of the great depression: social change in life experience*. Boulder, Co: Westview Press.

Eliason, M. and D. Storrie. 2009a. 'Does Job Loss Shorten Life?' *Journal of Human Resources* 44(2):277-302.

—. 2009b. 'Job loss is bad for your health – Swedish evidence on cause-specific hospitalization following involuntary job loss.' *Social Science and Medicine* 68(8):1396-1406.

Elo, I.T. 1998. 'Childhood conditions and adult health: Evidence from the Health and Retirement Study.' *Population Aging Research Center WPS* 98(03).

Enloe, C. 1980. 'Women—The reserve army of Army labor.' *Review of Radical Political Economics* 12(2):42-52.

Ettner, S.L. 1997. 'Measuring the human cost of a weak economy: Does unemployment lead to alcohol abuse?' *Social Science and Medicine* 44(2):251-260.

Eurostat. 2012a. 'Database on education and training.' Available online at http://epp.eurostat.ec.europa.eu/portal/page/portal/education/data/database.

—. 2012b. 'Unemployment statistics.' Available online at http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Unemployment_statistics.

Fagan, P., V. Shavers, D. Lawrence, J.T. Gibson, and P. Ponder. 2007. 'Cigarette smoking and quitting behaviors among unemployed adults in the United States.' *Nicotine and Tobacco Research* 9(2):241-248.

Falba, T., H.-M. Teng, J.L. Sindelar, and W.T. Gallo. 2005. 'The effect of involuntary job loss on smoking intensity and relapse.' *Addiction* 100(9):1330-1339.

Federico, G. 2002. 'The world economy 0–2000 AD: A review article.' *European Review of Economic History* 6(01):111-120.

Fenwick, R. and M. Tausig. 1994. 'The macroeconomic context of job stress.' *Journal of Health and Social Behavior*:266-282.

Ferber, M.A. and H.M. Lowry. 1975. 'Sex Differential in Earnings: A Reappraisal.' *Industrial and Labor Relations Review* 29:377.

Fergusson, D.M. and J.M. Boden. 2008. 'Cannabis use and later life outcomes.' *Addiction* 103(6):969-976.

Fergusson, D.M., J.M. Boden, and L.J. Horwood. 2007. 'Unemployment and Suicidal Behavior in a New Zealand Birth Cohort.' *Crisis: The Journal of Crisis Intervention and Suicide Prevention* 28(2):95-101.

Ferrarini, T., K. Nelson, and O. Sjöberg. 2014. 'Unemployment insurance and deteriorating self-rated health in 23 European countries.' *Journal of Epidemiology and Community Health*.

Ferrie, J., M. Shipley, S. Stansfeld, and M. Marmot. 2002a. 'Effects of chronic job insecurity and change in job security on self reported health, minor psychiatric morbidity,

physiological measures, and health related behaviours in British civil servants: the Whitehall II study.' *Journal of Epidemiology and Community Health* 56:450–454.

Ferrie, J.E., P. Martikainen, M.J. Shipley, M.G. Marmot, S.A. Stansfeld, and G.D. Smith. 2001. 'Employment status and health after privatisation in white collar civil servants: prospective cohort study.' *BMJ (Clinical Research Ed.)* 322.

Ferrie, J.E., M.J. Shipley, M.G. Marmot, S. Stansfeld, and G.D. Smith. 1998. 'The health effects of major organisational change and job insecurity.' *Social Science and Medicine* 46(2):243-254.

Ferrie, J.E., M.J. Shipley, S.A. Stansfeld, and M.G. Marmot. 2002b. 'Effects of chronic job insecurity and change in job security on self reported health, minor psychiatric morbidity, physiological measures, and health related behaviours in British civil servants: the Whitehall II study.' *Journal of Epidemiology and Community Health* 56(6):450-454.

Finkel, D., R. Andel, M. Gatz, and N.L. Pedersen. 2009. 'The role of occupational complexity in trajectories of cognitive aging before and after retirement.' *Psychology and Aging* 24(3):563.

Fitzenberger, B. and A. Kunze. 2005. 'Vocational training and gender: Wages and occupational mobility among young workers.' *Oxford Review of Economic Policy* 21(3):392-415.

Flippen, C. and M. Tienda. 2000. 'Pathways to retirement: Patterns of labor force participation and labor market exit among the pre-retirement population by race, Hispanic origin, and sex.' *Journals of Gerontology series b* 55(1):S14-S27.

Forbes, J.F. and A. McGregor. 1984. 'Unemployment and mortality in post-war Scotland.' *Journal of Health Economics* 3(3):239-257.

Freeman, D.G. 1999. 'A note on `Economic conditions and alcohol problems'.' *Journal of Health Economics* 18(5):661-670.

Frijters, P., J.P. Haisken-DeNew, and M.A. Shields. 2005. 'The causal effect of income on health: Evidence from German reunification.' *Journal of Health Economics* 24(5):997-1017.

Gale, C.R., C.N. Martyn, C. Cooper, and A.A. Sayer. 2007. 'Grip strength, body composition, and mortality.' *International Journal of Epidemiology* 36(1):228-235.

Gallo, W.T., E.H. Bradley, T.A. Falba, J.A. Dubin, L.D. Cramer, S.T. Bogardus, and S.V. Kasl. 2004. 'Involuntary job loss as a risk factor for subsequent myocardial infarction and stroke: Findings from The Health and Retirement Survey.' *American Journal of Industrial Medicine* 45(5):408-416.

Gallo, W.T., E.H. Bradley, M. Siegel, and S.V. Kasl. 2001a. 'The Impact of Involuntary Job Loss on Subsequent Alcohol Consumption by Older Workers.' *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 56(1):S3-S9.

Gallo, W.T., E.H. Bradley, M. Siegel, and S.V. Kasl. 2001b. 'The Impact of Involuntary Job Loss on Subsequent Alcohol Consumption by Older Workers Findings From the Health and Retirement Survey.' *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 56(1):S3-S9.

Gallo, W.T., H.M. Teng, T.A. Falba, S.V. Kasl, H.M. Krumholz, and E.H. Bradley. 2006. 'The impact of late career job loss on myocardial infarction and stroke: a 10 year follow up using the health and retirement survey.' *Occupational and Environmental Medicine* 63(10):683-687.

Gascon, D.J. and H.A. Spiller. 2009. 'Relationship of Unemployment Rate and Rate of Opiate Exposure in Kentucky.' *Journal of Psychoactive Drugs* 41(1):99-102.

Genda, Y., A. Kondo, and S. Ohta. 2010. 'Long-Term Effects of a Recession at Labor Market Entry in Japan and the United States.' *Journal of Human Resources* 45(1):157-196.

Gerdtham, U.-G. and M. Johannesson. 2005. 'Business cycles and mortality: results from Swedish microdata.' *Social Science and Medicine* 60(1):205-218.

Gerdtham, U.G. and C.J. Ruhm. 2006. 'Deaths rise in good economic times: Evidence from the OECD.' *Economics & Human Biology* 4(3):298-316.

Gist, J.R., C. Figueiredo, and S.K. Verma. 2012. 'Boom and Bust: Housing Equity Withdrawal and Consumption Decisions and Their Impacts on Household Wealth.' *Journal of Aging and Social Policy* 24(1):1-28.

Glymour, M., I. Kawachi, C.S. Jencks, and L.F. Berkman. 2008a. 'Does childhood schooling affect old age memory or mental status? Using state schooling laws as natural experiments.' *Journal of Epidemiology and Community Health* 62(6):532-537.

Glymour, M., J. Maselko, S. Gilman, K. Patton, and M. Avendano. 2010. 'Depressive symptoms predict incident stroke independently of memory impairments.' *Neurology* 75(23):2063-2070.

Glymour, M.M. and M. Avendano. 2009. 'Can Self-Reported Strokes Be Used to Study Stroke Incidence and Risk Factors?: Evidence From the Health and Retirement Study.' *Stroke* 40(3):873-879.

Glymour, M.M., M. Avendano, and L.F. Berkman. 2007. 'Is the 'Stroke Belt'worn from childhood? Risk of first stroke and state of residence in childhood and adulthood.' *Stroke* 38(9):2415-2421.

Glymour, M.M., M. Avendaño, S. Haas, and L.F. Berkman. 2008b. 'Lifecourse social conditions and racial disparities in incidence of first stroke.' *Annals of Epidemiology* 18(12):904-912.

Glymour, M.M., T.B. DeFries, I. Kawachi, and M. Avendano. 2008c. 'Spousal smoking and incidence of first stroke: the Health and Retirement Study.' *American Journal of Preventive Medicine* 35(3):245-248.

Glymour, M.M., A. Kosheleva, and B. Boden-Albala. 2009. 'Birth and adult residence in the Stroke Belt independently predict stroke mortality.' *Neurology* 73(22):1858-1865.

Goddard, G. 1988. 'Occupational accident statistics 1981-85.' *Employment Gazette* 96:15-21.

Graham, H. 2004. 'Social determinants and their unequal distribution: clarifying policy understandings.' *Milbank Quarterly* 82(1):101-124.

Grambsch, P.M. and T.M. Therneau. 1994. 'Proportional hazards tests and diagnostics based on weighted residuals.' *Biometrika* 81(3):515-526.

Gustman, A.L., T.L. Steinmeier, and N. Tabatabai. 2013. 'How Did the Recession of 2007-2009 Affect the Wealth and Retirement of the Near Retirement Age Population in the Health and Retirement Study?' National Bureau of Economic Research, *NBER Working Paper No. 17547*. Available online at http://www.nber.org/papers/w17547.

Hallqvist, J., J. Lynch, M. Bartley, T. Lang, and D. Blane. 2004. 'Can we disentangle life course processes of accumulation, critical period and social mobility? An analysis of disadvantaged socio-economic positions and myocardial infarction in the Stockholm Heart Epidemiology Program.' *Social Science and Medicine* 58(8):1555-1562.

Hammarström, A. and U. Janlert. 1994. 'Unemployment and change of tobacco habits: a study of young people from 16 to 21 years of age.' *Addiction* 89(12):1691-1696.

—. 2003. ‘Unemployment-an important predictor for future smoking: a 14-year follow-up study of school leavers.’ *Scandinavian Journal of Public Health* 31(3):229-232.

Hammer, T. 1992. ‘Unemployment and use of drug and alcohol among young people: a longitudinal study in the general population.’ *British Journal of Addiction* 87(11):1571-1581.

Hamoudi, A. and J.B. Dowd. 2013. ‘Physical Health Effects of the Housing Boom: Quasi-Experimental Evidence From the Health and Retirement Study.’ *American Journal of Public Health* 103(6):1039-1045.

Heckman, J.J. 1979. ‘Sample selection bias as a specification error.’ *Econometrica: Journal of the econometric society*:153-161.

—. 2006. ‘Skill formation and the economics of investing in disadvantaged children.’ *Science* 312(5782):1900-1902.

Hodrick, R.J. and E.C. Prescott. 1997. ‘Postwar U.S. Business Cycles: An Empirical Investigation.’ *Journal of Money, Credit and Banking* 29(1):1-16.

Hoffmann, J.P., M. Dufur, and L. Huang. 2007. ‘Drug use and job quits: A longitudinal analysis.’ *Journal of Drug Issues* 37(3):569-596.

Holland, P., L. Berney, D. Blane, G. Davey Smith, D.J. Gunnell, and S.M. Montgomery. 2000. ‘Life course accumulation of disadvantage: childhood health and hazard exposure during adulthood.’ *Social Science and Medicine* 50(9):1285-1295.

Hurd, M.D. and S. Rohwedder. 2010. ‘Effects of the financial crisis and great recession on American households.’ National Bureau of Economic Research, *NBER Working Paper No. 16407*. Available online at http://www.nber.org/papers/w16407.

ILO. 2012. ‘International Standard Classification of Occupation. Major, minor and unit groups.’ Available online at http://www.ilo.org/public/english/bureau/stat/isco/isco58/major.htm.

International Labour Organization (ILO). 2014. ‘Global Employment Trends 2014. Risks of a jobless recovery?’. Available online at http://www.ilo.org/global/research/global-reports/global-employment-trends/2014/WCMS_233953/lang--en/index.htm.

Iversen, L., O. Andersen, P.K. Andersen, K. Christoffersen, and N. Keiding. 1987. ‘Unemployment and mortality in Denmark, 1970-80.’ *British medical journal (Clinical research ed.)* 295(6603):879.

Jacobson, L.S., R.J. LaLonde, and D.G. Sullivan. 1993. ‘Earnings losses of displaced workers.’ *The American Economic Review*:685-709.

Janlert, U. 1992. ‘Unemployment and blood pressure in Swedish building labourers.’ *Journal of Internal Medicine* 231(3):241-246.

Janlert, U. and A. Hammarström. 1992. ‘Alcohol consumption among unemployed youths: results from a prospective study.’ *British Journal of Addiction* 87(5):703-714.

Janssen, F., A.E. Kunst, and J.P. Mackenbach. 2006. ‘Association between gross domestic product throughout the life course and old-age mortality across birth cohorts: Parallel analyses of seven European countries, 1950-1999.’ *Social Science and Medicine* 63(1):239-254.

Johnson, R.A. and D.R. Gerstein. 1998. ‘Initiation of use of alcohol, cigarettes, marijuana, cocaine, and other substances in US birth cohorts since 1919.’ *American Journal of Public Health* 88(1):27-33.

Johnson, R.W. 2012. ‘Older Workers, Retirement, and the Great Recession.’ The Russell Sage Foundation and The Stanford Center on Poverty and Inequality, Available online

at http://www.stanford.edu/group/recessiontrends/cgi-bin/web/sites/all/themes/barron/pdf/Retirement_fact_sheet.pdf.

Jusot, F., M. Khlat, T. Rochereau, and C. Serme. 2008. 'Job loss from poor health, smoking and obesity: a national prospective survey in France.' *Journal of Epidemiology and Community Health* 62(4):332-337.

Juster, F.T. and R. Suzman. 1995. 'An overview of the Health and Retirement Study.' *Journal of Human Resources*:S7-S56.

Kahn, L.B. 2010. 'The long-term labor market consequences of graduating from college in a bad economy.' *Labour Economics* 17(2):303-316.

Karp, F. 2007. 'Growing Older in America: The Health & Retirement Study.' edited by F. Karp: National Institute on Aging, National Institutes of Health, US Department of Health and Human Services.

Kasl, S. and S. Cobb. 1980. 'The experience of losing a job: some effects on cardiovascular functioning.' *Psychotherapy and Psychosomatics* 34(2-3):88-109.

Kasl, S.V. 1979. 'Mortality and the business cycle: some questions about research strategies when utilizing macro-social and ecological data.' *American Journal of Public Health* 69(8):784-788.

Katz, S., T.D. Downs, H.R. Cash, and R.C. Grotz. 1970. 'Progress in Development of the Index of ADL.' *The Gerontologist* 10:20-30.

Kentikelenis, A., M. Karanikolos, I. Papanicolas, S. Basu, M. McKee, and D. Stuckler. 2011. 'Health effects of financial crisis: omens of a Greek tragedy.' *The Lancet* 378(9801):1457-1458.

King, M., S. Ruggles, T. Alexander, S. Flood, K. Genadek, M.B. Schroeder, B. Trampe, and R. Vick. 2010. 'Integrated public use microdata series, current population survey: Version 3.0.' *Minneapolis: University of Minnesota*.

Kivimäki, M., P. Leino-Arjas, R. Luukkonen, H. Riihimäki, J. Vahtera, and J. Kirjonen. 2002. 'Work stress and risk of cardiovascular mortality: prospective cohort study of industrial employees.' *BMJ: British Medical Journal* 325(7369):857.

Kivimäki, M., J. Vahtera, M. Virtanen, M. Elovainio, J. Pentti, and J.E. Ferrie. 2003. 'Temporary employment and risk of overall and cause-specific mortality.' *American Journal of Epidemiology* 158(7):663-668.

Kondo, A. 2007. 'Differential Effects of Graduating During a Recession across Race and Gender ' *ISERP Working Paper 07-05*. Available online at http://iserp-6.webservices.lamptest.columbia.edu/files/iserp/2007_05.pdf.

Kposowa, A.J. 2001. 'Unemployment and suicide: a cohort analysis of social factors predicting suicide in the US National Longitudinal Mortality Study.' *Psychological Medicine* 31(01):127-138.

Krieger, N. 2001. 'A glossary for social epidemiology.' *Journal of Epidemiology and Community Health* 55(10):693-700.

Kuh, D., E.J. Bassey, S. Butterworth, R. Hardy, and M.E. Wadsworth. 2005. 'Grip strength, postural control, and functional leg power in a representative cohort of British men and women: associations with physical activity, health status, and socioeconomic conditions.' *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 60(2):224-231.

Kuh, D. and Y. Ben-Shlomo. 2004. *A life course approach to chronic disease epidemiology*. Oxford: Oxford University Press.

Kuh, D., Y. Ben-Shlomo, J. Lynch, J. Hallqvist, and C. Power. 2003. 'Life course epidemiology.' *Journal of Epidemiology and Community Health* 57(10):778.

Kyer, B.L.and G.E. Maggs. 2012. 'A note on double-dip recession.' *Atlantic Economic Journal* 40(2):215-216.

Laporte, A. 2004. 'Do economic cycles have a permanent effect on population health? Revisiting the Brenner hypothesis.' *Health Economics* 13(8):767-779.

Lawton, M.P. and E.M. Brody. 1969. 'Assessment of older people: self-maintaining and instrumental activities of daily living.' *The Gerontologist* 9(3):179-186.

Lee, S., G. Colditz, L. Berkman, and I. Kawachi. 2004. 'Prospective study of job insecurity and coronary heart disease in US women.' *Annals of Epidemiology* 14:24-30.

Lee, S., I. Kawachi, L.F. Berkman, and F. Grodstein. 2003. 'Education, other socioeconomic indicators, and cognitive function.' *American Journal of Epidemiology* 157(8):712-720.

Leino-Arjas, P., J. Liira, P. Mutanen, A. Malmivaara, and E. Matikainen. 1999. 'Predictors and consequences of unemployment among construction workers: prospective cohort study.' *BMJ (Clinical Research Ed.)* 319(7210):600-605.

Leschke, J. 2012. 'Has the economic crisis contributed to more segmentation in labour market and welfare outcomes?' European Trade Union Institute, Available online at http://www.etui.org/Publications2/Working-Papers/Has-the-economic-crisis-contributed-to-more-segmentation-in-labour-market-and-welfare-outcomes.

Levine, L. 2013. 'Economic Growth and the Unemployment Rate ' *Congressional Research Service* 7-5700. Available online at http://fas.org/sgp/crs/misc/R42063.pdf.

Li, C.-Y., S.C. Wu, and F.-C. Sung. 2002. 'Lifetime principal occupation and risk of cognitive impairment among the elderly.' *Industrial Health* 40(1):7-13.

Lindahl, M. 2005. 'Estimating the Effect of Income on Health and Mortality Using Lottery Prizes as an Exogenous Source of Variation in Income.' *Journal of Human Resources* XL(1):144-168.

Lloyd-Jones, D.M., M.G. Larson, A. Beiser, and D. Levy. 1999. 'Lifetime risk of developing coronary heart disease.' *The Lancet* 353(9147):89-92.

Lloyd-Jones, D.M., E.P. Leip, M.G. Larson, R.B. D'Agostino, A. Beiser, P.W.F. Wilson, P.A. Wolf, and D. Levy. 2006. 'Prediction of Lifetime Risk for Cardiovascular Disease by Risk Factor Burden at 50 Years of Age.' *Circulation* 113(6):791-798.

Loucks, E.B., J.W. Lynch, L. Pilote, R. Fuhrer, N.D. Almeida, H. Richard, G. Agha, J.M. Murabito, and E.J. Benjamin. 2009. 'Life-Course Socioeconomic Position and Incidence of Coronary Heart Disease The Framingham Offspring Study.' *American Journal of Epidemiology* 169(7):829-836.

Lundin, A., I. Lundberg, L. Hallsten, J. Ottosson, and T. Hemmingsson. 2010. 'Unemployment and mortality—a longitudinal prospective study on selection and causation in 49321 Swedish middle-aged men.' *Journal of Epidemiology and Community Health* 64(01):22-28.

Lusardi, A., D.J. Schneider, and P. Tufano. 2010. 'The economic crisis and medical care usage.' National Bureau of Economic Research, *NBER Working Paper No. 15843*. Available online at http://www.nber.org/papers/w15843.

Lynch, J.W., G.A. Kaplan, R.D. Cohen, T.W. Wilson, N. Smith, J. Kauhanen, and J.T. Salonen. 1994a. 'Childhood and adult socioeconomic status as predictors of mortality in Finland.' *The Lancet* 343(8896):524-527.

Lynch, J.W., G.A. Kaplan, R.D. Cohen, T.W. Wilson, N.L. Smith, J. Kauhanen, and J.T. Salonen. 1994b. 'Childhood and adult socioeconomic status as predictors of mortality in Finland.' *The Lancet* 343(8896):524-527.

Lynch, J.W., G.A. Kaplan, and S.J. Shema. 1997. 'Cumulative impact of sustained economic hardship on physical, cognitive, psychological, and social functioning.' *New England Journal of Medicine* 337(26):1889-1895.

Mackenbach, J.P., A.E.J.M. Cavelaars, A.E. Kunst, and F. Groenhof. 2000. 'Socioeconomic inequalities in cardiovascular disease mortality. An international study.' *European Heart Journal* 21(14):1141-1151.

Maclean, J.C. 2013. 'The health effects of leaving school in a bad economy.' *Journal of Health Economics* 32(5):951–964.

Maddison, A. 2003. 'The World Economy Historical Statistics.' in *Development Centre Studies,*. Paris: OECD Publishing.

—. 2006. 'The World Economy Volume 1: A Millennial Perspective and Volume 2: Historical Statistics.' in *Development Centre Studies,*. Paris: OECD Publishing.

Maddison, A. and O.f.E.C.a.D.D. Centre. 2003. *The world economy: historical statistics*. Paris: Development Centre of the Organisation for Economic Cooperation and Development.

—. 2006. *The world economy*. Paris, France: Development Centre of the Organisation for Economic Cooperation and Development.

Mann, S., M. Wadsworth, and J. Colley. 1992. 'Accumulation of factors influencing respiratory illness in members of a national birth cohort and their offspring.' *Journal of Epidemiology and Community Health* 46(3):286-292.

Mannheim Research Institute for the Economics of Ageing. 2011. 'Survey of Health, Ageing and Retirement in Europe: Release Guide 2.5.0 Waves 1 & 2 ' Available online at www.share-project.org/fileadmin/pdf.../SHARE_release_guide.pdf.

Manski, C. and J. Straub. 2000. 'Worker perceptions of job insecurity in the mid-1990s—evidence from the survey of economic expectations.' *Journal of Human Resour* 35:447–479.

Manton, K.G., E. Stallard, and L. Corder. 1997. 'Changes in the Age Dependence of Mortality and Disability: Cohort and Other Determinants.' *Demography* 34(1):135-157.

Marmot, M., S. Friel, R. Bell, T.A. Houweling, and S. Taylor. 2008. 'Closing the gap in a generation: health equity through action on the social determinants of health.' *The Lancet* 372(9650):1661-1669.

Marmot, M. and R. Wilkinson. 2009. *Social determinants of health*: Oxford University Press.

Martikainen, P., N. Mäki, and M. Jäntti. 2007. 'The effects of unemployment on mortality following workplace downsizing and workplace closure: a register-based follow-up study of Finnish men and women during economic boom and recession.' *American Journal of Epidemiology* 165(9):1070-1075.

Matoba, T., T. Ishitake, and R. Noguchi. 2003. 'A 2-year follow-up survey of health and life style in Japanese unemployed persons.' *International Archives of Occupational and Environmental Health* 76(4):302-308.

Mazzonna, F. and E. Havari. 2011. 'Can We trust older people's statements on their childhood circumstances? Evidence from SHARELIFE.' Munich Center for the Economics of Agein, Available online at

http://mea.mpisoc.mpg.de/uploads/user_mea_discussionpapers/1203_recall_bias13_MEA%20%281%29.pdf.

McAvinchey, I.D. 1988. 'A comparison of unemployment, income and mortality interaction for five European countries.' *Applied Economics* 20(4):453-471.

McDonough, P., G.J. Duncan, D. Williams, and J. House. 1997. 'Income dynamics and adult mortality in the United States, 1972 through 1989.' *American Journal of Public Health* 87(9):1476-1483.

McFall, B.H. 2011. 'Crash and Wait? The impact of the Great Recession on Retirement Planning of Older Americans.' *American Economic Review* 101(3):40.

McInerney, M. and J.M. Mellor. 2012. 'Recessions and Seniors' Health; Health Behaviors; and Healthcare Use: Analysis of the Medicare Current Beneficiary Survey.' *Journal of Health Economics*(0).

McLeod, C.B., J.N. Lavis, Y.C. MacNab, and C. Hertzman. 2012. 'Unemployment and mortality: a comparative study of Germany and the United States.' *American Journal of Public Health* 102(8):1542-1550.

Mensah, G.A. and D.W. Brown. 2007. 'An Overview Of Cardiovascular Disease Burden In The United States.' *Health Affairs* 26(1):38-48.

Midanik, L.T., K. Soghikian, L.J. Ransom, and I.S. Tekawa. 1995. 'The Effect of Retirement on Mental Health and Health Behaviors: The Kaiser Permanente Retirement Study.' *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 50B(1):S59-S61.

Miller, D.L., M.E. Page, A.H. Stevens, and M. Filipski. 2009. 'Why are recessions good for your health?' *American Economic Review*:122-127.

Milne, J.S. and M.M. Maule. 1984. 'A longitudinal study of handgrip and dementia in older people.' *Age Ageing* 13(1):42-48.

Mossakowski, K.N. 2008. 'Is the duration of poverty and unemployment a risk factor for heavy drinking?' *Social Science and Medicine* 67(6):947-955.

Nagi, S.Z. 1976. 'An Epidemiology of Disability among Adults in the United States.' *The Milbank Memorial Fund Quarterly. Health and Society* 54(4):439-467.

Neuman, K. 2008. 'Quit Your Job and Get Healthier? The Effect of Retirement on Health.' *Journal of Labor Research* 29(2):177-201.

Neumayer, E. 2004. 'Recessions lower (some) mortality rates: evidence from Germany.' *Social Science and Medicine* 58(6):1037-1047.

O'Donnell, C. 1984. 'Major Theories of the Labour Market and Women's Place Within It.' *Journal of Industrial Relations* 26(2):147-165.

O'Rand, A.M. and J. Hamil-Luker. 2005. 'Processes of cumulative adversity: childhood disadvantage and increased risk of heart attack across the life course.' *Journals of Gerontology Series B: Psychological Sciences & Social Sciences*.

OECD. 2012. 'OECD.Stat.' Available online at http://stats.oecd.org.

Ofstedal, M., G. Fisher, and R. Herzog. 2012. 'Documentation of Cognitive Functioning Measures in the Health and Retirement Study. HRS Documentation Report DR-006 [online].' Available online at http://hrsonline.isr.umich.edu/sitedocs/userg/dr-006.pdf.

Oreopoulos, P., T. von Wachter, and A. Heisz. 2012. 'Short- and Long-Term Career Effects of Graduating in a Recession.' *American Economic Journal: Applied Economics* 4(1):1-29.

Peretti-Watel, P. and J. Constance. 2009. ‘‘It’s all we got left’. Why poor smokers are less sensitive to cigarette price increases.’ *International Journal of Environmental Research and Public Health* 6(2):608-621.

Portrait, F., R. Alessie, and D. Deeg. 2010. ‘Do early life and contemporaneous macroconditions explain health at older ages?’ *Journal of Population Economics* 23(2):617-642.

Power, C., O. Manor, and S. Matthews. 1999. ‘The duration and timing of exposure: effects of socioeconomic environment on adult health.’ *American Journal of Public Health* 89(7):1059-1065.

Power, C., S. Matthews, and O. Manor. 1996. ‘Inequalities in self rated health in the 1958 birth cohort: lifetime social circumstances or social mobility?’ *BMJ (Clinical Research Ed.)* 313(7055):449-453.

Prachowny, M.F. 1993. ‘Okun's law: theoretical foundations and revised estimates.’ *The review of Economics and Statistics*:331-336.

Raaum, O. and K. Røed. 2006. ‘Do Business Cycle Conditions at the Time of Labor Market Entry Affect Future Employment Prospects?’ *The Review of Economics and Statistics* 88(2):193-210.

Rantanen, T., J.M. Guralnik, D. Foley, K. Masaki, S. Leveille, J.D. Curb, and L. White. 1999. ‘Midlife hand grip strength as a predictor of old age disability.’ *JAMA; Journal of the American Medical Association* 281(6):558-560.

Reeves, A., D. Stuckler, M. McKee, D. Gunnell, S.-S. Chang, and S. Basu. 2012. ‘Increase in state suicide rates in the USA during economic recession.’ *The Lancet* 380(9856):1813-1814.

Reine, I., M. Novo, and A. Hammarström. 2004. ‘Does the association between ill health and unemployment differ between young people and adults? Results from a 14-year follow-up study with a focus on psychological health and smoking.’ *Public Health* 118(5):337-345.

Richards, M. and A. Sacker. 2003. ‘Lifetime antecedents of cognitive reserve.’ *Journal of Clinical and Experimental Neuropsychology* 25(5):614-624.

Roelfs, D.J., E. Shor, K.W. Davidson, and J.E. Schwartz. 2011. ‘Losing life and livelihood: A systematic review and meta-analysis of unemployment and all-cause mortality.’ *Social Science and Medicine* 72(6):840-854.

Rohwedder, S. and R.J. Willis. 2010. ‘Mental retirement.’ *Journal of Economic Perspectives* 24(1):119-138.

Rolden, H.J.A., D. van Bodegom, W.B. van den Hout, and R.G.J. Westendorp. 2014. ‘Old age mortality and macroeconomic cycles ‘ *Journal of Epidemiology and Community Health* 68(1):44-50.

Rolland, Y., V. Lauwers-Cances, M. Cesari, B. Vellas, M. Pahor, and H. Grandjean. 2006. ‘Physical Performance Measures as Predictors of Mortality in a Cohort of Community-dwelling Older French Women.’ *European Journal of Epidemiology* 21(2):113-122.

Rubin, D. 1987. *Multiple Imputation for Nonresponse in Surveys*. New York: John Wiley & Sons, Inc.

Ruhm, C. 2013. ‘Recessions, Healthy No More?’ National Bureau of Economic Research, *NBER Working Paper No. 19287*. Available online at http://www.nber.org/papers/w19287.

Ruhm, C.J. 1991. 'Are workers permanently scarred by job displacements?' *The American Economic Review* 81(1):319-324.

Ruhm, C.J. 1995. 'Economic conditions and alcohol problems.' *Journal of Health Economics* 14(5):583-603.

Ruhm, C.J. 2000. 'Are recessions good for your health?' *Quarterly Journal of Economics* 115(2):617-650.

—. 2003. 'Good times make you sick.' *Journal of Health Economics* 22(4):637-658.

—. 2005. 'Healthy living in hard times.' *Journal of Health Economics* 24(2):341-363.

—. 2007. 'A healthy economy can break your heart.' *Demography* 44(4):829-848.

Ruhm, C.J. and W.E. Black. 2002. 'Does drinking really decrease in bad times?' *Journal of Health Economics* 21(4):659-678.

Saar, E., M. Unt, and I. Kogan. 2008. 'Transition from Educational System to Labour Market in the European Union.' *International Journal of Comparative Sociology* 49(1):31-59.

Schoenfeld, D. 1980. 'Chi-squared goodness-of-fit tests for the proportional hazards regression model.' *Biometrika* 67(1):145-153.

Schröder, M. 2011. *Retrospective Data Collection in the Survey of Health, Ageing and Retirement in Europe. SHARELIFE Methodology*. Mannheim: MEA.

Schröder, M. 2013. 'Jobless now, sick later? Investigating the long-term consequences of involuntary job loss on health.' *Advances in Life Course Research* 18(1):5-15.

Silles, M.A. 2009. 'The causal effect of education on health: Evidence from the United Kingdom.' *Economics of Education Review* 28(1):122-128.

Simeral, M.H. 1978. 'Women and the reserve army of labor.' *Critical Sociology* 8(2-3):164-179.

Singh-Manoux, A., J.E. Ferrie, T. Chandola, and M. Marmot. 2004. 'Socioeconomic trajectories across the life course and health outcomes in midlife: evidence for the accumulation hypothesis?' *International Journal of Epidemiology* 33(5):1072-1079.

Smith, G.D., C. Hart, D. Blane, C. Gillis, and V. Hawthorne. 1997. 'Lifetime socioeconomic position and mortality: prospective observational study.' *BMJ: British Medical Journal* 314(7080):547.

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.

Smith, J.P. 2009. 'Reconstructing childhood health histories.' *Demography* 46(2):387-403.

Sonnega, A., J.D. Faul, M.B. Ofstedal, K.M. Langa, J.W. Phillips, and D.R. Weir. 2014. 'Cohort Profile: the Health and Retirement Study (HRS).' *International journal of epidemiology* 43(2):576-585.

Stern, Y. 2002. 'What is cognitive reserve? Theory and research application of the reserve concept.' *Journal of the International Neuropsychological Society* 8(03):448-460.

Stern, Y., G.E. Alexander, I. Prohovnik, L. Stricks, B. Link, M.C. Lennon, and R. Mayeux. 1995. 'Relationship between lifetime occupation and parietal flow: Implications for a reserve against Alzheimer's disease pathology.' *Neurology* 45(1):55-60.

Stevens, A.H., D.L. Miller, M.E. Page, and M. Filipski. 2011. 'The best of times, the worst of times: Understanding pro-cyclical mortality.' National Bureau of Economic Research, *NBER Working Paper No. 17657*. Available online at http://www.nber.org/papers/w17657.

Strully, K. 2009. 'Job loss and health in the U.S. labor market.' *Demography* 46(2):221-246.

Stuckler, D., S. Basu, M. Suhrcke, A. Coutts, and M. McKee. 2009. 'The public health effect of economic crises and alternative policy responses in Europe: an empirical analysis.' *Lancet* 374(9686):315-323.

Sullivan, D. and T. von Wachter. 2009. 'Job Displacement and Mortality: An Analysis Using Administrative Data.' *The Quarterly Journal of Economics* 124(3):1265-1306.

Survey of Health Ageing and Retirement in Europe. 2006. 'Interviewer Project Manual: 2006 Baseline and Longitudinal Data Collection.' Available online at http://www.share-project.org/t3/share/fileadmin/wiki/Appendix-4-IWER-Manuals/Wave2_IWER-Manual.pdf.

Swan, A.V., R. Creeser, and M. Murray. 1990. 'When and why children first start to smoke.' *International Journal of Epidemiology* 19(2):323-330.

Tapia Granados, J. 2005a. 'Recessions and Mortality in Spain, 1980–1997.' *European Journal of Population/Revue européenne de Démographie* 21(4):393-422.

Tapia Granados, J.A. 2005b. 'Increasing mortality during the expansions of the US economy, 1900-1996.' *International Journal of Epidemiology* 34(6):1194-1202.

Tapia Granados, J.A. 2012. 'Economic growth and health progress in England and Wales: 160 years of a changing relation.' *Social Science and Medicine* 74(5):688-695.

Tapia Granados, J.A. and E.L. Ionides. 2008. 'The reversal of the relation between economic growth and health progress: Sweden in the 19th and 20th centuries.' *Journal of Health Economics* 27(3):544-563.

The Economist. 2008. 'Diagnosing depression. What is the difference between a recession and a depression? .' in *The Economist*. Available online at http://www.economist.com/node/12852043.

Thévenon, O. 2009. 'Increased women's labour force participation in Europe: Progress in the work-life balance or polarization of behaviours?' *Population (english edition)* 64(2):235-272.

Thomas, C., M. Benzeval, and S.A. Stansfeld. 2005. 'Employment transitions and mental health: an analysis from the British household panel survey.' *Journal of Epidemiology and Community Health* 59(3):243-249.

Tsae-Jyy, W. 2004. 'Concept analysis of functional status.' *International Journal of Nursing Studies* 41(4):457-462.

U.S. Bureau of Labor Statistics. 2009. 'Labor Force Statistics from the Current Population Survey.' Available online at http://www.bls.gov/cps/cps_htgm.htm.

—. 2011. 'Labor Force Statistics from the Current Population Survey: Frequently Asked Questions.' Available online at http://www.bls.gov/cps/faq.htm#Ques3

U.S. Census Bureau. 2006. 'Design and Methodology: Current Population Survey.' *Technical Paper 66*. Available online at http://www.census.gov/prod/2006pubs/tp-66.pdf.

UNESCO. 2012. 'International Standard Classification of Education ', edited by S.a.C.O. United Nations Educational. Paris.

University of Michigan, S.R.C. 2008a. 'The Health and Retirement Study (HRS): Design History.' Available online at http://hrsonline.isr.umich.edu/index.php?p=sdesign

—. 2008b. 'The Health and Retirement Study (HRS): Sample Evolution - 1992-1998.' Available online at http://hrsonline.isr.umich.edu/index.php?p=sdesign

—. 2008c. ‘The Health and Retirement Study (HRS): Sample Sizes and Response Rates.’ Available online at http://hrsonline.isr.umich.edu/index.php?p=sdesign

van den Berg, G.J., D.J.H. Deeg, M. Lindeboom, and F. Portrait. 2010. ‘The Role of Early-Life Conditions in the Cognitive Decline due to Adverse Events Later in Life.’ *The Economic Journal* 120(548):F411-F428.

van den Berg, G.J., G. Doblhammer-Reiter, and K. Christensen. 2011. ‘Being Born Under Adverse Economic Conditions Leads to a Higher Cardiovascular Mortality Rate Later in Life: Evidence Based on Individuals Born at Different Stages of the Business Cycle.’ *Demography* 48(2):507-530.

van den Berg, G.J., G. Doblhammer, and K. Christensen. 2009. ‘Exogenous determinants of early-life conditions, and mortality later in life.’ *Social Science and Medicine* 68(9):1591-1598.

van den Berg, G.J., M. Lindeboom, and F. Portrait. 2006. ‘Economic Conditions Early in Life and Individual Mortality.’ *American Economic Review* 96(1):290-302.

Vandoros, S., P. Hessel, T. Leone, and M. Avendano. 2013. ‘Have health trends worsened in Greece as a result of the financial crisis? A quasi-experimental approach.’ *The European Journal of Public Health* 23(5):727-731.

Vinokur, A., R. Price, and R. Caplan. 1996. ‘Hard times and hurtful partners: how financial strain affects depression and relationship satisfaction of unemployed persons and their spouses.’ *Journal of Personality and Social Psychology* 71:166–179.

Virtanen, M., S.A. Stansfeld, R. Fuhrer, J.E. Ferrie, and M. Kivimäki. 2012. ‘Overtime Work as a Predictor of Major Depressive Episode: A 5-Year Follow-Up of the Whitehall II Study.’ *PLoS ONE*, 7(1):e30719. Available online at http://dx.doi.org/10.1371%2Fjournal.pone.0030719.

Vita, A.J., R.B. Terry, H.B. Hubert, and J.F. Fries. 1998. ‘Aging, Health Risks, and Cumulative Disability.’ *New England Journal of Medicine* 338(15):1035-1041.

Wadsworth, M.E.J. 1997. ‘Health inequalities in the life course perspective.’ *Social Science and Medicine* 44(6):859-869.

Wagstaff, A. 1985. ‘Time series analysis of the relationship between unemployment and mortality: a survey of econometric critiques and replications of Brenner's studies.’ *Social Science and Medicine* 21(9):985-996.

Weden, M.M., N.M. Astone, and D. Bishai. 2006. ‘Racial, ethnic, and gender differences in smoking cessation associated with employment and joblessness through young adulthood in the US.’ *Social Science and Medicine* 62(2):303-316.

Willis, R. 2006. ‘Aging in the US: the Health and Retirement Study.’ *conference on longitudinal social and health surveys in an international perspective, Montreal, CA*. Available online at http://www.ciqss.umontreal.ca/Longit/Doc/Robert_Willis.pdf.

Wolff, E.N. 2011. ‘Pensions in the 2000s: the Lost Decade?’ National Bureau of Economic Research, *NBER Working Paper No. 16991*. Available online at http://www.nber.org/papers/w16991.

World Health Organization. 2013. ‘The top 10 causes of death.’ Available online at http://www.who.int/mediacentre/factsheets/fs310/en/.

Wunsch, G., J. Duchene, E. Thiltges, and M. Salhi. 1996. ‘Socio-economic differences in mortality. A life course approach.’ *European Journal of Population* 12(2):167-185.

Xu, X. 2013. ‘The business cycle and health behaviors.’ *Social Science and Medicine* 77(0):126-136.

Yuan, Y. 2000. ‘Multiple Imputation for Missing Data: Concepts and New Development (Version 9.0).’ in *Proceedings of the Twenty-Fifth Annual SAS® Users Group International Conference*, edited by S.I. Inc. Rockville: SAS Institute Inc.

Zanjani, F.A.K., K.W. Schaie, and S.L. Willis. 2006. ‘Age group and health status effects on health behavior change.’ *Behavioral Medicine* 32(2):36-46.

Zavras, D., V. Tsiantou, E. Pavi, K. Mylona, and J. Kyriopoulos. 2013. ‘Impact of economic crisis and other demographic and socio-economic factors on self-rated health in Greece.’ *European Journal of Public Health* 23(2):206-210.