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Greening our working lives:
The environmental impacts of changing patterns
of paid work in the UK and the Netherlands,
and implications for working time policy

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The University of Edinburgh
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Declaration

I declare that this thesis is my own composition, based on my own work, with acknowledgement of other sources, and has not been submitted for any other degree or professional qualification.

Martin Pullinger

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Abstract

Paid working patterns are currently regulated by governments around the world for a range of social and economic reasons: to increase labour supply and skills; to provide a strong tax base to support an ageing population; to help people reconcile work and family life over increasingly diversified life courses; and to be in line with the general principle of the activating, employment led welfare state. Environmental considerations rarely feature in the design or evaluation of working time policy. Nevertheless, various authors working on policies for sustainable development argue that reductions in average paid working time could lead to environmental benefits: as people work less, they in turn earn less, and so consume less, resulting in lower environmental impacts from lower levels of production of products.

This thesis takes this argument as its starting point, and synthesises these distinct perspectives on working time and its regulation to address two key questions: what level of environmental benefits could arise from such reductions in paid working time?; and what are the implications for the design of working time policy?

The research addresses these questions, taking the case of greenhouse gas emissions, and the UK and the Netherlands in the early 2000s as case studies. Using household expenditure survey data and data on product emissions intensities, the relationship between paid working time and emissions is analysed at both the household and national levels. At the household level, statistically and substantively significant correlations are found between higher levels of paid work and higher levels of consumption and so greenhouse gas emissions. The effects on emissions of hypothetical changes in the working patterns of the national populations are then modelled. The research estimates that meeting current national objectives to increase labour market participation rates would increase national greenhouse gas emissions by 0.6-0.7%, a cost that might be considered acceptable if it also achieves its aims of reducing income poverty, benefit dependency, and social exclusion. Meanwhile, widespread reductions in average working hours and increased use of career breaks, with corresponding reductions in income, would reduce national emissions. The scenarios modelled (a 20% reduction in the working hours of full time workers, and increasing use of 3 month career breaks) lead to reductions of 3-4.5% in national emissions, with the corresponding increases in “leisure” time, reductions in income inequality, and reduced gender imbalances in the distribution of paid work potentially also improving wellbeing, social cohesion, and gender equality in work and care.

The results indicate that environmental factors warrant consideration in the design and evaluation of working time policy, and that challenging but achievable levels of working time reduction could contribute a small but significant share to meeting greenhouse gas emissions targets. Policy instruments would need to address a range of values, attitudes and norms around employment and consumption, as well as employer and situational factors, if substantial working time reduction were to be achieved. Reconciling diverse environmental, social and economic goals also requires careful policy design, particularly for certain demographic groups such as the low income, who would need financial and other support to turn rights to reduce working time into functional freedoms that they could utilise.

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Chapter 1 Introduction

Paid working time is currently regulated by governments around the world for a range of economic and social reasons. Governments seek on the one hand to increase participation rates in paid labour, setting up rules and incentives to encourage people to work more, to boost labour market supply and skills and hence, it is hoped, economic growth, and to reduce income poverty and social exclusion. Such increases in participation rates also support state fiscal sustainability, reducing benefits payments, increasing income tax receipts, and hence providing extra funds to service debt and support the needs of ageing populations (Knijn, Martin, and Millar 2007; European Commission, Directorate-General for Employment 2007; Viebrock and Clasen 2009a). On the other hand, other policies support reductions in paid labour. These include regulation of the maximum working hours per week, minimum holiday entitlements, and controls and rights relating to different periods of the life course: minimum and maximum working ages, and rights to career breaks and financial support for periods out of the labour market for parental leave, for (early) retirement, for skills training, for illness, disability and unemployment, or even just for leisure and personal reasons (Plantenga 2005a).

Policy development, and academic literature in the field of social policy, highlight these social and economic goals and have developed detailed perspectives for the design and evaluation of policy instruments to reconcile them against the backdrop of increasing global competition, ageing populations, falling fertility rates, greater demands for gender equality, and increasing diversity in individual life courses (Bovenberg 2007).

Meanwhile, a parallel literature emphasises a further aspect of working time regulation that is rarely mentioned in the social policy literature. Various authors researching sustainable development policy, in a field sometimes described as ecological economics, highlight the link between paid work and environmental impacts: the more people work and earn, the more they consume, and the higher their environmental impacts as a result, as the goods they consume have impacts in their

production, distribution, use and eventual disposal. Encouraging reductions in paid working time, with concurrent reductions in earned income, will, they argue, lead to reduced consumption and environmental impacts (e.g. Coote, Franklin, and Simms 2010; Robinson 2006; Schor 2005). In this way, working time reduction could contribute to solving the world's ever-growing environmental problems, and represents a way in which paid work and income could be distributed equitably among the population even as total demand for consumer goods, and hence for paid labour, falls (Victor 2010). Furthermore, supporting and encouraging people to escape the cycle of work and spend could bring wellbeing benefits, as people have more time outside of paid work to spend with their families and friends, getting involved in the local community and in voluntary activities, and spending time on creative pastimes and personal and spiritual development, all things which the literature on happiness demonstrates contribute more to wellbeing among affluent societies than does increasing material consumption (Speth et al. 2007). The argument has a long pedigree: in the mid 1800s, John Stuart Mill argued for working time reduction to give people time to practise "the Art of Living" instead of the "art of getting on", and to check growth in consumption (and population) before there is "nothing left to the spontaneous activity of nature[, with] every rood of land brought into cultivation .. and [there is] scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of improved agriculture" (Mill 1870:ch. IV).

Such arguments are also increasingly pertinent to current policy concerns: happiness is receiving increased policy attention. In 2008, French president Nicolas Sarkozy commissioned Joseph Stiglitz and Armatya Sen to produce a report on alternative indicators of progress to GDP growth that better captured non-consumption contributors to wellbeing, perhaps irked that GDP measures fail to reflect the wellbeing benefits of the French welfare state and work life balance policies (livemint.com 2008; Davies 2009; and see Stiglitz, Sen, and Fitoussi 2009). British Prime Minister David Cameron is intent on measuring the nation's happiness and taking it into account, with a new survey of national happiness recently launched to inform policy (BBC News 2010; Else 2011). Meanwhile, sustainable development,

and climate change in particular, have risen from something of a specialist interest of environmentalists to a mainstream policy, and media, concern in recent years. The intention to tackle the “Inconvenient Truth” (Al Gore, in Guggenheim 2006) of global warming is now strong, even if action itself is slow. The 2009 Copenhagen Accord, whilst weak on details, lays out a global consensus among governments that greenhouse gas emissions should be cut to levels that would limit average temperature rises to 2°C (UNFCCC 2009) (although several states are still pushing for this to be 1°C). Current scientific models suggest this equates to a cut of at least 50% of 1990 global emissions levels (the year commonly used as a baseline against which to compare) by 2050, with the largest reductions coming from high income countries. The European Union echoes this goal, and has imposed targets on itself to reduce territorial emissions by 80-95% over 1990 levels by 2050, with an interim target of a 20% reduction by 2020 (European Commission 2011), possibly to be raised to 30%. The UK recently became the first national government to put its climate change goals into law in the 2008 Climate Change Act. “Carbon management” has also become a multibillion pound industry, thanks in part to initiatives such as the European Union’s Emissions Trading Scheme, where businesses can buy and sell rights to emit greenhouse gases.

Mitigating climate change is currently framed largely as a technological and engineering issue, one of “decarbonising” production methods by breaking the link between economic growth and the burning of fossil fuels and deforestation. Economic policy initiatives, such as the emissions trading described above, or green investment schemes, in turn typically focus on incentivising these production side solutions. Policy options to reduce *consumption*, as the driver of production, receive much less attention except in particular, peripheral areas of the economy (such as reducing plastic bag use), arguably as this conflicts with the central tenet of GDP growth. The production side solutions, meanwhile, include increasing the use of renewable energy such as wind, solar and wave power, increasing use of nuclear power, capturing and burying carbon dioxide emissions from burning fossil fuels using carbon capture and storage, electricity grid developments, development of electric or hydrogen vehicles, and increasing energy efficiency in buildings,

manufacturing and appliances. Whilst some sources argue this could be done at a relatively minor cost to the economy (Stern 2007), others question whether the technology can be developed and made commercially viable quickly enough, and if the political will exists, to achieve such a major global infrastructural change sufficiently quickly (Jackson 2009b:67–86). Currently, global rates of emissions have continued to rise year-on-year, while the meteoric economic growth of China has seen its domestic emissions outstrip even the United States to take pole position as largest national emitter (although its per capita emissions are far lower). Financial crisis and rich-world recession has done nothing to slow the emissions increases (Harvey 2011). And breaking the link between the growth in greenhouse gas emissions and economic (GDP) growth is only one issue: economic activity has similarly major impacts on ecosystem services and biodiversity, and are similarly difficult to tackle, potentially bringing huge costs to humans and non-humans alike (ten Brink et al. 2009; Rockström et al. 2009). These impacts are driven largely by the growing demand for consumer goods in the West and increasingly in other countries, a demand which has driven the rapid construction of factories and coal power stations in China and elsewhere, boosting emissions and resource use alike. Approaches to improve the sustainability of consumption seem to have a clear place too therefore.

This thesis contributes to the literature on working time in several ways. Firstly, chapter 2 assesses the commonalities and differences between the two distinct perspectives on working time found in the ecological economics and social policy literatures. A synthesis of the two is created which adds environmental goals to the conventional social and economic ones, and which draws on insights from both literatures to build an enhanced “life course” perspective with which to design and evaluate working time policy instruments which contribute to these diverse goals and mitigate tensions between them, considering the interests of different state and sectoral actors, and the changing situations and preferences of different demographic groups over their life courses. Acknowledging that people’s behaviours are more complex than typically considered in the design of working time policy, the thesis assesses not just the time rights and financial incentives that could be used to achieve

working time reduction, but looks at further policy instruments to influence values, attitudes, habits and preferences around work and consumption, as well as wider situational factors such as employer attitudes.

The thesis then addresses a central outstanding question in the ecological economics literature on working time. Whilst it is intuitively sensible that reducing working time, and hence income, reduces expenditure, and so environmental impacts, this argument appears never to have been tested, nor has the substantive size of such effects been estimated for different changes in working time. Arguably, the environmental effects of working time changes are worthy of consideration in the design of working time policy only if they are large. The thesis addresses this gap, considering the case of greenhouse gas emissions as probably the most pressing of current environmental concerns. Specifically, it asks two related questions.

The first of these is: what is the relationship between working time and greenhouse gas emissions? The second is: what are the implications of this relationship for the design of working time policy? The first question is addressed empirically, whilst the second is addressed discursively, drawing on the empirical results and the modified life course perspective.

Two countries are chosen as case studies: the UK and the Netherlands, using data from the early 2000s. The two countries represent highly suitable cases. Both are high income, high consuming countries, which have goals to reduce emissions by some 80% by 2050, broadly in line with the global requirements for climate stability mentioned above. They are also similar in several respects: they are both EU members, their populations have similar age profiles, they have high labour market participation rates, and aim to increase these rates further. At the same time, there are substantial differences in working patterns and working time policy instruments that make them interesting comparators. Both have substantial variation in working hours in their populations, with high numbers of part time jobs. However, average working hours in the early 2000s were substantially higher in the UK than in the Netherlands. Furthermore, whilst the Netherlands has a range of innovative policy

instruments which provide collective regulation of working hours and extensive individual rights to reduce weekly hours and take career breaks, UK policy support is much weaker. This is interesting for the second of the research questions.

The analytical approach addresses the research questions at two levels. Firstly, as the arguments relate to how people's patterns of work affect their private consumption levels, a household level of analysis is taken. The household rather than individual level is taken as this is the unit at which income and time resources, and expenditure decisions, are typically co-determined by its members (Phipps and Burton 1996). By using household expenditure survey data combined with data on "product emissions intensities" (the greenhouse gas emissions emitted in the production and distribution of different products per pound or euro of their market price), estimates are made of the annual greenhouse gas emissions of a representative sample of UK and Dutch households. The consumer behaviour literature is drawn on to build an analytical model of the household, linking working patterns, via income, to greenhouse gas emissions. Using representative samples of the working age populations drawn from these data, and the model of the household developed, how patterns of paid work and income affect household expenditure patterns and the resultant greenhouse gas emissions is statistically modelled using regression analysis.

In the second stage of the empirical work, these household level results are drawn on to consider how national greenhouse gas emissions might be affected by different scenarios of change in the working patterns of the UK and Dutch populations. What is the size of change in emissions that could be expected under certain changes in working patterns, and is it large enough to be of policy interest? This stage of the work involves modelling the effects on greenhouse gas emissions of different hypothetical scenarios of change in the working patterns of the two populations. Estimating how a dependent variable (in this case, greenhouse gas emissions) would change under different hypothetical scenarios is a relatively uncommon methodology in social policy research, but quite common in environmental fields, in which the likely environmental effects of different untested policy instruments is often of interest. Two sets of scenarios are modelled. The first set relates to current

government objectives, which are to increase labour market participation rates, and hence to *increase* rather than decrease total working time among the working age population. What are the greenhouse gas implications of this? The second set of scenarios takes the starting point of attempting to reduce greenhouse gas emissions, and asks what kind of reductions could be achieved by different levels of *reductions* in working time. Here, the effects on greenhouse gas emissions of substantial reductions in the average paid working hours of full time workers, and the increased use of career breaks, are modelled. The effects of these scenarios on household incomes, expenditure and levels of work are also considered for different demographic groups. These empirical results then inform the discussions of the implications for working time policy. How could environmental goals be combined with the social and economic goals that such policy already aims to meet, to maximise compatibility and minimise tensions between them? How can policy instruments be designed to influence people's working time behaviour?

In short, the thesis seeks to analyse and quantify how different scenarios of change in the working patterns of the UK and Dutch populations would affect greenhouse gas emissions in the two countries. The ultimate aim of the research is to assess the role working time changes might play in meeting, or failing to meet, greenhouse gas targets, to inform the design of working time policy instruments that can support multiple environmental, social and economic goals. In doing so, it contributes to the social policy literature on working time by raising the rationale for considering environmental impacts, and by extending the range of instruments considered for influencing working time behaviour. It contributes to the ecological economics literature by providing the first estimates of the effects on greenhouse gas emissions of different working time changes, and by elaborating on how policy instruments to encourage such changes might look.

The development of the thesis questions and methodology was, as with most research, a long process, and it is fitting to elaborate on that process a little here. Moving from the initial general interest, in working time reduction as an approach to increasing both environmental sustainability and wellbeing, to specific testable

hypotheses took a substantial amount of time and effort, and involved discussions with academics from ecological economics, environmental sciences and social policy, who generously gave advice, information and insight, particularly into the fields of measuring household environmental impacts and the life course approach to conceptualising working time policy. There were dead ends, with some possible research avenues having to be left to one side. Early on, investigating the usage patterns of the Dutch Life Course Scheme seemed one ideal avenue of research, but after conversations with, in particular, Janneke Plantenga and her research team, it became clear that the scheme was still in its infancy and that it would still be some years before substantial numbers of employees were able to use it for career breaks. In effect, although the scheme has, as will be discussed in chapter 7, many of the characteristics of a “good” working time reduction policy, there were no employees yet using it that could constitute participants in this research. Notably, the wish of the author to investigate how individual wellbeing is affected by working time reduction, through survey data and qualitative interviews with career breakers in the Netherlands, had to be left for another future research project, given the difficulty in measuring happiness and identifying its determinants, as well as the time, financial and word limit constraints. Similarly, early on the author investigated the potential of utilising time use data to assess how people’s use of time outside paid work affected their environmental impacts and behaviours. Again, it was the kind help of and conversations with other researchers, this time Jessie Vandeweyer, Prof. Ignace Glorieux and Bert Desmet at the Vrije Universiteit Brussel in Belgium in June 2007, which made it clear that this avenue would be prohibitively difficult to pursue. As the focus on measuring and modelling the environmental impacts of households developed, it was again other academics working in this field kindly giving their time to meet me and give advice and, ultimately, giving me the data I needed, which made this research possible. Thanks go to Kees Vringer, René Benders, Henri Moll and colleagues in the Netherlands, and all at the Stockholm Environment Institute-York working in this field. The numerous meetings with academics in the Netherlands, and with the team in Belgium, was made possible by the generosity with which Janneke Plantenga and Utrecht University’s School of Economics hosted me for a three month research visit in April to July 2007, and with funding from the

RECWOWE European Network of Excellence for a further two week visit in May 2008. It was the advice of these and others at key junctions in the research process, through formal meetings and chance conversations at conferences and the like, as well as the invaluable ongoing support of my supervisors throughout the PhD, which helped crystallise the research topic into specific testable hypotheses and a functional methodology, and ultimately helped me to produce this thesis as a coherent document. Finally, my internal and external viva examiners, Dr Claire Hagggett at the University of Edinburgh, and Prof Ian Gough at LSE, helped with recommendations for finishing touches to the thesis. Thanks go to all those named and unnamed here who helped me.

The thesis is structured as follows. Chapter 2 begins with a review of the two largely distinct literatures on working time found in the fields of ecological economics and social policy. It then compares the two, assessing the similarities and differences in the goals they address and their underlying values relating to work, individual freedoms, and routes to happiness. A new, modified, life course perspective is developed out of the synergy of the two literatures, which is used in later chapters to frame the discussions of the implications of the research results for the design of working time policy instruments. Chapter 3 elaborates the analytical framework, discussing the approach by which a household's greenhouse gas emissions are estimated based on what it consumes, developing the model of household consumption behaviour which links household greenhouse gas emissions with the working patterns of its members, and detailing how the greenhouse gas effects of different scenarios of change in working patterns will be estimated. Chapter 4 contextualises the research, beginning by presenting the case study countries of the UK and the Netherlands, the datasets used, and their preparation for analysis, before providing a first look at the patterns of greenhouse gas emissions from their populations as revealed by the data. Chapter 5 tests the hypothesis that reductions in the paid working hours of household members will reduce the greenhouse gas emissions arising from that household's consumption. Drawing on these household-level results, chapter 6 estimates how much national greenhouse gas emissions would increase if UK and Dutch objectives to increase labour market participation rates

were met. Chapter 7 takes the opposite approach, estimating how emissions would reduce under different scenarios of reductions in paid working hours, and increases in the use of career breaks, in the two populations. Chapter 8 concludes, summarising the key results of the thesis, and their implications for the research questions and for working time policy. It also discusses limitations to the work and possible topics for further research.

Chapter 2 The regulation of working time for environmental, social and economic ends: two perspectives, common ground?

Patterns of paid working time have attracted increasing policy attention across high income nations. Starting out mainly as a labour market issue, with efforts to increase labour market participation for economic ends or, in times of difficulty, to manage unemployment levels, policy goals have evolved with changing conditions and cultural values to increasingly consider social factors, relating in particular to gender equality, to the effects of paid work on childcare provision and fertility, and to changing, increasingly individualised life courses (Lewis, Knijn, et al. 2008). Environmental considerations meanwhile still remain largely unconsidered in the design and evaluation of policy to regulate working time, indeed the linkages between environmental and social policies in general are largely unexplored (Gough et al. 2008). Despite this, a small but growing body of literature highlights this environmental aspect, arguing that working time reduction could be an important tool in addressing such environmental crises as climate change, habitat loss and biodiversity loss. Such broad environmental benefits would arise, it is argued, because working time reduction would ultimately lead to concurrent reductions in income and, as a result, consumption of market goods and services, reducing the current unsustainable levels of demand for multiple natural resources and the generation of diverse forms of pollution. What is more, working time reduction could provide people with more time to pursue happiness in other, less material, ways (see, for example, Coote et al. 2010; Hayden 1999; LaJeunesse 2009; Robinson 2006; Schor 2005).

This environmental perspective is the starting point of the research in this thesis. What contribution to these environmental issues could working time reduction make? What are the implications for policy design? This chapter reviews the existing literature on working time, both from the ecological economics perspective, from which the environmental arguments arise, and from the social policy

perspective, in which existing policy is framed, conceptualised, designed and evaluated for social and economic ends.

The first section of this chapter presents the arguments relating to working time reduction as a route to environmental sustainability, presenting the environmental issues facing society and the role working time reduction could play in addressing them. It also reviews the argument that such reductions in working time could bring wellbeing benefits too. It discusses the size of contribution working time reduction could make to these issues, and then looks at the policy instruments that the literature proposes to achieve these reductions in paid work.

The second section of the chapter reviews the social policy literature on working time, or “work life balance” policy, reviewing its social and economic goals and its instruments. Being grounded in the analysis of real, implemented policies, it has developed nuanced analytical perspectives from which to evaluate and propose policy design, something which the ecological economics literature largely lacks. One of the most prominent of these perspectives, the life course perspective, is presented.

The third section compares the two literatures. Despite the two distinct starting points, it is found that they have similar values around the role of paid work, and in many ways are complementary. A novel synergy of the two perspectives is presented in the form of a modified life course perspective, incorporating environmental goals alongside the social and economic, and considering a wider range of areas of policy intervention to influence patterns of paid work.

The final section summarises the key points and the several outstanding questions raised by the literature, and discusses the rationale for this thesis’ focus on one of these questions in particular: the environmental impacts of changing patterns of work in a population.

2.1 Working time reduction: Working time policy for sustainable development

“Shorter working hours could help to adapt the economy to the needs of society and the environment, rather than subjugating society and environment to the needs of the economy” (Coote et al. 2010:3).

Working time reduction is proposed as a solution to balancing the needs of environmental sustainability with human wellbeing, by authors in the field of ecological economics.¹

Ecological economics take a rather different perspective to mainstream economics with respect to environmental problems and to human wellbeing, and proponents of working time reduction draw on these perspectives. With respect to mounting ecological problems, ecological economics, rather differently to Neoclassical economics, explicitly considers the economy “as an open subsystem of the larger, but finite, closed and nongrowing [natural] ecosystem” (Daly 1992:186). Rather than nature being an inert source of raw materials and a place to dump waste, its role as life support system upon which humanity (and of course the economy) depend is taken as a starting point when addressing environmental problems (Boulding 1966). A key question from this perspective is then, what is the optimum size of the economic subsystem (Simms, Johnson, and Chowla 2010:118–124)? It cannot, in material terms, go on growing forever on a planet that is fixed in size, as there is only so much ecological space. This is something mainstream economics doesn’t consider, with a focus firmly on GDP growth (Daly 1992:186). The answer is also nuanced, involving questions about the fair distribution of ecological resources between people alive today, and between current and future generations (World

¹ Ecological economics is, as we shall see, by its nature interdisciplinary, focused as it is on elaborating how a sustainable and just economic system could be achieved, rather than on a specific analytical perspective (see, e.g. Edwards-Jones, Davies, and Hussain 2000). As such, authors might not identify themselves as ecological economists: others identify themselves with, for example, Steady State Economics (Daly 1991) and, more recently, degrowth (Fournier 2008), which respectively focus particularly on what a sustainable economy, once achieved, might look like, and on how the process of transition to it could be smoothly achieved. Work also draws on research from various other disciplines. The term ecological economics is used throughout the rest of this thesis to refer to this field, as arguably the most encompassing term.

Commission on Environment and Development 1987), and indeed between human and non-human species.

In essence, there is separate consideration of three factors: the “biophysical throughput” of the economy (that is, its levels of resource and energy use and waste production), the achievement of high levels of human welfare, and levels of economic activity, commonly measured by GDP. The three “have a complex and by no means fixed relationship to each another” (Ekins and Jacobs 1995:22). Indeed, GDP growth as a goal in itself is criticised for its lack of consideration of its side effects on the other two factors, in terms of environmental damage from high levels of resource use and pollution, and impacts on wellbeing, which arise from “the stressful demands of too much work, consumption and competition” (Fitzpatrick 2000:10) in high income countries, and from inadequate attention to the highly unequal global distribution of wealth that it has brought (Jackson 2009a). In short, the effectiveness of pursuing indefinite GDP growth in meeting these environmental and social goals is questioned (Woodward, Simms, and Murphy 2006), indeed its compatibility with these goals is questioned, given the need to stay within ecological limits (Simms et al. 2010; Daly 1996; Ekins and Jacobs 1995). Past a certain level of GDP the negative impacts of further growth on wellbeing and the environment could even outweigh the positive (Max-Neef 1995).

Ecological economics does not however involve a total rejection of neoclassical economics by any means. Indeed, if anything, the market system of production and distribution is generally considered even more vital: its capacity to enable innovation and a steady increase in production efficiency seems essential to support a future projected population of over 9 billion people (by 2050) within environmental limits (Daly 1995; Department of Economic and Social Affairs of the United Nations Secretariat, Population Division 2008).

The next section discusses why working time reduction² is argued by some authors in the literature to be necessary. The arguments are firmly linked to the issues of environmental sustainability and human wellbeing found in ecological economics, and so these two key issues are discussed, with a focus on the role working time reduction is argued to play with regards to them. Following that, the scope and limits of working time reduction as a solution to these issues is discussed, followed by a look at how working time reduction might be achieved in practice.

2.1.1 Why working time reduction is needed

2.1.1.1 Environmental benefits

The literature on working time reduction takes as a starting point the assertion that current levels of economic activity lead to levels of environmental damage so high that the very life support services of the Earth upon which societies rely are being undermined at local, regional and increasingly global scales, threatening the livelihoods of future generations (Rockström et al. 2009; WWF 2010). Working time reduction can help address these environmental issues, it is argued, by contributing to reducing the consumption of market goods and services, the production of which is the primary source of environmental impacts. Put simply, if people work, and so earn, less, they will in turn spend and consume less, resulting in lower environmental impacts (Coote et al. 2010:17). As production falls as a result too, a lower amount of labour would also be required, and working time reduction also then helps to distribute this more evenly through the population, by allowing more people to be employed for fewer total hours each, rather than having some working long hours and high numbers unemployed (Lintott 2004).

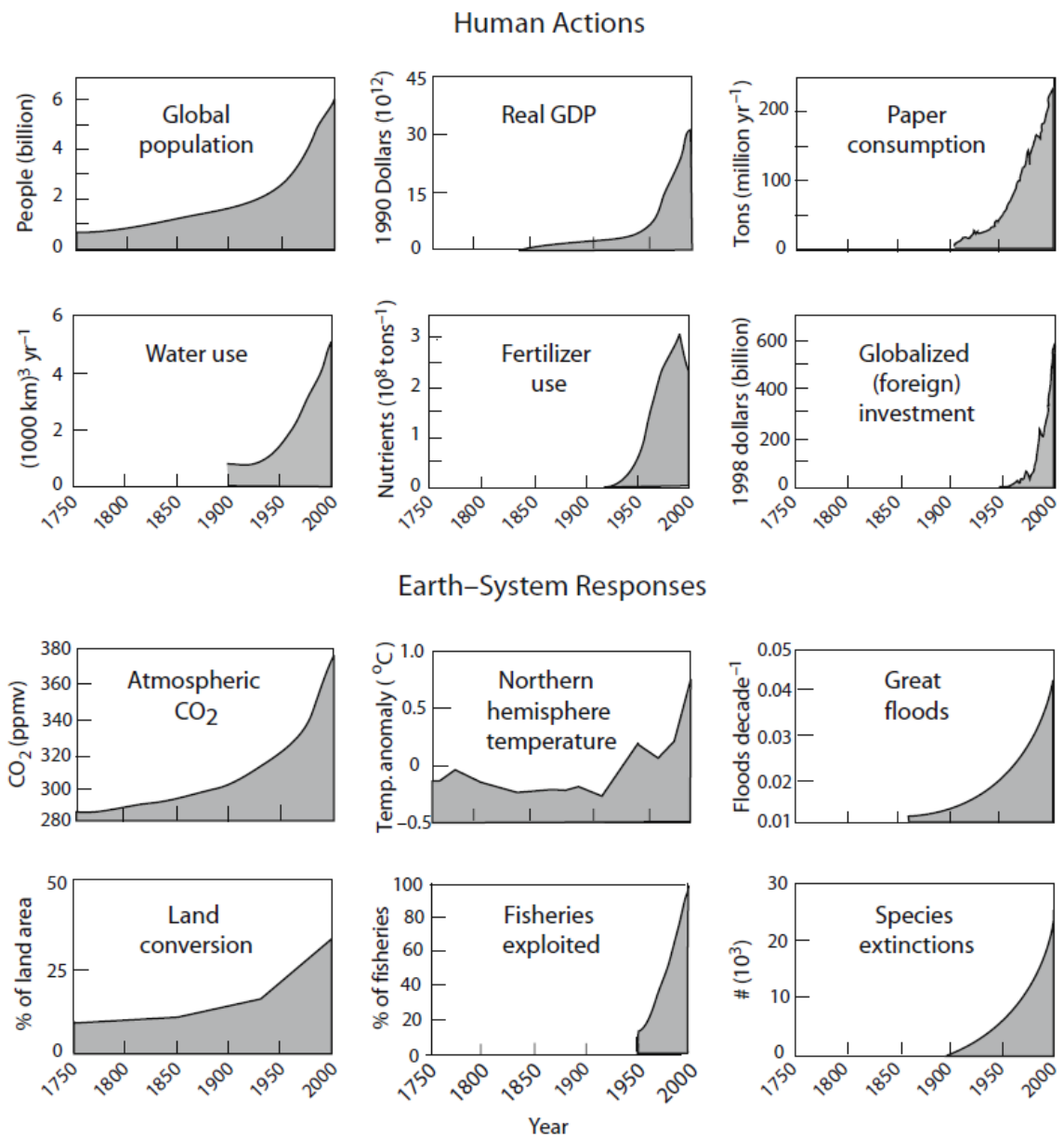
The evidence on the environmental impacts of economic activity, and the need to address the scale of these, is discussed briefly below, followed by the arguments in

² The term working time reduction is used throughout this thesis as a convenient shorthand to refer to the arguments for reducing average *paid* working time per capita as part of an environmentally sustainable and just economic system.

the literature about what this means for levels of work in the economy, and the role of working time reduction as a policy response.

The overwhelming weight of research evidence indicates that human activities, particularly economic, have recently grown to the extent that they are using an array of resources, and producing levels of waste and pollution, at rates that are increasingly reaching or exceeding the capacity of the planet's ecosystems to support (Rockström et al. 2009). Recent human activity of the last 50 years or so has seen modern gross domestic product (GDP), one measure of the productive output of the economy, increase by more than 7 times. Natural resource extraction, waste and pollution generation, land use, climate changing emissions, species extinctions, and so on have increased by substantial amounts as a result too (Young and Steffen 2009:295–315). Materials use has grown more slowly than GDP but has still increased substantially, and per capita has doubled in the last century, primarily due to increases in the use of non-renewable materials such as minerals, ores and fossil fuels (Krausmann et al. 2009). Use of renewable resources such as wood, land and fisheries has also grown substantially. Figure 2.1 provides an illustration of select impacts: note the rapid rate of increase in the scale of these since around 1950.

Figure 2.1 Size of human actions and responses in the “Earth System” since the start of the Industrial Revolution



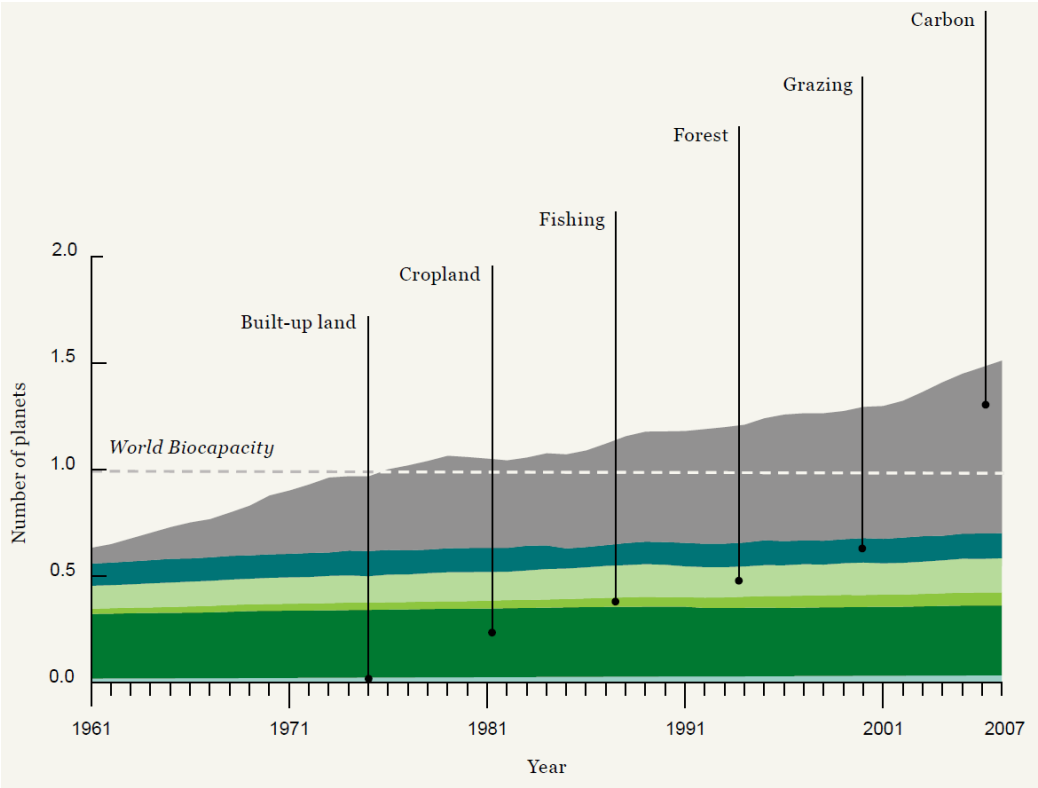
Source: Young and Steffen (2009:300)

Why should this be of concern? For one thing, evidence suggests that renewable natural resources are now being used faster than nature can produce them. Research on the “ecological footprint” of our economy, a measure of its total impact on the natural world, suggests globally we had, in 2007, an “ecological overshoot of 50 per cent.” As WWF describe, “This means it would take 1.5 years for the Earth to regenerate the renewable resources that people used in 2007 and absorb CO_2 waste.

Put another way, people used the equivalent of 1.5 planets in 2007 to support their activities.” (WWF 2010:34). Figure 2.2 below shows how humanity’s ecological footprint grew from 1967 to 2007, broken down by source of the impact. Over 50% of this impact is now the result of carbon dioxide emissions. Given the wide global disparity in affluence, if everyone consumed resources and produced waste at UK-average per capita levels, at least 3.4 planets would be needed (Simms et al. 2010:12).

Figure 2.2 Ecological Footprint by component, 1961–2007

“The Footprint is shown as number of planets. Total biocapacity, represented by the dashed line, always equals one planet Earth, although the biological productivity of the planet changes each year.”



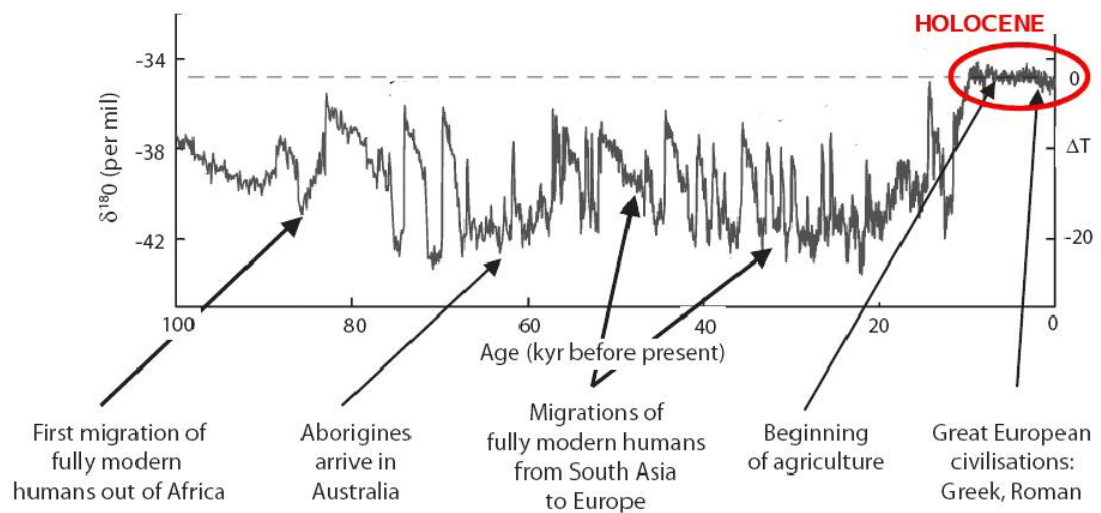
Source: WWF (2010:34)

Some argue that innovation, driven by market forces, will simply allow us to substitute one resource for another as it becomes scarcer due to this overexploitation, so that these issues are not of concern. This is controversial in itself (see for example Ayres 2007 for a discussion of the important limits to such substitutability), but anyway misses a more important issue: natural resources are not inert goods awaiting

economic exploitation, but rather they provide a huge array of life support services for the planet, including for human life. The Earth is a complex, dynamic, self-regulating climatic, biological and geological system. Throughout recorded human history (within the last 10,000 years or so), this “Earth system” has been in a period known as the Holocene, in which an uncharacteristic level of climatic stability has prevailed (Rockström et al. 2009:2) (see Figure 2.3). This, some argue, is what has enabled human societies to develop to an advanced level, as the generally predictable climate has provided a secure supply of natural resources and allowed reliable agriculture to develop, a stable setting for civilisations to develop in (Young and Steffen 2009:296).

Figure 2.3 Levels of oxygen-18 (^{18}O), an indicator of temperature, since the last glacial period, and selected events in human history.

The Holocene is the last 10,000 years.



Source: Rockström et al. (2009:3), adapted from Young and Steffen (2009:297)

Research suggests that human impacts on the environment are now becoming so large that they are pushing values of key biophysical variables³ outside the range in which they have existed for the entire Holocene period. Large and sometimes multiple impacts risk pushing key Earth systems past “tipping points” beyond which sudden, non-linear and irreversible changes occur at the local, regional and global

³ Such as atmospheric greenhouse gas levels, release of active nitrogen into the environment, levels of land use change, and rates of biodiversity loss (extinctions) (Rockström et al. 2009).

scales⁴, pushing the planet's regional and global climate and ecosystem services into new dynamic stable states that could be far less hospitable to human life and civilisation than they are in their current form (Rockström et al. 2009). In addition to the risks to humanity, these activities are driving the sixth mass extinction of species on earth, with extinction rates at an estimated 100-1,000 times the natural background level (and estimated to increase a further 10-fold over the coming century) (Leakey and Lewin 1996; Rockström et al. 2009). These species arguably have an intrinsic right to exist independent of any value they have to humans, with humans having a corresponding duty to protect them (see e.g. Rolston III 1995 for a discussion).

At the time of writing, the environmental impact receiving most attention is climate change due to human emissions of greenhouse gases, produced primarily from burning fossil fuels for power generation and industry, from deforestation, and from agriculture (Stern 2007:iv). These have resulted in levels of carbon dioxide (CO₂) in the atmosphere growing from pre-industrial levels of 280ppm (parts per million) (Pachauri and Reisinger 2007:37) to over 386ppm in 2009 (Tans and NOAA/ESRL 2010). Concentrations of other greenhouse gases are also increasing due to human activity (Pachauri and Reisinger 2007:37). Expressed in terms of “equivalents” of carbon dioxide (CO_{2e}),⁵ the atmospheric concentration of all greenhouse gases was already 430ppm in 2007 (Stern 2007:vii). Estimates of “safe” atmospheric levels vary depending on assumptions regarding the ability of humans to adapt and the acceptability of different levels of climate change and associated impacts, but range between 350ppm (Rockström et al. 2009) and a risky, high, but perhaps more

⁴ For example: recent record lows in Arctic summer sea ice appear to be driven by local positive feedback mechanisms initially triggered by climate warming but now self-sustaining and causing further regional warming (Lindsay and Zhang 2005); climate change and agricultural and other pressures have the potential to trigger a large scale die-back of the Amazon rainforest ecosystem, this itself releasing billions of tonnes of carbon dioxide back into the atmosphere, driving climate change even further (Nepstad et al. 2008).

⁵ Carbon dioxide equivalent, CO_{2e}, provides a standard unit of measurement for different greenhouse gases expressed in terms of their potential for contributing to global warming compared to that of carbon dioxide. Six gases are included in the measure, being the principle contributors to human-induced climate change: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (UNFCCC 2008:106). Atmospheric concentrations of these gases are measured in parts per million, whilst emissions of these gases are typically measured by mass (kilograms or tonnes).

attainable 500-550ppm (Stern 2007:vii). Such levels, evidence suggests, would provide a good chance of the resultant mean global temperature rise staying below 2°C, the current EU and international objective (Commission of the European Communities 2007:3; UNFCCC 2009), and arguably sufficient to stand a high chance of avoiding “dangerous” climate change. This implies that global CO_{2e} emissions need to fall well below 50% of current rates by 2050, the majority of this reduction to occur in high income countries if per capita emissions are to become more equitable at a global level. Currently, by contrast, CO₂ levels in the atmosphere are increasing at some 1.9ppm per year (Pachauri and Reisinger 2007:37) with the global rate of emissions also increasing year on year, even despite the recent financial crisis and recession in high income countries (Harvey 2011).

The comparatively limited action on emissions that accompanies the global agreement on the urgency of the issue is in part because of fears, particularly in the major emitters the USA and China, that acting on climate change would impede global GDP growth, and there is deadlock over who should be allowed (ecological) space for economic growth and who should not (Retallack 2010; Victor 2010). There is justifiable suspicion that emissions targets for stabilising atmospheric greenhouse gases cannot be reconciled with GDP growth and increasing global income equity: even if everyone by 2050 were to have today’s EU-average level of material affluence, in a world of 9 billion people this would imply emissions per dollar of GDP would need to fall by 55 times between now and then (Jackson 2009b:81). On top of this, some still-dissenting voices continue to argue that concern over climate change is based on tentative or unsound science, or is even a socialist conspiracy against high income countries (CBC News 2007)⁶.

Even if the reader is not convinced of the need for action on greenhouse gas emissions and other environmental impacts because of the danger they pose to humanity and other species, or considers it a normative issue outside the field of

⁶ Despite significant attention in the media given to those questioning climate change, the scientific consensus is extremely strong: one study of nearly 1,000 climate change related journal articles found not a single one questioning the consensus that climate change is both happening and largely due to human activity (Oreskes 2004).

academic research, a more pragmatic issue is that governments have set themselves policy goals to be met in relation to them. The EU has set itself a goal of reducing its greenhouse gas emissions by 20% of 1990 levels by 2020⁷, and 80-95% by 2050 (European Commission 2011), and the UK and the Netherlands have long term goals of 80% reductions by 2050, with interim 2020 goals exceeding the EU's of 34% in the UK and 30% in the Netherlands (DECC 2009:36; Peeters 2010:6). The current globally agreed aims are unclear, although the tentative goal of ensuring a low risk of mean surface temperature increases of 2°C above pre-industrial levels implies total global reductions in annual emissions of over 50% by 2050, and some 80-90% from current high income countries. Factors affecting the ability of nations to meet, or fail to meet, these goals are worthy of consideration and research from this perspective also.

So how does working time reduction contribute to these aims? For one thing, it is argued that it is an effective and just way to reduce consumer demand, the ultimate driver of the economic activities which cause these impacts. Households are the largest “final demand category” in most high income countries (Hertwich 2005b:4676), i.e. they account for the largest share of national consumption. In this thesis' case study countries of the UK and the Netherlands, households account for approximately 76% and 65% of total national consumption emissions respectively (Hertwich and Peters 2009). The public sector and investments account for the remaining consumption emissions of the two countries. Working time reduction would reduce these household emissions and other environmental impacts, as people work less, and hence earn less, and so spend and consume less.⁸ This in turn also means that less labour is likely to be needed by the economy as a whole, and working time reduction therefore becomes an effective way to spread the remaining labour across the population, as it institutionalises shorter average hours per employee. In principle this should mean that for a given total labour demand in the economy, more

⁷ With a European Parliament vote on increasing this to 30% due in July 2011.

⁸ As the production of these goods, and the resultant emissions, are globally dispersed, then these emissions reductions would also be dispersed around the world. As such, whilst they would contribute equally well to global goals, only a proportion of these emissions reductions would contribute to the goals of the country in which the household is situated, i.e. those emissions from products and services produced within that same country, including energy generated for home use.

people are employed, but working fewer hours each on average, than would otherwise be the case, thus helping to ensure that everyone has the opportunity to earn a living rather than some working full time and there being increasing unemployment, an unjust outcome that would limit the acceptability of efforts to reduce environmental damage (Lintott 2004:41).

This might be all well and good, but what about the effects of this on people's wellbeing? What might the effects on wellbeing be if they consume less? What about the extra spare time people will have if they spend less time in paid work? The next section looks at these issues.

2.1.1.2 Increasing wellbeing

“Scientists are discovering a convenient truth: our happiness does not depend on the consumption of conventional economic goods and services, but instead is enhanced when we have more time and space for socializing, for nature, for learning, and for really living instead of just consuming” (Speth et al. 2007).

The ecological economics literature is characterised by a concern not just for the environment but also with human wellbeing, including minimum material living standards. This again takes a different approach to mainstream economics, drawing on the literature on happiness studies, or “positive psychology”, to move beyond simple utility functions to attempt to identify determinants of wellbeing. The results have important implications for what constitutes a wellbeing-maximising balance between paid work and non-paid time: many activities correlated with high levels of happiness require time rather than substantial amounts of money to pursue (Speth et al. 2007), whilst increasing income has apparently little impact on wellbeing once a certain level of material comfort has been attained (Frey and Stutzer 2002). The values and beliefs of individuals also seem to be central to wellbeing regardless of their external environment and situation (Delhey 2009:32). Below, the literature on the factors that contribute to high levels of happiness is summarised. The implications for working time are then discussed.

In the positive psychology literature, the term happiness, or subjective wellbeing is typically defined as “a predominance of positive over negative affect, and satisfaction with life as a whole...thus encompassing both affective and cognitive aspects” (Lu et al. 2001:1161–2). It thus has three components: “positive affect – the presence of pleasant emotions such as joy, contentment and affection; negative affect – the relative absence of unpleasant emotions such as fear, anger, and sadness; and personal judgements about satisfaction” (Biswas-Diener, Diener, and Tamir 2004:19). But what, if anything, can be said to be a ‘cause’ of happiness? Are their universal causes?

The psychologist Abraham Maslow developed in the 1950s an influential model of human needs that contribute to happiness. This split needs into two kinds: ones related to “deficiencies”, material and social requirements for wellbeing; and “self-actualisation” needs related to the achievement of moral factors (Edwards-Jones et al. 2000:72) (see Figure 2.4). The modern literature also broadly supports the factors included by Maslow: Layard, in his review of the happiness literature, concludes that there are a “big seven” factors influencing happiness: family income, family situation (married, divorced, widowed, cohabiting, etc), work (e.g. unemployment and security of job), community and friends, self-rated health, personal freedom, and personal values. Age, gender, looks, IQ and education seem to make little difference meanwhile (Layard 2006:62–70). Csikszentmihalyi (1997) also proposes a theory on the importance of “flow” experiences for subjective wellbeing. He argues that experiencing flow, the frame of mind that occurs when fully engaged in creative activities or those that involve discovery, is a route to longer-term, fuller life satisfaction than that which is experienced as a result of being passively entertained.

Figure 2.4 Maslow's model of human needs



* Self-actualization needs are of equal importance (not hierarchical)

Source: Edwards-Jones et al. (2000:72)

Of the factors that do contribute to happiness, their effects vary however. Some seem to often have long term, even permanent impacts on happiness, including changes in family situation (marriage, divorce, becoming widowed, etc) and changes in health and disability (Easterlin 2004a; Biswas-Diener et al. 2004), whilst others (such as increases in income) seem to bring only transitory benefits, as looked at more below.

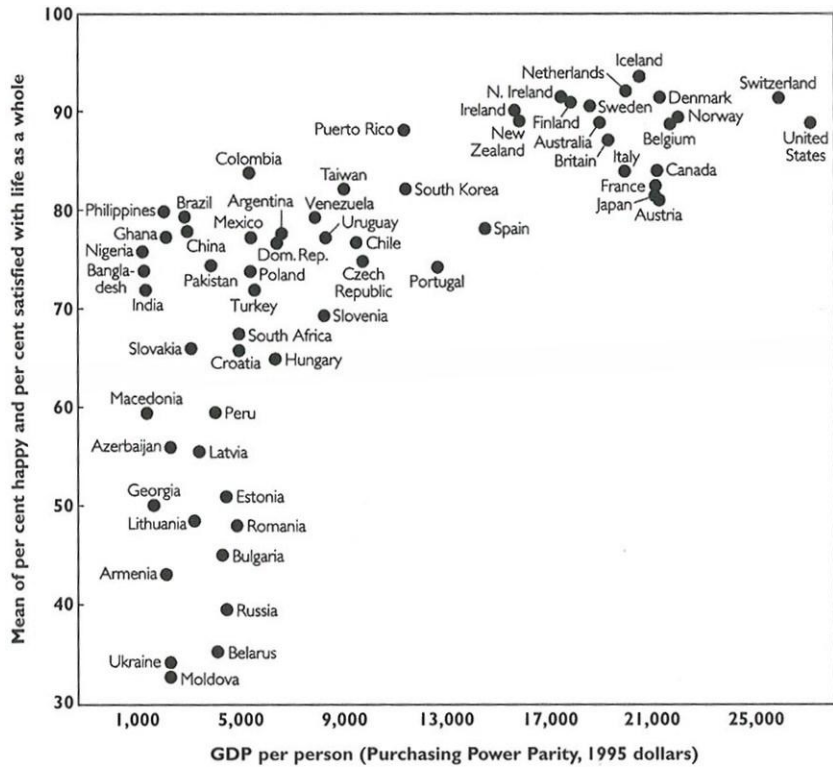
Of the deficiency needs in Maslow's hierarchy, high social capital, including the intimacy of close personal relationships, connections with ones local community, and the sense of security and trust afforded by living in a stable, amicable and accepting society with health services, pensions, employment and job security, seems to be an important contributor to people's happiness (Gowdy 2005:218; Helliwell and Huang 2006:20). However, whilst such strong social connections are apparently necessary for high levels of happiness, they are seemingly not sufficient (Diener and Seligman 2002; Biswas-Diener et al. 2004).

What of income, and consumption? Certainly in market societies, a certain level of income is generally necessary to be able to meet a person's physiological material

needs (water, food, shelter). However, the effect of income in increasing happiness seems to diminish or even disappear once a certain level is surpassed, one that is enough to meet these basic needs securely. Easterlin (1974) first observed this cross-nationally, noting that the correlation between wellbeing and per capita income falls to close to zero once a certain, fairly low, level is passed (see Figure 2.5 for more recent data on this effect). This so-called Easterlin paradox is further supported by within-country studies over time: in the UK, for example, life satisfaction was found to remain unchanged between 1973 and 1995, despite GDP per capita rising over 50% during that time (Figure 2.6). The correlation between individual income and happiness becomes weak past about US€10,000 per year (Frey and Stutzer 2002). A range of other important measures of quality of life, such as life expectancy at birth, infant mortality and participation rates in education, follow similar patterns, with a strong correlation with GDP per capita rapidly disappearing above about US\$10,000⁹ per person (Jackson 2009b:55–61). This questions the idea at the very heart of modern free-market economics, that increased consumption can increase subjective wellbeing. What explains it?

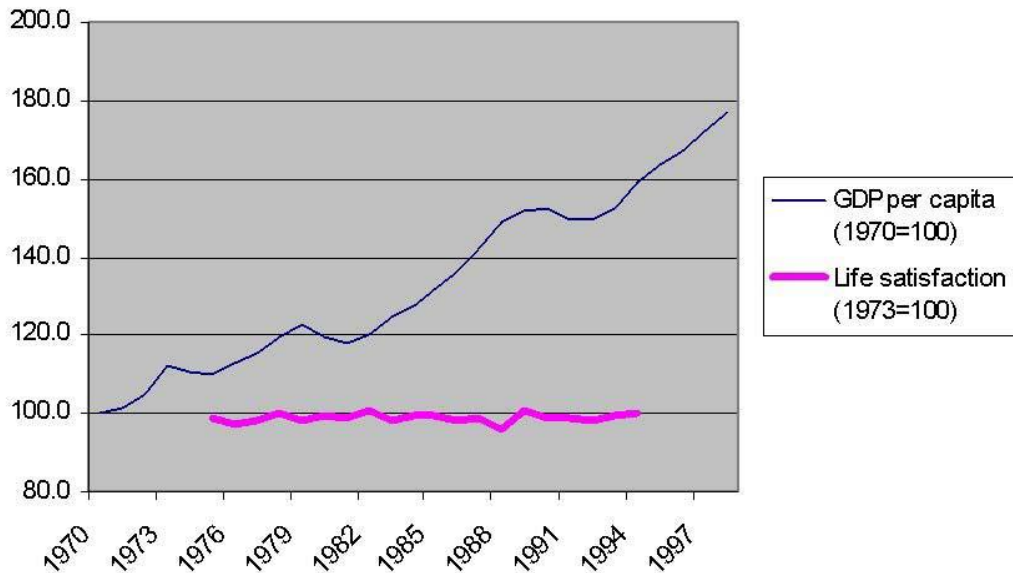
⁹ US dollars, 2005 values, adjusted for purchasing power parity.

Figure 2.5 Mean self-reported happiness against mean GDP per capita across nations



Source: Jackson (2009b:42)

Figure 2.6 UK life satisfaction and GDP per capita 1973-1997



Source: Sustainable Development Commission (2003)

Firstly, it is worth noting that mainstream economics acknowledges that the marginal utility of income should fall as income increases, i.e. as people get more materially affluent, further money will do less for their wellbeing (Layard, Mayraz, and Nickell 2008; Easterlin 2004b).

Two theories suggest that this marginal utility actually falls to zero. The first of these, which takes the perspective of the individual, is “hedonic adaptation”, or setpoint theory. This draws on the observation that people seem to adapt fully to many life events within even a few months, returning to their previous level of happiness. Hence, it is argued, people “have a fixed setpoint of happiness or life satisfaction determined by genes and personality” (Easterlin 2004a:26–7). As mentioned above, this does not hold for all life events; if it did, it would suggest a certain nihilism is permissible in the development of any social policy by government, as nothing it did would make any difference to the happiness of its population. Nevertheless, complete and rapid adaptation apparently *does* occur when a person receives a pay rise, at least in the affluent societies in which such studies have occurred, where basic material needs are generally already easily covered by wages (Easterlin 2004a). It is argued that under these conditions, people quickly adapt their preferences to match their new level of income, developing a new internal norm of what should be considered an adequate income (Schor 1995:74).

The second theory looks at the societal level, arguing that a person’s income level *relative to others* in a country seems to have more importance for their happiness than their absolute income (Donovan, Halpem, and Sargeant 2010:16). Easterlin (2004a:32) suggests that this is because people shape a concept of what is a good income with reference to the apparent affluence of their friends, family, peers and wider society. Another argument is that, as people earn more, an increasingly large share of consumption is of so-called positional or status goods. This “status consumption” is designed to make the buyer feel, and signal that they are, of a higher status than those around them, part of “keeping up with the Jones” (Mason 1998:ch 9; Schor 1995:75). In this situation, Mason notes, increases in income increase an individual’s happiness only inasmuch as he or she becomes more affluent compared

to those around him or her. As this leads to the relative affluence of others falling, it is harder for a society's average happiness to increase in this scenario (LaJeunesse 2009:240–241); indeed, the impacts on wellbeing due to the competition between individuals to increase their relative standing, and on the environment as a result, can even lead to welfare being reduced by GDP growth (Ng and Ng 2001).

There are ways around this apparent impasse in increasing wellbeing through means of consumption. Countries with lower levels of inequality tend to have, at least in Europe, higher levels of life satisfaction particularly, unsurprisingly, among lower income groups (Donovan et al. 2010:23), which suggests reducing inequality could raise wellbeing as people feel less acute relative poorness. Growing levels of status consumption could also lead to increased wellbeing if the status goods consumed have, on average, positive externalities, for example if status is indicated via philanthropic projects such as donations to charities. However, Veblen (1899) argued that waste was an essential element of such status consumption: goods are bought to conspicuously display status, not because they are needed or will be used fully, or because they imbue benefits to others. This is further the case when consumption is used not just to indicate status but also to construct and signal identity and belonging to a particular social group, the physical markers of which, such as clothing, are in constant flux, requiring replacement of goods before they have reached the end of their usable life (see chapters 3 and 4 in particular in Bocoock 1993). Given the scale of negative environmental externalities of much consumption, any positive externalities that do arise are likely to be comparatively trivial.

Humans are by no means trapped in some primal desire to materially outclass those around them however: Biswas-Diener et al (2004:24) note that studies of groups from around the world that live “a materially simple lifestyle” such as the Maasai and Amish, indicate that they “exhibit positive levels of subjective wellbeing despite the absence of swimming pools, dishwashers and Harry Potter.”

This links to the observation that personal characteristics seem to be one of the most important contributors to happiness. For one thing, personality traits are important: extroversion for example seems to correlate with generally higher levels of subjective wellbeing, while neuroticism correlates with lower levels (Biswas-Diener et al. 2004). But more importantly, an individual's *values* are “an important filter through which living conditions translate into subjective well-being” (Delhey 2009:32). Valuing and pursuing something deeper in life than merely the accumulation of ever more mass-produced goods is important to happiness (Csikszentmihalyi 1999; Diener and Biswas-Diener 2002). Materialistic people have been found to be consistently less happy and satisfied with life, more distressed, more likely to suffer “depression, anxiety, and narcissism; [have] less frequent experience of pleasant emotions in daily life and more frequent experience of unpleasant emotions; more problems with substances, such as cigarettes, alcohol and illegal drugs; and even physical health problems, such as headaches and stomach aches” (Kasser 2006:202). A fixation on consumption for the individual, and on GDP growth by society as a whole, arguably corrodes “moral standards [through] glorification of self-interest and a scientific-technocratic world view” which undermines individual and spiritual beliefs and goals both for individuals and society (Daly 1991:229–239). However, this is not an inevitable process: even those living in consumer capitalist environments can choose and pursue alternative life goals, and benefit from doing so. “Post-materialistic” as opposed to “materialistic” values are on the rise in affluent countries, particularly among younger cohorts: with physical needs and safety largely secure, people are increasingly concerned with non-material factors in their lives, such as belonging, self-expression, environmental issues, and quality of life, as determinants of happiness (Delhey 2009; Inglehart 1990:66–103). Those who spend more time in volunteering work for example have significantly higher average levels of happiness (both because happier people volunteer more, and because volunteering boosts wellbeing) (Thoits and Hewitt 2001). Some people in high income countries already “voluntarily simplify” their lives, consuming less overall, and less from large corporations, producing more of their own material needs, so as to live in a manner compatible with their environmental, community and

personal development life goals and values (McDonald et al. 2006)¹⁰. Having spiritual life goals and following religious values can also improve wellbeing. In Buddhism, for example, happiness, and eventually enlightenment, requires freedom from desires of all kinds, including material ones. It is desires which are seen as the cause of suffering, as they bring a longing, an “unsatisfactoriness”. Wishing for more, for different, we end up living in our minds, focusing on some idealised future state in which we have acquired that new car or house, or wishing some past event would be changed. Freedom from suffering requires relinquishment of and freedom from these desires (Pauling 1993:54–57). In Buddhism, this in turn is achieved through following the Buddhist path, in no small part requiring, time consuming, meditation practice to cultivate “mindfulness”, a mental state in which full awareness is brought to and held on the present moment and ones own experiences of it, not jut in meditation but in the rest of ones time too, enjoying the present fully as it is. As the famous Buddhist monk Thích Nhất Hạnh puts it, “If we’re really engaged in mindfulness ... then we will consider the act of each step we take as an infinite wonder, and a joy will open our hearts like a flower” (Nhất Hạnh 2008:12). Modern psychological evidence also lends empirical weight to this ancient wisdom: people who practice mindfulness meditation, even non-religiously, without any Buddhist links, tend to be happier, less materialistic and more environmentally-minded (Kasser 2006), and whilst it requires time to practice and cultivate the technique, it can be effectively taught to increase positive and reduce negative emotional states (Kabat-Zinn 2004; Baer 2003).

Such alternative perspectives are rarely promoted in consumer capitalist societies. Indeed, we are taught materialism from our earliest years, when our deeply felt values are predominantly shaped and formed. “Children in western social formation have to learn to become consumers; they are not born with a set of wishes to consume the goods on offer in modern capitalism. Babies’ and young children’s early learning experiences affect the ways in which they develop later on in life in

¹⁰ The voluntary nature of this simplification of lifestyle, and reduction in income, is important though: when such simplification fits with the individual’s values and life situation, it can be beneficial to wellbeing, but this is in marked contrast to those who “involuntarily simplify” through job loss, for example, on which see below for more.

relation to consumerism” (Bocock 1993:82–4). These experiences are shaped by education and “the pervasive influence of advertising which emphasise[s] self-interest and social status in persuading people to buy” (Mason 1998:141). A false path to happiness, through endless material consumption, is a dominant, pervasive message in Western, high income, countries that shapes and builds materialistic norms and values from childhood (Kasser 2006:200–202). The fact that individuals are strongly influenced in their ideas about the route to happiness by the dominant messages found in a country perhaps helps explain why “nationality is by far the strongest predictor of both life satisfaction and happiness” (Inglehart 1990:242).

The review above indicates that income and consumption seem to do little for wellbeing once a basic level of material security has been met; indeed, valuing consumption seems to actively damage wellbeing. Labouring to earn more money to consume more is unlikely to bring much benefit if this is the case. By contrast, the literature shows that many of the contributors to wellbeing and flourishing require personal time, and energy, to pursue.

Time is a key resource in achieving happiness and other life goals then. This implies a need to provide people the freedoms and capabilities to pursue these other life goals (Sen 2001:16–27), including the freedom to control their own time. Time outside paid work especially is argued to bring benefits, to allow for more child care, to participate in community, society and politics, and simply to relax (Coote et al. 2010:20–23). These bring benefits not just to the individual: there are wider societal benefits of many non-paid activities (positive externalities) which are argued would contribute to increased wellbeing: greater gender equality in work and care distribution, more time to spend with children, and more time and energy for what Coote et al (2010:3) describe as the “core economy”: non-commodified human activities that contribute to community, caring, participation, and so on. The New Economics Foundation sees a future in which people are “less attached to carbon intensive consumption and more attached to relationships, pastimes, and places that absorb less money and more time” (Coote et al. 2010:3).

But doesn't time spent in paid work bring benefits too, as a source of wellbeing in itself, aside from the income earned from it? Whilst traditional economics sees it firmly as a source of disutility, something that people must be compensated for (via pay) to undertake (Robinson 2006:25), there is also a substantial literature espousing the benefits of paid work (summarised in detail by Waddell and Burton 2006). This concludes that, in such cultures where paid work is a common activity, it generally plays an important role, not just in providing material wellbeing (via earned income), but also in promoting wellbeing through mental and physical health, a sense of contribution to society, and social status. These factors are also improved when people transition to employment from sickness or disability statuses (when their health permits) and from short and long-term unemployment (*ibid.*). Unemployment, for its part, can be an experience sharply in contrast to voluntary working time reduction, with a host of associated social ills, not to mention financial stress, rising with the length of unemployment, from boredom and depression to increasing family tensions and social exclusion (Glyptis 1989:71–91).

The quality of jobs is important here however: menial and unfulfilling or unsafe work can be less good for wellbeing. Paid work in which the employee lacks job security, control of their labour or of the times of day or week they work does not bring the same benefits, and can instead lead to job dissatisfaction, a general reduction in wellbeing and even depression (Radcliff 2005). There is also some evidence that work is becoming increasingly stressful, and that both over and under-work (in terms of hours worked) can damage wellbeing (Coote et al. 2010:18).

The contribution of paid work to wellbeing, as an activity to use ones time on, rather than for the income it provides, seems really thus to depend on the situation: on the nature of the job, on the values placed on and around work by society, and, ultimately again, on how the individual themselves values and perceives it. Certainly the argument that work is socially the most acceptable way for people to derive income seems defensible. But as a use of time itself, little can perhaps really be said on its contribution to happiness beyond the fact that, as work generally involves the individual subjugating their will and energy to that of another, it is likely that the

time spent in work will not match ideally what people prefer to be doing. Indeed, Putnam (2001) found that some 84% of people in the US preferred their time outside work to that in it, a percentage that has increased with time, and is likely to be even worse in more heavily industrialised countries.

It is worth noting that the relative importance, for the happiness and wellbeing of both the individual and society, of free time over paid work and material consumption is hardly a new concept. John Stuart Mill saw a time when a stationary state of economic activity (i.e. in which the economy was no longer growing) would be achieved that would allow human needs to be met and increasing leisure time to be achieved:

"It is scarcely necessary to remark that a stationary condition of capital and population implies no stationary state of human improvement. There would be as much scope as ever for all kinds of mental culture, and moral and social progress; as much room for improving the Art of Living, and much more likelihood of its being improved, when minds ceased to be engrossed by the art of getting on. Even the industrial arts might be as earnestly and as successfully cultivated, with this sole difference, that instead of serving no purpose but the increase of wealth, industrial improvements would produce their legitimate effect, that of abridging labour" (Mill 1870:ch. IV).

In fact, it is very interesting to see that Mill in this chapter of his work presents, in very similar terms, essentially all the arguments put forward in the working time reduction literature for moving towards greater time outside of paid work for social, wellbeing and even environmental reasons (see Introduction).

Keynes meanwhile, in his *Economic Prospects of Our Grandchildren*, foresaw a time when we would be finally free from the "economic problem" of meeting our material needs and could get by with an average of just 3 hours of paid work a day:

"Thus for the first time since his creation man will be faced with his real, his permanent problem – how to use his freedom from pressing economic cares, how to occupy the leisure, which science and compound interest will have won for him, to live wisely and agreeably and well.

"The strenuous purposeful money-makers may carry all of us along with them into the lap of economic abundance. But it will be those peoples, who can keep alive, and cultivate into a fuller perfection, the art of life itself and do not sell themselves

for the means of life, who will be able to enjoy the abundance when it comes”
(Keynes 1930).

Cultivating the “Art of Living” seems to be the real challenge of modern high income nations. Growing up taught to be consumers, we are arguably somewhat deskilled in producing our own happiness, relying on market goods and services to distract us from the unsatisfactoriness of life without deeper meaning or purpose. Time outside of paid work seems to be a necessary precursor to addressing this problem, and people need the freedom to choose how to use their time to pursue life goals: it takes time to develop social bonds, to contribute to community and nature altruistically rather than for pay; to reflect, meditate on and pursue life goals; and to be able to take the time to sit and bring full awareness, mindfully, to the wonder of the world around us.

2.1.2 Only part of the solution

Reducing paid working time, with concurrent reductions in earned income, seems then to be a route by which we can reduce the environmental damage of our consumer society. As people work less, earn less, and so spend and consume less¹¹, both demand for labour and its supply drop in conjunction, in turn reducing the demand for the nature around us to be turned into consumer goods.

It also seems to be a necessary precursor to moving from a consumerist value-system to something more compatible with increasing happiness and the pursuit of spiritual development. With less paid labour required, more free time is available to pursue life outside of employment, with the associated wellbeing effects reviewed above.

Working time reduction is a way to avoid this reduction in labour demand resulting in wellbeing-damaging unemployment. Traditionally this is achieved through GDP growth, with labour productivity increases being turned into higher levels of production so that total labour demand is maintained (Tim Jackson 2009a:488). However, there are already concerns about the feasibility of meeting traditional full

¹¹ Taken over the whole lifecourse, an individual’s or family’s total expenditure on average matches their total income.

employment (in the sense of full time jobs for all) by this means, both in terms of the quantity and quality of jobs created (Bowring 1999; Lerner 1994). The problem of maintaining full employment with full time jobs is likely to be exacerbated if GDP growth were constrained by environmental considerations (Alic 1997). Working time reduction should allow the diminishing level of labour required to be distributed more evenly throughout society, so that all have the opportunity to earn their way and high unemployment is avoided (Victor 2010).

However, as a modification to market economies, working time reduction, and policies to support it, are not argued in the ecological economics literature to be sufficient on their own to achieve environmental sustainability. For a given level of technological development, the optimal balance for happiness between paid work/consumption and non-paid time to pursue non-material routes to wellbeing may still mean unsustainably high levels of environmental impacts (Gowdy 2005:219). Druckman and Jackson (2008b) for example find that even if all UK citizens reduced their consumption levels to what a survey suggested was commonly considered the absolute minimum for a satisfactory life, greenhouse gas emissions would fall just 37% below the baseline levels, a far smaller reduction than the evidence suggests is needed to stabilise the climate. Technology and material efficiency improvements are therefore needed too, if a given population size is to maintain a level of material affluence within environmentally sustainable limits. Working time reduction policy effectively places boundaries on the influence of the economy in time: it limits the proportion of people's time, both individually and for society as a whole, which is commodified, that is, made available for market exploitation. It also provides incentives for people to reduce their material affluence¹². The economy still also needs to be bounded physically too: limits need to be placed on how much, and which parts of, the natural world are available for exploitation as raw materials for the economy, and how much pollution and waste is generated and returned to nature (Victor 2010). And a new "ecological macroeconomics" is needed so that the economy, and people, can manage, adapt and thrive during and after the transition

¹² Which may or may not fit with their own preferences and capabilities to live off a lower income. See the next section, 2.1.3, for more about how such policy might work, and the potential for and limits to reconciling the environmentally, socially and individually optimal levels of consumption.

period to a sustainable economy in a way that is “socially sustainable, i.e. a prosperous and stable, rather than a catastrophic, descent” (Jackson 2009a:489; Kallis 2011:873). A wide range of policies have been proposed to achieve these goals, from taxes and tradable quotas on different resources and emissions to “correct” market prices to reflect externalities (Stern 2009:7–11, 162–165) through reform of the debt-based monetary system (Lietaer 2002), programmes to combat poverty, and to stabilise the world population (Victor 2010), to alternative goals and indicators of economic success than GDP growth which include social, wellbeing and ecological considerations, and non-market (unpaid) labour (Daly and Cobb 1994:443–508; Fitzpatrick 2000:349). Daly (2008) gives a brief summary of the multiple areas of economic policy that might need modification, Jackson (2009b) among others gives a more detailed perspective.

Whilst working time reduction is clearly only part of a solution to a sustainable economic system, it is seen to be a necessary part, both in theoretical arguments about creating a socially just and environmentally sustainable economy (e.g. Fitzpatrick 2000:348), and in macro-economic models which have attempted to create scenarios of transition of economies to environmental sustainability, low unemployment, low poverty and inequality, and a sustainable government debt to GDP ratio (see Spangenberg, Omann, and Hinterberger 2002; and Victor 2008, and 2011 for the German and Canadian economies respectively). It is also perhaps a politically expedient starting point for a transition to a sustainable economy. Setting quotas to limit resource use and pollution is unlikely to suffice, or even be politically possible, whilst consumer demand remains so much higher than sustainable limits. In a recent UK government review of the possibility of using personal tradeable energy quotas to reduce carbon emissions, for example, it was noted that “[w]hile it is tempting to think of a tightening cap on emissions as a solution in itself, the true challenge is to transform our society so that it can thrive within this limit” (Fleming and Chamberlin 2011:40). Quotas and caps can be set based on ecological evidence to define the boundaries of the economy and keep it to a sustainable scale, but further policies are needed to reshape the economic system to make sure these boundaries can be kept within, and in a way that is socially just. It also needs to be socially

acceptable: simply labelling consumption levels in high income countries as excessive doesn't encourage people to reduce consumption, as it "underestimates the complexity of human motivations and risks alienating those whose behavior [policy] seeks to change" (Jackson 2005a:20). Working time reduction has a potentially substantial role in this respect in encouraging reduced consumption: it gives people alternatives to high levels of material consumption, providing a benefit, in the form of more time for non-paid activities, in exchange for reducing consumption, and hence in theory increasing its appeal and reducing political pressure to allow unsustainable consumption levels. At the same time it institutionalises one of the key components necessary to prevent the high unemployment and inequality that could otherwise result from reducing consumption levels: policies to justly distribute a diminished and diminishing pool of work and income. It is also argued to support not just the environment but key wellbeing-improving services provided for free by people in their time outside of paid employment, which require time and energy to pursue (Coote et al. 2010:16).

2.1.3 *Achieving working time reduction*

2.1.3.1 Historical trends and preferences in paid working time

Paid working time has indeed been in decline for some substantial period. For this thesis' case study countries, the UK and the Netherlands, Schor (2005) finds that the average annual working hours for employees dropped by 22% and 37.5% respectively between 1950 and 2000, in line with other countries, and also in line with trends going back at least to the 1870s (Maddison 1987).

At the same time however, participation rates have increased substantially, particularly for women, where participation rates of 30% or so in the first part of the 20th century have grown substantially to be 60, 70 or even over 80% in many high income countries (although this is lower during periods of childcare and in later working life) (Esping-Andersen 2009:20–25; Taylor-Gooby 2004:3). The quest for gender equality, one driver of this latter trend, has been realised as an increase in women's participation in paid work much more than it has in men's reduction of paid

hours to take on a more equal share of non-paid work responsibilities (such as household tasks and childcare), a “masculisation” of women’s roles (Esping-Andersen 2009:20–25). Women, particularly mothers, are however much more likely than men to be working part time, and tend to have more broken labour market contact over the life course (den Dulk 2008:135; Spiess et al. 2004:80–88). In addition, governments are increasingly pursuing increased labour market participation rates in an effort to maintain economic growth, and to support the sustainability of welfare state expenditure by having a strong tax base and few claimants of unemployment, disability and other benefits associated with “inactivity” (European Commission 2010:2; Hetzler 2009).

The overall result of the above trends is that the majority of increases in labour productivity (measured in terms of market value added per hour worked) since the industrial revolution has been converted into producing more manufactured goods and services rather than into more time outside of paid work: some 70% in the UK and the Netherlands, and even more in some other countries (Maddison 1987). The role of industrial improvements in reducing total labour hours per capita (“abridging” labour, as Mill 1870, quoted above, referred to it) have been somewhat limited therefore.

At the same time, there is evidence of apparently substantial unmet demand for reduced paid working time (Bowring 1999:80–89), particularly at certain stages of the life course, such as when a couple has young children to care for, and as retirement age is approached (Heuvel 2004:7). Even this demand is potentially underestimated as a result of the format of the questions used in surveys gathering such data. For one thing, people are known to be more averse to cutting current income in exchange for more time outside of work than they are to sacrificing a future pay rise for it, as people become accustomed to particular income levels (Schor 2005:45–6). Surveys on working time satisfaction tend to phrase the questions in terms of the former option however, of cutting income in exchange for more free time, so that respondents indicate a lower preference for reduced hours than they would if they were asked to choose between a pay rise or more free time.

Also, in societies which emphasise and value paid work, undervalue non-paid activities like childcare, and promote consumption as a route to wellbeing rather than personal activities, people are more likely to (incorrectly) perceive wellbeing benefits from high levels of paid work and income, and less likely to see the benefits of reduced working time, especially if they see this as being out of step with the social norm level of paid work (Easterlin 2004a; Bowring 1999:80–81). People may then also misreport their working time reduction preferences in surveys to better fit with the perceived social norm of high levels of paid work.

2.1.3.2 Individual behaviours: deviation from the “optimal”

Some authors argue that these historical trends in paid working time simply reflect people’s preferences: they have preferred an increase in consumption more than an increase in leisure time (e.g. Robinson 2006:25). However, this argument requires that individuals are free to choose their own working time. This has arguably been the case for the collective over the decades (given that collective working hours have fallen historically), and for individuals as they are free (in principle) to choose their retirement age (Robinson 2006:25). However this ignores important variations in an individual’s preferences across the lifecourse (for example, surrounding child care), which they often cannot freely adapt their working time to meet. Even where policy provides rights to reduce working hours, various barriers can inhibit individuals from making use of these rights. Financial constraints may limit the capability to survive for even a short period on a reduced or zero income. People fear impacts on career and future employment (Groot and Breedveld 2004:294), and hence income security, and not without reason: employers often report that they feel more senior jobs cannot be done on a part time basis (European Commission et al. 2005). This particularly affects women, whose earning power after childbirth (and the associated reduction in labour market contact) is often severely impacted, either from leaving the labour market or only be able to get a lower wage rate job compatible with combining work and care responsibilities (Spiess et al. 2004:86–87). Perceived social pressures and norms that prioritise paid work and undervalue non-paid activities are also strong barriers (Bowring 1999:80). The very high levels of part time work in the

Netherlands are in part due to strong moral support for this from supervisors and co-workers (den Dulk 2008:143).

Another issue is that the preferred, “optimal” work life balance for individuals, even if they were met, are unlikely to match the social and environmental optima. It is unlikely that they would lead to sufficient working time reductions to achieve environmental sustainability. There are, for one thing, arguments why the economically rational actor would choose a suboptimal level of paid work even when they have complete freedom to choose their work life balance. This is because many environmental impacts are still externalities: that is, they are not reflected in the price of the goods and services which cause these impacts, nor in the wages of the jobs which cause them. Individuals as a result choose to work too much, because the costs of their work in terms of environmental damage are external, and so not included in their decisionmaking when choosing their optimum balance of work and non-work time (Robinson 2006:26–31). As environmental externalities have grown in step with economic growth from generally minor, localised impacts to costs which increasingly dwarf the value of the economy itself, individual working patterns have become hugely out of step with the social and ecological optimum.

Furthermore, behavioural psychology research demonstrates that people’s behaviour is often far from rational in this narrowly economic sense¹³. People’s behaviours are inevitably constrained by their own capabilities and external opportunities. As discussed above, they usually have far from perfect knowledge of the effectiveness of different strategies for pursuing happiness and other life goals. They are guided by values and beliefs that are absorbed from the world around from birth. They also act out of habit, a logical strategy for navigating the huge complexities of the social world without being overwhelmed (Dwyer 2009). And individual behaviour is shaped by the world around not just by the limitations it places on different options available to them, but also by the value judgements relating to those different options, which can lead to people acting in ways that are out of line with their own

¹³ Darnton (2008) provides a detailed review of psychological models of human behaviour.

values to fit with (perceived) social norms (Kasser 2006:209). In consumer capitalist countries this can all lead to an excessive focus on paid work and consumption.

All this means that there are varied and in some cases deeply entrenched barriers to work life balance matching individual, social and environmental optima.

2.1.3.3 Motivating sustainable behaviour: the role of working time reduction policy

Given this disjoint between individual working patterns and the wider aims of society and environmental sustainability, there is arguably a role for government to play in regulating working time to align them.

What does the ecological economics literature say about the shape that working time policy instruments could, or should, take to achieve this?

The literature reviewed so far suggests multiple instruments could be used to influence working time behaviour: to provide opportunities to reduce working time, and support individual capabilities to use these opportunities (i.e. to provide truly “functional” freedoms). Further interventions could be to correct the market prices of products and labour to reflect their environmental impacts; to counter cultural values and restrict marketing messages which lead to suboptimal values, norms and habits of behaviour relating to paid work, consumption and non-work activities, and to promote mindfulness and the wellbeing value of non-work activities.

However, the ecological economics literature generally does not go very far in suggesting detailed policy instruments for influencing working time patterns. As Schor (2005:47) notes, even in the literature there are few articles arguing for working time reduction for sustainability. As such, they tend to focus on points of principle rather than on the details of policy instruments; that is, they primarily discuss why other policies (such as increasing technological efficiency) are insufficient as solutions to environmental problems, and why working time reduction would be a functional solution. Nonetheless there are some suggestions made, which

are summarised below in Table 2.1. The first set of ideas relate to influencing individual functional freedoms to choose preferred working patterns. The second set relate to wider policy interventions.

Table 2.1 Policy instruments for working time reduction in the ecological economics literature

Instruments to influence individual opportunities and capabilities											
Working time reduction mandated by government: as there is market failure it should intervene, via mandating shorter weekly hours, increased vacation days, and fewer years of work over the life course ^{*,§§}											
Collective working time reduction with union support (including pro rata pay reductions) [*]											
Regulate flexible working arrangements to balance the preferences of employees and the needs of employers, including “job sharing, school term shifts, extended care leave and sabbaticals” [#]											
Employee rights to shorten working hours, in effect to “purchase” more time off work from employer – employee sacrifices some income in exchange for more free time, or foregoes a future pay rise in exchange for shorter hours ^{*,§§,***}											
Protection of part-time workers’ employment rights (pro rata with full time) ^{§§}											
Financial penalties on overtime (higher taxes on long hours) ^{§§}											
Ensure those below median income can reduce working hours without income loss, via benefits (funded by taxes on long hours) ^{§§}											
Instruments to influence wider factors											
Instruments to encourage employers to reduce the use of overtime and to instead increase the workforce, e.g. by compensating employers for costs that are per employee rather than per hour of work ^{#,§§}											
Increased training to combat skills shortages and to help the unemployed find work [#]											
Providing better protection to the self-employed against “low pay, long hours, and job insecurity” [#]											
Public information campaigns to increase support for working time reduction by: <ul style="list-style-type: none"> • educating about externalities (as there is an information failure); • attempting to change values around work[*] and around materialism and consumerism^{**} 											
To support the pleasantness and different uses of non-work time: <ul style="list-style-type: none"> • Support from government for “uncommodified” activities, and for “local action to build neighbourhoods that everyone feels safe in and enjoys”[#] • Encourage value change to value community, nature and local activities more^{##} 											
Teach people mindfulness to counter materialistic values ^{§§}											
Teach people how marketing cultivates materialistic desires ^{§§}											
Emphasise quality of life improvements of spending more time outside of paid work [§]											
Provide a Basic Income and use other income approaches to revalue non-paid activities outside the labour market [§]											
Increase the share of jobs with positive externalities: for example, those relating to public goods such as greening of infrastructure, ecosystem and biodiversity protection, restoration and enhancement, core research on sustainable technologies, etc. [*]											
Sources:	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"># Coote et al (2010:29,32)</td> <td style="width: 50%; border: none;">§§ LaJaneusse (2009:235–242)</td> </tr> <tr> <td style="border: none;">§ Fitzpatrick (2000:351)</td> <td style="border: none;">* Robinson (2006:105–111)</td> </tr> <tr> <td style="border: none;">## Hayden (1999:75)</td> <td style="border: none;">§ Schor (1995:70)</td> </tr> <tr> <td style="border: none;">** Jackson (2009b:183)</td> <td style="border: none;">*** Schor (1999:146–150)</td> </tr> <tr> <td style="border: none;">§§ Kasser (2006:205–209)</td> <td></td> </tr> </table>	# Coote et al (2010:29,32)	§§ LaJaneusse (2009:235–242)	§ Fitzpatrick (2000:351)	* Robinson (2006:105–111)	## Hayden (1999:75)	§ Schor (1995:70)	** Jackson (2009b:183)	*** Schor (1999:146–150)	§§ Kasser (2006:205–209)	
# Coote et al (2010:29,32)	§§ LaJaneusse (2009:235–242)										
§ Fitzpatrick (2000:351)	* Robinson (2006:105–111)										
## Hayden (1999:75)	§ Schor (1995:70)										
** Jackson (2009b:183)	*** Schor (1999:146–150)										
§§ Kasser (2006:205–209)											

There is also a focus on the need for a transition period: rapid working time reduction is not suggested. On the one hand, by phasing in reduced working hours gradually over a number of years, the resultant wage reductions could at least partially be offset by increases in wage rates, and businesses are given time to adapt (Coote et al. 2010:28; Schor 1995). On the other hand, the transition to a sustainable economy could also mean major shifts in the relative sizes of economic sectors: some industries may grow (e.g. in renewable energy generation), others shrink (e.g. fossil fuel energy generation), and others change production methods (e.g. switching to greener production methods such as in agriculture, aquaculture, forestry and mining). Hence the availability of particular types of jobs will change too, requiring facilitated transitions and reskilling. Also, time would likely be needed for further institutional change, as “[i]nstitutions of all kinds — financial, political, legal, educational, religious and social — that have evolved to thrive in a fast-growing economy will have to adapt” (Victor 2010:371).

Working time, and wider employment, policy for a sustainable economy thus, it seems, will need to be able to manage both an overall reduction in the total paid work requirement, and major, sometimes rapid, changes in the relative sizes, and workforces, of different economic sectors. While the ecological economics literature makes the case for working time reduction, and the need for policy to support this, the policy instruments suggested are less detailed. What could the social policy literature contribute in this respect?

2.2 Regulating “work life balance”: Working time policy as social policy

Policies to influence the working patterns of individuals are by no means novel. They are often referred to as “work life balance” policies, and in many high income countries, especially in Europe, work life balance policies have already been in place for many years, and have an extensive list of social and economic goals to which it is argued they contribute, including better utilisation of the productive working age population in paid labour, for economic efficiency and international competitiveness, reduced levels of unemployment, greater support for individuals to balance work and

family commitments and non-work interests, and greater flexibility to lead one's life as one wishes.

Whilst these policies have no environmental aims, and often exist alongside policies aimed at increasing total paid work in the economy rather than reducing it, they and the academic literature on them nevertheless provide useful insights into how working time reduction policies could be designed and work in practice.

This section reviews the literature on work life balance policies, focusing on those elements more explicitly aimed at enabling and incentivising reduced working time, that is, approaches in work life balance policy that most inform and are compatible with working time reduction. The focus is on European Union-related literature, as EU Member States have, among high income countries, among the most developed and innovative work life balance policies, and the thesis' case study countries, the UK and the Netherlands, are situated in the EU.

The section begins with a look at the goals and underlying values informing the development of work life balance policies. This is followed by a discussion of the life course perspective for the design of work life balance policy instruments: this perspective underpins the development of work life balance policies in one of this research's case study countries, the Netherlands, in particular, and is helpful in conceptualising how multiple macro-level policy goals around paid labour can be reconciled and combined with individual working preferences. This informs the next section (2.3), which discusses the commonalities and differences between the work life balance and working time reduction approaches, and looks at the contribution the two literatures can make to one another.

2.2.1 The goals and values of work life balance policy

A common narrative can be seen in the work life balance literature regarding the modern context within which policy developments in the EU are set. Social, economic and demographic changes and considerations common across high income countries leave the EU with a dilemma.

On the social front, it wants to preserve the best of the European Social Model in the face of these changes: strong welfare state protection of citizens from risks, increasing gender equality, a more even distribution of the “benefits of prosperity”, social inclusion for all, and recognition, respect and support for changing and increasingly individualised, diverse life courses (Knijn et al. 2007; Freud 2007; Esping-Andersen 2002; Heinz and Krüger 2001)

At the same time, its economies are facing increasing international competition on globalised markets, as a result of increasing economic integration and rapid technological change (European Commission, Directorate-General for Employment 2007:8). In response to this, EU countries have set common goals for high rates of participation in paid work for their populations, with high labour market mobility, and high and continuously updated skill levels in the workforce through lifelong learning (European Commission 2010:15; European Commission, Directorate-General for Employment 2007:12). The aim is for the labour force to be flexible to changing economic requirements, whilst still having a good level of income security for all individuals: so-called “flexicurity” policy (European Commission, Directorate-General for Employment 2007; Viebrock and Clasen 2009b).

All this is against a context of an ageing and increasingly long lived population and falling fertility rates (Lewis, Knijn, et al. 2008:262) which threaten the fiscal sustainability of welfare state systems, an issue greatly exacerbated by the financial crisis of 2008 (Gough 2010). In response to these issues, policy goals have been set to try to increase tax revenue (including through increasing levels of paid work at different stages of the life course) and reduce benefit payments (by shifting pensions funding to business and individuals, increasing retirement ages, and reducing the numbers claiming other types of benefit), as well as to increase fertility rates (Knijn et al. 2007; Committee on Labour Market Participation 2008; European Commission 2010; Jacquot, Ledoux, and Palier 2011).

The goals modern work life balance policies aim to meet (or at least contribute to, as part of wider social and economic policy) are thus diverse, reflecting the diverse challenges to be met. In addition, various institutions, controlling elites, and interest groups inevitably want their interests met by policy too: the state, businesses, unions, and the general population of citizens, the latter three in particular of which can be broken down further into differing sectors and demographic groups, each having potentially diverse needs, preferences and values. Tensions between goals and interests inevitably arise, but there is nevertheless substantial policy convergence in the EU. This is in part down to the similar contexts EU countries are in, and also due to common European goals and policy instruments laid down in the Lisbon Agenda and European Employment Strategy, and various Directives.

Similarity in policy goals and approaches is also down to common values that are increasingly informing their development. Values embedded in policy, often implicitly, shape both what can be achieved by policy, and how, and have a strong influence in this field (Lewis, Knijn, et al. 2008:263). Work life balance policy, as with wider social policy, is becoming more employment-led (see O'Connor 2005), with the role of the welfare state being seen increasingly as being to encourage and help people into paid work (to “activate” them) rather than simply to support their income security in times of need (Dingeldey 2007). This is in keeping with the idea that “[p]aid labour plays an important part in the modern ideal of citizenship and makes up a vital element of any viable welfare state” (Plantenga 2005a:55). This focus on employment is apparent in EU-level documents, such as in the Lisbon Strategy for Jobs and Growth, a central pillar of EU labour market reform in the decade up to 2010, which sets the goal of “achieving sustainable growth with more and better jobs” (Commission of the European Communities 2006:3). It is assumed just that people do not derive their income from the state (and hence, ultimately, from the labour of others) unless there is good reason (Department for Work and Pensions 2008). Work itself is argued to be good for wellbeing and social inclusion (Waddell and Burton 2006). Finally, it is argued that the approach makes the least normative assumptions about the lifestyle of individuals, treating all the same as “citizen workers”, and hence affording them the greatest freedom of choice to meet

the demands of diversifying lifecourses and behaviours (Knijn et al. 2007:638; Lewis and Giullari 2005:79).

In line with this employment-led approach, two related principles are being increasingly used to restructure the approach taken by European welfare states to meet their social policy goals: the adult worker model, and welfare to work (Lewis and Giullari 2005; Freud 2007). Both give paid work a central role in social policy and in modern welfare state regimes: the normative assumption is that all adults should be in paid work, and should derive their own individual income (primarily) from undertaking paid work (Knijn et al. 2007:638), except when there are specific accepted reasons why the state should instead support them (such as in retirement, due to illness or disability, or for briefer periods of involuntary unemployment or parental leave: see below for a more detailed discussion). (Re)commodifying the population in this way (Dingeldey 2007) is argued to meet the diversity of social and economic goals already discussed, providing an adaptive, financially independent population for economic growth and state fiscal sustainability, and making the minimum of assumptions about individual behaviour: all are financially independent to live life as they prefer, without state interference.

The adult worker model is, in essence, this approach applied to the working age population as a whole. Welfare to work meanwhile is the manifestation of the adult worker model for a specific group of the population, i.e. those once considered either unable to or unsuitable for work, particularly the incapacitated (Hetzler 2009) and lone parents (Knijn et al. 2007), or those able to work but unwilling to do so (Department for Work and Pensions 2008). Paid work for these groups is argued to bring all the same benefits to the individual (and their dependents): an escape from social exclusion and from either poverty or social security dependency, from the negative impacts on wellbeing of not being a productive member of society, and a reduction in child poverty (for lone parents) (Freud 2007).

The approach is certainly not without criticisms, which relate particularly to three issues: childcare, gender equality, and incapacity.

With respect to childcare, the presumption that people should be in paid work unless there is a good reason to (temporarily) leave it has led to increasing pressure to “commodify” care, so that parents hand over childcare to professional services so that they can rapidly return to work. There are question marks over the desirability of this, both in terms of the limits of parents’ willingness to hand over responsibility for raising their children to professional services (Lewis and Giullari 2005:87) as well as possible negative impacts on child wellbeing and development, especially for children under 18 months old (Lewis 2006:390), which concerns even those concerned primarily with the purely economic aspects of this (as children represent tomorrow’s labour supply) (Bovenberg 2005).

Care is also central to tensions regarding gender equality. There are criticisms that this gender neutral policy approach, which treats men and women the same, as “adult workers”, ignores that, culturally, women are still generally assumed to be, and most commonly in practice still are, the primary care-giver (Smith and Williams 2007). Policy instruments offer support for women to re-enter the labour market after a break for childcare via a focus on increasing childcare provision, but do less to promote greater equality in non-paid care work, through improved paternal leave for example (León 2009). The labour market focus in the way in which gender equality is interpreted points to a primary concern with ensuring it contributes to economic growth through increasing female labour market participation (Lewis and Giullari 2005), and the framing can even then reinforce existing gender inequalities if the outcome of flexible working policies is that women make more use of them than men to take on care responsibilities (Vandeweyer and Glorieux 2008). This is arguably clearly seen in the Netherlands with its high levels of working time rights, which has highly gender-unequal distributions of time use, with women tending to work part time and men full time (as demonstrated later in chapter 7).

Finally, there are question marks over who is capable for work, by what criteria, and who judges, in the case of incapacity from sickness or disability. Whilst avoiding social exclusion for these groups is a desirable goal, whether recent reforms in many

EU states, including the UK and the Netherlands, intended to radically tighten eligibility criteria for incapacity benefits really serve the wellbeing of the sick and disabled is questionable (Hetzler 2009), particularly when employer reluctance to employ these individuals mean they are simply moved from incapacity benefits to, sometime far lower, unemployment benefits (Devetzi Forthcoming).

2.2.2 Policy instruments in theory: the life course perspective

2.2.2.1 Main elements of the life course perspective

Modern work life balance policy instruments therefore have to try to integrate various policy goals, contexts, values and levels of analysis. A “good” work life balance policy can thus be assessed against how well it meets the policy goals and values discussed above and against how well it tailors diverse policy instruments to reconcile the diverse goals of government, different industrial sectors, demographic groups and individuals. A perhaps unexpected result of the increasing recognition, and respect for, diverse individual life courses and preferences is that people are coming to all be treated the same by policy: as adult workers. The result is that policy areas once considered and treated separately – parental leave, child care, retirement, disability and sickness benefits, unemployment, labour market participation rates, workforce skills training, and so on – are increasingly being dealt with in the same way, even with the same, unified, set of policy instruments (Delsen and Smits 2010). This allows for institutional simplification by allowing various leave schemes to be combined into one scheme with a common approach to identifying and accommodating needs and preferences (Plantenga 2004).

The life course approach provides a useful analytical perspective from which to analyse these work life balance policy instruments and evaluate how well they meet these diverse aims. It arose in the Netherlands, where it is an “important frame of reference” for policy reform (Plantenga 2005a:54).¹⁴ The perspective considers how

¹⁴ Whilst the life course perspective is used in this discussion, there are other approaches that could be mentioned that appear in EU policy discourses, notably the Transitional Labour Market perspective and the social investment perspective (Knijn and Smit 2009). The approaches share substantial

policy can provide individuals the freedom to lead life how they wish, but also considers how this can be combined with labour market functioning and the interests of the collective (Leijnse et al. 2002:16–17; Plantenga 2005b:302–303), i.e. it looks at how the sum of individual behaviours can be shaped to meet the social optimum (here defined in terms of policy goals for society and the economy as a whole and for different industrial sectors).

The life course perspective essentially considers two key resources which are juggled by individuals over the life course, money and time. It can be said that in a market economy, these two resources allow individuals or households to either buy or produce all the things needed to maximise their wellbeing (Becker 1981). Policy from the life course perspective should provide individuals with functional freedom to manage their time use and income as they wish, to meet the varying demands on these over the life course, providing opportunities to exit and (re)enter the labour market in manners which suit individual circumstances, facilitating transitions between labour market statuses whilst protecting income security (Schmid and Schömann 2004). The perspective allows an analysis of how policy can be tailored to meet the diverse goals of different actors at different levels, so that whilst broad freedom to meet work life balance preferences can be provided to individuals, time rights and the relative financial costs and benefits of different working patterns can be tailored to meet overall macro (national) and differing meso (sector and employer) goals, as well as being tailored to particular demographic groups considered worthy of distinctive treatment. Although there is an attempt to recognise diverse life courses, the “rush hour of life” is still recognised as a phenomenon occurring in most people’s lives around the ages of 30 to 50, and extra policy support is provided for this period: greater rights for career breaks (such as maternity leave) and reductions in working hours; financial support (such as child benefits); and services in kind (such as childcare services).

Whilst a wide range of ways could be envisaged to support people in meeting their work life balance preferences and to influence their decisions, it is these three areas

common ground; indeed the Dutch life course perspective was inspired by the Transitional Labour Market approach (Maier 2007:340).

that tend to be exclusively focused upon in the life course perspective literature and policy: increased time rights for employees (rights to career breaks and to flexible and part time hours); fiscal instruments (tax credits, benefits restructuring, paid leave rights); and services in kind (primarily childcare services, which exist to facilitate and encourage a return to paid work, especially after maternity leave) (Lewis and Giullari 2005:47; European Commission et al. 2005:25). To these can also be added policies aiming more specifically to support people to return to work after an involuntary exit from the labour market: Active Labour Market Policies, lifelong learning services, job centres, etc., which form part of “flexicurity” policy (Wilthagen 2007). The targeting of policy instruments is also important: to different demographic groups, to different industrial sectors, and also to different individuals.

The sections below discuss these different types of policy instruments in more detail.

2.2.2.2 Time sovereignty

Policy can influence working patterns at different stages of the life course, to shape the hours per week worked, levels of holiday, and periods of career break, and the rights people have to determine these for themselves. Such rights involve greater “sovereignty” over one’s own time (Klammer 2004), to change working hours or leave the labour market more easily, such as for childcare, skills training, sabbatical or even leisure purposes. This should be a functional right too, that is, it should be useable in practice without prohibitive costs or barriers: it should include, for example, protection from adverse future career impacts such as job loss or labour market exclusion. The Belgian Time Credit Scheme is a good example of such a policy. Private sector workers have the right to a career break at any stage of their career, taking up to a year off work full time, two years part time (with 50% reduction in hours), or up to five years with a 20% reduction in hours. Public sector workers have access to a similar scheme. This is a functional right: the employer cannot prevent an employee from taking a career break, except under exceptional circumstances, and must give the employee their post back at the end of the break (Debacker, de Lathouwer, and Bogaerts 2004). A more common policy example is parental leave rights, where mothers (and to a generally lesser extent fathers) may

take a period off work to care for newly born children, with their job protected for them for some period.

Policies may also act collectively, reducing working time or prohibiting work for entire demographic groups; for example, a minimum age for undertaking paid work exists in the form of child labour law; a maximum age may exist in the form of a compulsory retirement age (or employer rights to require retirement after a particular age); whilst maximum weekly working hours and minimum holiday entitlements are protected by law.

For such policy instruments to help people meet their preferences, individuals, rather than employers, must be able to control not just how much they work at given periods, but when, in terms of what times of day and the level of regularity (Gorz 1999:93–98). A study of the popularity, among parents of children aged under six years, of the French policy to collectively limit the paid working week to 35 hours (or, more accurately, to limit paid work to 1600 hours per year), found that employees whose employers gave them unsociable or irregular working hours often felt little benefit from the policy (Fagnani and Letablier 2004).

2.2.2.3 Financial instruments

Financial instruments sit alongside time rights to further support individual capabilities to use these rights, and also to incentivise particular patterns of working time at different stages of the life course.

On the one hand, such instruments provide facilities for the decoupling, to an extent, of when an individual works in the labour market and when they receive income, essentially using borrowing and savings facilities. For example, an individual saves part of their income during periods of employment, for use during a later career break or period of shorter working hours, as in the Dutch Life Course Savings Scheme.¹⁵ Alternatively, they borrow for a career break now and pay it back later through paid work (although there is a risk to the lender of never being repaid)

¹⁵ Which is described in detail in chapter 7, section 7.1.

(Groot and Breedveld 2004:300). Such facilities simply make it easier for individuals or households to manage, or “smooth”, their income over longer periods of varied labour market contact. Incentives such as tax-free saving or small benefits payments may also be provided to encourage use of such facilities, as they are in the Dutch scheme (Ministry of Social Affairs and Employment 2011).

On the other hand, financial transfers (benefits payments) can be made from the state to the individual to protect them from income loss when they exit the labour market for specific “socially and politically acceptable reasons” (Lewis, Knijn, et al. 2008:278). These can roughly be divided into involuntary reasons (“external risks”), when individuals have left work due to factors outside of their control (such as job loss or illness); and voluntary reasons (“internal risks”), when individuals choose to leave for socially valuable or acceptable reasons (which may include for child care, lifelong learning to improve their labour market value, to set up their own business, for retirement, due to stress, etc.). There are many potential reasons for transitions out of the labour market, and the distinction of them between those that are involuntary and those which are voluntary is not necessarily clear (Plantenga 2005a:56–57, 2005b:311; Leijnse et al. 2002), although neither is it really necessary for the perspective. It could be argued, for example, that in some cases unemployment arose from a personal failure to invest in ones own skills. What factors are socially valuable and acceptable is also a matter of debate.

In any case, the life course approach in this way covers benefits dealt with under current social security systems, which tend to insure against “traditional” risks (unemployment, retirement, incapacity, etc.), as well as “new social risks” relating to child and other care responsibilities, establishing a career and obtaining and maintaining sufficient skills to access better jobs, labour market exclusion and long term unemployment, lone parenthood, and so on, which tend to be less well covered under traditional systems (Bonoli 2005; Taylor-Gooby 2004). The key point of the perspective is that the degree of responsibility for individual income security should be set appropriately between the individual and the collectivity, based on assessment of the degree to which the reason for exiting the labour market was outside of the

person's control, and the degree to which the purpose of it was socially valuable or acceptable (Koopmans and Plantenga 2008). Benefits payments from the state to the individual could then represent anything from zero to 100% of lost income, for varying periods of time, depending on the reason for the exit from the labour market.

Aside from financial support for these two sets of reasons, the life course perspective follows the adult worker model assumption that individuals should derive their own individual (or family's) income from undertaking paid work, so that their total income from paid work over the life course should match their total lifetime expenditure.

2.2.2.4 Other instruments

Time rights and financial tools support functional freedoms to alter work life balance patterns to match preferences, by providing opportunities and capabilities to do so. To some extent too, they aim to alter behaviours by altering the costs and benefits, and risks, of different work life balance patterns, with the aim of matching the sum of individual behaviours to macro goals.

Other instruments can also be used. These policy instruments are often aimed at increasing the participation rates of particular demographic groups. Provision of childcare services, either directly by the state or by providing parents money to find services privately in the market, unambiguously raise the participation rate of mothers, as long as the services are of sufficiently high and reliable quality (Lewis, Campbell, and Huerta 2008). Employment law also provides protection against discrimination against women in general, particularly around this period of childbearing age and during pregnancy, to reduce labour market exclusion.

Meanwhile, "active labour market policies" aim to increase participation rates more generally: skills training, subsidised jobs, and obligations on the unemployed to seek work or take up employment in exchange for benefits, are all used to reduce long term unemployment, increase participation and increase the employability of people, the quality of jobs they obtain, and the skills of the labour force.

Active labour market policies and lifelong learning form parts of the EU labour market model of “flexicurity”. Flexicurity aims to combine labour market flexibility, to meet whatever job needs businesses in an (assumed) unpredictable, dynamic economy might need, with an element of security for individuals, carefully coordinating employment and social policy (Viebrock and Clasen 2009b). Importantly in this approach, this security is not job security (i.e. protection from losing a particular job with a particular employer) but employment and income security (i.e. the ability to find employment and maintain an accustomed level of income). Employment security here means that if one is made redundant by an employer, or is outside the labour market (unemployed or inactive) but wishes to work, one is able to find a (new) job (Borghouts-van de Pas 2010:122): receiving state or sector support as necessary to do so, including to reskill if necessary. Income security meanwhile implies high levels of income replacement during periods of unemployment between jobs. Although acknowledgement of the diverse situations EU Member States find themselves in means that flexicurity is promoted as a range of possible policy combinations rather than a prescriptive package, the Danish “golden triangle” of policies is nevertheless held up as the exemplar: low protection from job loss (being made redundant), high expenditure on active labour market policies, and high rates of benefits payments during unemployment (for a period).¹⁶

Policies have also existed to *reduce* labour supply to prevent unemployment in times when labour demand was insufficient to meet supply. In the Netherlands, the 1982 Wassenaar Agreement between the unions and employers was an explicit attempt to share a reduced level of labour demand among the workforce, using working hours reductions and wage moderation to attempt to prevent rising unemployment (International Labour Organization 2011). The Belgian Time Credit Scheme mentioned earlier also had the same aim initially (Debacker et al. 2004). Despite the ongoing effects of the financial crisis, the longer term view, based on the aim of continued GDP growth, is rather of labour market supply shortages in future:

¹⁶ Although Jørgensen (2009) notes that the current Danish government is itself dismantling this labour market policy utopia in favour of a more neoliberal approach.

increasing participation rates across the life course is thus the general policy goal (Plantenga 2005a:59).

2.2.2.5 Targeting of rights and incentives, sharing of risks

The rights and incentives provided by policy can also be adjusted for particular groups, i.e. they can be targeted. In the life course perspective, policy instruments are targeted to different industrial sectors and to different demographic groups, to respond to their differing situations, preferences and needs. Hence there are three levels, “three pillars” of support for work life balance policy rights and tailoring of incentives, at macro (state), meso (economic sector or demographic group) and individual levels (Plantenga 2005a:63–64; Leijnse et al. 2002). At each level, and for each sector, the optimum balance of rights and incentives may vary and can be tailored. The optimal division of responsibility between these pillars for supporting work life balance changes over the life course is also emphasised (Bovenberg 2007).

At the national level, insurance and rights are tailored to meet national goals and solidarity against risks. Individuals meanwhile can save or borrow under the schemes to give them the capabilities to adapt their working patterns to personal preferences, and to cover voluntary risks the state level does not fully cover (Leijnse et al. 2002:18–24). Different economic sectors meanwhile can tailor (extend) these rights and incentives further, to meet the needs of their particular context, allowing accommodation of factors such as their level of exposure to international competition, the relative level of skilled labour abundance or shortage, need for lifelong learning to maintain workforce skills, whether their sector is in expansion or decline, and so on, which can mean that from the employer perspective working time rights can be accommodated, or be beneficial, to a greater or lesser extent.

Policy also targets different groups of the population defined along lines of their characteristics: their work history, life course stage, the reason for their exit from the labour market, etc. This reflects the already discussed point that the validity of their reason for not being in the labour market may be different (from the perspective of the policymakers), and also that they have different opportunities, capabilities and

preferences. In short, the desired policy outcome (in terms of labour market participation) may vary by demographic group, whilst achieving a given outcome may require different policy instruments for different groups. Hence permitting and supporting career breaks for childcare may be more politically desirable than for leisure, whilst low income single mothers may need more financial support to be with their child than high income dual earner parents. Policy instruments particularly focus around the ages of 30 to 50 years, the so-called “rush hour of life”. The rationale, it is argued, is that with education lengthening and a new phase of young adulthood in the 20s characterised by having few responsibilities, and the period after retirement lengthening, many demands on time and money are increasingly compressed into this period, a “shrinking middle”, during which people tend to form stable relationships with partners, build a career, pay off student debts, take on a mortgage and save for retirement, as well as have children, paying for them and saving for their future, and having to juggle work and family commitments (Maier 2007; Bovenberg 2005:402–403). Time comes to be seen as a scarce commodity (de Gues and Rutte 2004). Women tend to take on more of the family commitments, working part time and having more and longer career breaks, whilst men tend to have a more continuous, full time, labour market attachment (Maier, de Graaf, and Frericks 2007:348).

Finally, another group targeted by policy are those who are able to work but unwilling to do so, or at least are not doing so. This particularly applies to those who are also claiming state benefits: the unemployed, particularly longer term, being seen as a social problem, whilst the definition of ability to work is becoming broader to encompass more of those once considered sick or disabled and hence eligible for incapacity benefit, and excluded from requirements to work. Even those who are not claiming benefits, i.e. the “inactive”, are increasingly being targeted: the Netherlands for example states that due to perceived future labour shortages, everybody has “an obligation to either be in education or participate in the work process. Whether someone accepts that obligation is no longer a voluntary matter” (Committee on Labour Market Participation 2008:3). These groups of individuals become subject to activation policies to attempt to move them into paid labour.

2.3 A comparison of the two perspectives: A sustainable approach to working time

The two literatures on working time have different starting points and perspectives, one looking at the role of working time in achieving an environmentally sustainable economic system whilst meeting wellbeing goals, the other analysing policy instruments and developing an analytical framework with which to assess their level of match to existing social and economic goals. What are the similarities and differences in the two approaches? Can they be combined to provide an integrated approach to working time? Would integrating them help working time policy be better designed to meet multiple policy goals? This section considers these questions, providing a novel integration of the two perspectives.

2.3.1 Goals and values

From supporting economic and business growth through improving the skills and flexibility of the labour force, ensuring the fiscal sustainability of the public sector and welfare state, increasing fertility rates and gender equality, as well as meeting the diverse individual work life balance preferences of the population, all within a specific value framework, a lot is expected of working time policy in the social policy field. Whether a life course approach or any other can combine them all is questioned by some, despite often optimistic promotion of such an approach (Jansweijer 2004:54). Certainly, it seems inevitable there will be tensions between goals, and different countries prioritise goals in different ways under such conditions. As seen, tensions seem to arise primarily between labour market participation goals and particular social aims, particularly around gender equality, childcare and incapacity.

The working time reduction literature adds environmental considerations to the heady mix of policy goals, arguing that working time patterns have substantial implications for environmental goals and sustainability, which thus need consideration in working time policy design. But it does a lot more: it takes a critical perspective of policy goals as a whole, stepping up an analytical level to question

what goals should be from a wider perspective that is rarely touched upon in the social policy literature. Rather than largely accepting “the major contours of present society, such as the structures of global capitalism, the dominance of paid work, the inequalities of the market” and working out small incremental changes from there, it “think[s] first about where we want to be, and then about how we might get there”, a “utopian method” in some respects (Levitas 2001:450). In particular it questions the centrality of GDP growth as a policy goal, from two angles.

Firstly, from the environmental perspective, economic activities are causing unsustainable levels of damage to ecological systems (Rockström et al. 2009; WWF et al. 2008). Whilst this does not inherently rule out GDP growth in the longer term, as production efficiencies improve and more can be produced with fewer resources and less pollution, in the short term, resource use and pollution levels seemingly need to fall substantially, suggesting that substantial “degrowth” in economic activities is needed. This degrowth particularly applies to high income nations, if they are to leave space for other lower income nations’ economies to grow to meet their populations’ basic needs, and for global inequality to reduce.

An interest in how to increase human wellbeing under these conditions gives the second angle. The evidence in the happiness literature and beyond provides a “convenient truth” (Speth et al. 2007) that time is more important for human flourishing than money, once basic material needs are securely met. This raises questions about the value of GDP growth even if there were no environmental considerations.

A reduced requirement for paid work is both an outcome of the necessary reductions in consumption and production, and a driver of these reductions. This is relevant to the current social policy perspective on working time too, in two respects. Firstly, it is observed by some in the ecological economics literature that working time reduction could also help to reduce the gender inequalities in care that affect existing work life balance policy. In families with children and other care responsibilities, it is men who more commonly work long hours, and hence would be more likely to

reduce their hours, which at least offers greater possibilities for a more gender equal distribution of care time (Coote et al. 2010). Secondly, one goal of working time reduction is to spread a reduced level of paid work more evenly among the population, to prevent high unemployment amid pockets of workers. It could thus address the problem of economies facing either increasing unemployment or increasing numbers of low-skilled marginal jobs that threaten high income countries (as discussed above in section 2.2.1).

Whilst there is some difference in policy goals between the two literatures, the underlying values are similar. There is an assumption in working time reduction that unemployment is an undesirable state, and that individuals should, in general, earn via paid work all the money that they spend over the life course, with policy ensuring that they have the opportunities to do so. This follows the adult worker model principle found in the work life balance literature. The interpretation of this principle arguably differs between the two literatures however. In social policy, the adult worker model principle is often taken to mean that the central role of the adult in society is to participate in paid labour, except where there are “socially and politically acceptable reasons” of education, care, or, perhaps, leisure (Lewis, Knijn, et al. 2008:278). Wellbeing is thus either subsumed below economic growth goals or is equated with paid work and the consumption of market goods and services. The approach conveniently allows governments to work towards the economic goal of high labour market participation whilst claiming to minimise normative assumptions about the structure of human relationships (in the sense that everyone can thus be economically independent to live life as they wish, within the boundaries this imposes) (Lewis, Knijn, et al. 2008:262, 278). Other social policy authors do take a different perspective though: van der Meer and Leijnse (2005:5), for example, note that a person’s lifecourse is “an individual project, one in which employment may not necessarily be dominant”. This is more in line with the perspective in the working time reduction literature, where paid work has a more instrumental value, as a means to earn money to pay for goods and services to meet needs.

The structure of paid work is different in the two literatures too: whilst flexicurity and high employment rates see job security fall and many services such as childcare increasingly commodified, provided by the state, Bowring critiques the wellbeing impacts of this also, arguing that it monetises and formalises human interactions, eroding the individual and societal capacity to confer meaning to their own activities and relationships (Bowring 1999:81–82).

Table 2.2 below shows a summary of the goals and values discussed above that are found in the two literatures. In general, whilst there are clear differences between the two, many are differences in emphasis rather than principle, with many of the goals and values being complementary rather than conflicting. The different perspective of the ecological economics approach could even help relieve some of the tensions around the nexus of childcare, labour market participation and gender equality that are found in the social policy perspective. The clear tension between the two approaches centres on economic growth, which is taken as the implicit context within which social policy operates in one literature (Gough 2010), whilst being explicitly questioned by the other literature. Following this comes tension regarding the optimum level of paid work in people's lives.

Table 2.2 Policy goals and values of EU work life balance policies and the Working Time Reduction literature

Summary of work life balance policy goals and values	Summary of working time reduction policy goals and values
<p><i>Environmental</i></p> <ul style="list-style-type: none"> • The official EU approach is to mainstream environmental sustainability considerations into all policymaking, but this is not apparent in EU and Member State documentation nor academic literature in this area. 	<p><i>Environmental</i></p> <ul style="list-style-type: none"> • Reduced resource use. • Reduced pollution. • And hence reduced environmental impacts. • And hence greater security of environmental services for life, greater ecosystem resilience, reduced species loss, greater environmental security for future generations.
<p><i>Social</i></p> <ul style="list-style-type: none"> • Protection from new, and old, social risks. • Social inclusion including solidarity with all social groups segmented along different axes (gender, race, class, etc.). • Income should generally be earned through paid work. • Employment (rather than job) security is protected. • Smooth transitions between labour market statuses. • Support for childcare and the rush hour of life. • Commodification of care work. • Generally longer working lives, but early retirement rights. • Support for individualised life courses, and individualised rights to choose work life balance. • But only within limits, i.e. when compatible with labour market goals. 	<p><i>Social</i></p> <ul style="list-style-type: none"> • Greater happiness through focusing on non-material routes to wellbeing. • Importance of having adequate time for these. • Just distribution of the reduced paid work needed to produce a sustainable level of goods and services.
<p><i>Economic</i></p> <ul style="list-style-type: none"> • Market model with state intervention. • GDP growth-oriented. • International competitiveness. • High labour market participation rates. • Dynamic, flexible, skilled labour force. • Low resistance (from the labour force) to change in industrial sectors. • Structured around high-skilled, high-technology, high-added value sectors. • Security/ resilience. • Government fiscal sustainability. 	<p><i>Economic</i></p> <ul style="list-style-type: none"> • Market model with state intervention. • Total maximum size of economy determined by ecological evidence on sustainable levels of resource use and pollution generation. • Optimum size of economy determined by this and by wellbeing considerations i.e. the balance between paid work and non-paid time. • Balancing of equity, efficiency, and scale goals.

Table 2.2 continued.

Summary of work life balance policy goals and values	Summary of working time reduction policy goals and values
<p><i>Values</i></p> <p>Wellbeing</p> <ul style="list-style-type: none"> • Consumption of market goods and services as route to wellbeing. <p>Equalities</p> <ul style="list-style-type: none"> • Gender equality: in work opportunities, and theoretically in care. • Equalities along other social lines. <p>The role of paid work</p> <ul style="list-style-type: none"> • Adult Worker Model (replacing male breadwinner): <ul style="list-style-type: none"> ○ Individuals should work to earn what they spend. ○ Social inclusion through paid labour. <p>Individual preferences and interaction with policy goals</p> <ul style="list-style-type: none"> • Respect for individualisation of life courses and behaviours. • Individualisation of welfare state services • Individual preferences taken as exogenous and should be accepted and met: reduced normative assumptions in policy design. • Except for a small group whose behaviours do not align with the adult worker model, i.e. those who “can but won’t work”. 	<p><i>Values</i></p> <p>Wellbeing</p> <ul style="list-style-type: none"> • Consumption of market goods provides many deficiency needs (food, shelter, clothing, etc). • But non-market activities are key to human flourishing, and require substantial time outside of paid labour to achieve. <p>Equalities</p> <ul style="list-style-type: none"> • Gender equality: in work opportunities, and in care. • Equalities along other social lines. <p>The role of paid work</p> <ul style="list-style-type: none"> • Partial Adult Worker Model <ul style="list-style-type: none"> ○ Individuals should work to earn what they spend... ○ But paid work is not the central purpose of or duty in life. ○ Social inclusion through community participation, volunteering, etc. <p>Individual preferences and interaction with policy goals</p> <ul style="list-style-type: none"> • Respect for individualisation of life courses and behaviours. • Individual preferences are generally suboptimal as environmental, and social, externalities are not considered, and a range of cultural and marketing factors overemphasises the role of paid work and material consumption in achieving wellbeing. • Multiple policy instruments should correct these market and information failures to align individual preferences, values and behaviours with the social and ecological optima. • As such, many groups’ behaviours are influenced to align with these optima.

2.3.2 Conceptual approach

The ecological economics literature lacks a clear conceptual approach for designing policy instruments to achieve the goals it argues working time reduction can achieve in principle. As such, the literature on the life course approach provides a valuable perspective for the design of working time reduction policy. It focuses on the two resources of the household that are also identified in the working time reduction literature as being key, in a market economy, to producing, buying and achieving all

the elements needed for human flourishing: time and money. The perspective focuses on mechanisms – time sovereignty and financial savings and borrowings – that should provide individuals with real freedoms, that is, the opportunities and capabilities, to realise their preferred work life balance pattern at any point in the life course, acknowledging that preferences will change over the life, and are increasingly varied between individuals. However, what instruments there are that are designed to adjust individual behaviour to match macro and sector goals tend to be designed to *increase* work rather than *decrease* it, in keeping with the general EU aim of achieving “more and better jobs”. Such instruments include active labour market policies, lifelong learning, childcare provision and coercion of the unwilling but able to find work. Ideas on how to incentivise reduced work are essentially limited to financial instruments, i.e. benefits payments aiming to encourage specific non-work activities where there is a perceived societal interest (e.g. to support childcare and retirement, or to protect against income loss due to involuntary redundancy, illness or disability). It thus misses the implications of behavioural psychology that are increasingly being considered in policymaking for sustainable consumption, i.e. the role of influencing values, preferences, habits and norms, and in correcting information failure.

Hence, whilst the life course perspective is valuable for the design of instruments to provide people the opportunities and capabilities to alter working time, its understanding of how to *encourage* reduced working time is more limited. The ecological economics literature has a contribution to make to the life course perspective therefore.

In Table 2.3, the author has produced a modified life course perspective for the design of working time policy instruments, which integrates the strengths of the perspectives of the two literatures. This modified perspective is used to help frame discussions later in the thesis regarding the implications of the research results for the design of working time policy. It takes the life course perspective as its starting point, so that policy considers the goals and interests of government, different industry sectors and demographic groups, and the varied preferences of individuals

over the life course. Time rights and financial facilities aim to provide the opportunities and capabilities for people to alter their working patterns to match their preferences, protected from impacts on their future employability and career, by decoupling periods of paid work from the periods in which the resultant income is received and used. Incentives to reduce working time are also tailored to the purpose for which the individual is using the time outside of work. What is novel is the explicit consideration of environmental goals alongside the social and economic, as a result of which incentives aim to encourage a general reduction in working time over the life course. In addition, the instruments for influencing people's behaviour extend beyond financial incentives to attempt to influence values, norms, and habits around work and consumption, and to provide more opportunities to pursue non-material routes to wellbeing outside of paid work, including provision of courses in mindfulness, and activities in which "flow" experiences can be had. These aim to raise awareness of the evidence regarding routes to happiness and actively encourage new behavioural norms based around them.

Table 2.3 A modified life course perspective for the design of working time reduction policy instruments

<p>Aims:</p> <ul style="list-style-type: none"> ● To balance and meet: <ul style="list-style-type: none"> ○ (macro) government environmental, social and economic policy goals; ○ (meso) industrial sector labour needs, and goals for particular demographic groups, and; ○ (micro) individual wellbeing and flourishing. <p>Policy instruments:</p> <p><i>Opportunities and capabilities:</i></p> <ul style="list-style-type: none"> ● Provide individuals functional sovereignty of their own time: <ul style="list-style-type: none"> ○ Time rights to alter working patterns at different scales: hours per week, days per year, periods of career break, retirement age, etc. ○ Functional rights: protection against impacts on future employability and career (job and employment security). ○ Financial facilities: periods in paid work and of receipt of income decoupled, via saving and borrowing facilities. ○ Financial support and services in kind (e.g. childcare services) to facilitate desired patterns of work. <p><i>Incentives:</i></p> <ul style="list-style-type: none"> ● Financial incentives (benefits, tax credits). ● Level of time rights and (financial) incentives increased for periods outside of paid work which are: <ul style="list-style-type: none"> ○ Outside of individual control (e.g. unemployment, illness, disability). ○ Used for socially valuable or accepted reasons (e.g. childcare, retirement, lifelong learning, community participation, volunteering, personal and spiritual development). ○ Environmentally beneficial (either directly via reduced earnings and consumption, and/or indirectly via use of non-work time in environmental projects). ● Diverse policy instruments to influence cultural and individual values, norms, habits, knowledge and behaviours regarding paid work, consumption and non-material routes to wellbeing. ● Increased provision of structured activities which improve wellbeing and the environment, including mindfulness training, volunteering opportunities, and creative and other activities in which 'flow' can be experienced. <p><i>Targeting:</i></p> <ul style="list-style-type: none"> ● Rights and support differentially provided by three pillars: state, sector/employer, and individual, i.e. collective and individual provisions, to share responsibilities and to adapt overall outcomes to different contexts. ● Instruments to address employer costs, preferences and behaviours. ● Policy instruments adjusted at these different levels so that the sum of individual behaviours aligns with macro and meso goals.
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2.4 Key points for the thesis and outstanding questions raised

The two distinct literatures on working time – one from ecological economics, looking at the potential of reductions in paid work to reduce the environmental impacts of the economy whilst enhancing human wellbeing; the other from social policy analysing how work life balance policy can help reconcile individual working

preferences with macroeconomic and social goals – are found to share many similarities, to have some notable differences, but ultimately to contribute valuably to one another to provide an integrated approach to understanding the effects of working time on different goals, and on how to shape working time policy to reconcile these diverse goals. To the author’s knowledge, attempts to integrate the perspectives have not been made before.

The ecological economics literature adds to the social policy literature an understanding of the potential of working time policy to impact on environmental policy goals, providing a strong argument that these impacts are substantial enough to warrant consideration in the design and evaluation of such policies. It also considers human wellbeing, drawing in evidence from positive psychology that questions the rationale for the normative assumption that work and consumption should be the central life goals of individuals, something that is rarely critiqued in the social policy literature except where it produces tensions between the needs of children for adequate parental care and goals to encourage parents to rapidly return to paid work.

From the social policy literature, the life course approach provides a valuable framework for designing and analysing the effects of working time policy instruments, to see how they can reconcile diverse policy goals. With modifications to incorporate some further considerations regarding behavioural psychology, it can help investigate how policy instruments could be designed in practice to achieve the “double dividend” (Jackson 2005a) of reduced environmental impacts and increasing wellbeing via working time reduction.

Several outstanding questions nevertheless arise from this review which could make interesting research topics. Perhaps of foremost importance is the question of the environmental effects of working time change. It is a central assumption in the literature reviewed that working time reduction would lead to substantial environmental benefits, as people work less and so earn and consume less. Whilst this makes intuitive sense, apparently no work has been done to estimate the scale of

environmental effects of different scenarios of working time changes. This fits with a criticism that has previously been levied at research on policy relating to sustainable consumption, that it has primarily been conceptual and policy-focussed, without grounding itself in empirical work (Ferrer-i-Carbonell and van den Bergh 2004). Without such empirical estimates however, it is harder to argue that environmental effects warrant consideration in the design of working time policy, or that working time reduction has a contribution to make in solving the environmental crises faced.

A second outstanding question which follows on from this is, can working time policy instruments be designed to achieve environmental benefits and also meet social and economic goals, both overall and for different demographic groups and industrial sectors? The modified life course perspective developed above provides a useful analytical framework with which to respond to this question.

This then is the central topic of this thesis: what are the environmental implications of different changes in the paid working patterns of the population? What contribution to environmental goals could working time reduction make? And can tensions between diverse environmental, social and economic goals be reconciled by working time policy? That is, can the individual, social and environmental optima be aligned, and the double dividend be achieved? How?

The next chapter looks at the conceptual approach and assumptions needed to analyse this research topic, and elaborates the hypotheses to be tested in more detail.

Chapter 3 Analytical framework

The central concern of this thesis is to estimate the size of change in greenhouse gas emissions that would arise under different patterns of paid working time. How would emissions increase, or fall, if typical levels of paid work increased, or decreased? Furthermore, what are the implications for policy which aims to influence paid working patterns? This chapter elaborates this topic into three research hypotheses, and develops and critiques the analytical framework by which they will be tested.

The analytical approach taken in this research is comparatively unusual in the study of working time, but is frequently adopted in environmental research, as described later in the chapter. This thesis is interested in how current policy goals to increase participation rates will affect greenhouse gas emissions in the study countries of the UK and the Netherlands, and also in how substantial reductions in average paid working time among different demographic groups would reduce national emissions. Both of these topics relate to situations which are hypothetical, and have not occurred in practice. Rather than studying the effects of past changes in working time using existing data, the analytical approach is rather different: first, based on current data, the relationship between household greenhouse emissions and its members' working patterns is estimated; second, this relationship is used to estimate how different hypothetical changes in working patterns would affect emissions in the future. The approach is common in research concerned with determining the environmental sustainability of different trends in the economy, in land use, in pollution levels, and so on, and which estimates the effects of different policy options for addressing environmental impacts that have been proposed but not (yet) implemented. Such an approach allows the effects of different scenarios of change to be estimated, making it suitable for the research hypotheses in this thesis. It also brings its own analytical challenges, which are discussed in this chapter.

The chapter begins by elaborating the research hypotheses tested in the thesis in later chapters. The rest of the chapter introduces the analytical approach to be taken. It first makes the case for the use of a household level analysis, then develops the

household model by which the relationship between paid working time and greenhouse gases can be statistically tested. Next, it elaborates how the greenhouse gas effects of different scenarios of hypothetical change in the working patterns of the populations will be estimated, before going on to discuss the modelling assumptions in this approach. The next section presents the rationale for looking in greater detail in the results at different demographic groups of the population, not just the population as a whole. The chapter ends with a brief summary.

3.1 Thesis aims and hypotheses

The aim of this thesis is to contribute to the literature on paid working time by investigating an assumption in the ecological economics research in the area, namely that:

Patterns of paid work correlate with environmental impacts

This draws on the intuitive, but apparently empirically untested, argument that reductions in paid working time lead to reduced environmental impacts, as people work less, earn less, and so consume less, that consumption being the driver of the activities which use resources, pollute, and damage the environment.

This needs stating with more precision to be a testable hypothesis. For parsimony, and because it is the most pressing environmental concern (see chapter 2, section 2.1.1.1.), the thesis focuses on greenhouse gas emissions rather than all environmental impacts. Meanwhile, it is appropriate to study this effect at the household level (the next section discusses why this is so). With this in mind, the assumption above can be restated as the following hypothesis:

Hypothesis 1: Reductions in the paid working hours of household members will reduce the greenhouse gas emissions arising from that household's consumption

To be of policy interest, this effect really needs to be large enough to substantially reduce greenhouse gas emissions, and so to contribute to policy goals relating to

reducing emissions and climate change. Hence, assuming hypothesis 1 is found to hold, a further assumption can be stated as:

Changes in paid working hours will have *large* effects on levels of greenhouse gas emissions

Of course, the size of this effect on emissions would relate to the level of change in working time. The thesis therefore considers specific scenarios of change in working time to assess their effects on emissions. Two approaches are taken, leading to the two hypotheses below.

Firstly, as discussed in chapter 2, working time policies already exist, but their environmental impacts are not considered in their design. Governments have objectives for these policy instruments, and for the case study countries of the UK and the Netherlands, these objectives all relate to increasing the proportions of the population, and of specific demographic groups, who are in paid work, i.e. to *increase* total paid working time in the population. The assumption above can thus be restated as:

Hypothesis 2: Current UK and Dutch policy goals relating to paid work will substantially increase national greenhouse gas emissions

A second approach is to start from the perspective in the ecological economics literature, that working time policy can be used to reduce paid work, and hence emissions. The hypothesis can thus again be restated:

Hypothesis 3: Reductions in average paid working time will substantially reduce national greenhouse gas emissions

These three hypotheses form the basis of the research in this thesis. Hypothesis 1 is the subject of chapter 5. Hypotheses 2 and 3 form the bases of chapters 6 and 7 respectively.

As well as these hypotheses, a parallel issue is considered in the discussion sections of these chapters. Working time is subject to significant influence by policy, and, as we have seen in the last chapter, these policies already have a host of social and economic goals. The addition of environmental goals further complicates such policies and their design. What are the compatibilities and tensions between these environmental, economic and social goals? How can working time policy instruments be designed to reduce tensions and maximise compatibility between the goals?

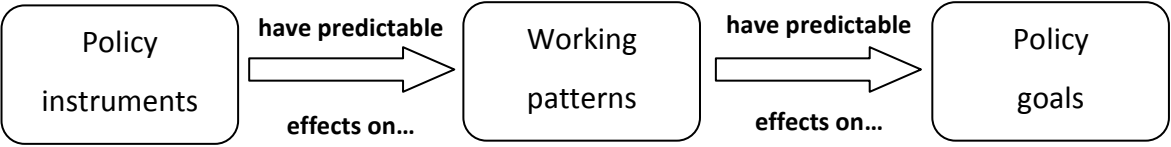
To frame these discussions, it is worth considering certain assumptions about such policies, namely that there are deterministic relationships between policy instruments, working patterns and the achievement of policy goals. These assumptions are implicit in both the working time reduction literature and the literature on work life balance policies.

In short, it is argued that:

- 1. Policy instruments can be designed and used to influence working patterns in predictable ways;
- 2. Working patterns predictably alter the values of variables which policy seeks to change (such as levels of greenhouse gas emissions).

This can be presented graphically, as in Figure 3.1 below.

Figure 3.1 The relationship between policy instruments, working patterns, and policy goals



The hypotheses being tested relate to how working patterns affect greenhouse gas emissions (and so how they effect the policy goal of reducing these emissions). The discussion sections discuss how policy instruments could be shaped to achieve the

working patterns that are being considered. To frame the discussions, the modified life course perspective described in chapter 2 (section 2.3) is taken, as it represents a clear approach for analysing diverse policy instruments and diverse goals of policy at national level and for different industrial sectors, and for different demographic groups and individuals.

3.2 Appropriate level of analysis

The total effect on national greenhouse gas emissions of different working patterns is the topic of interest in this thesis. However, the argument in the ecological economics literature that reducing paid working time reduces income, and thus expenditure, in turn reducing environmental impacts, is essentially a household level one, with the effect of individual choices around paid working time affecting household consumption and hence emissions. Changes in total greenhouse gas emissions at the national level are then the sum of the changes arising from all households in the population.

Many econometric studies of consumption patterns nevertheless use national level data in their analyses. They take an idealised “representative agent” as the unit of analysis, a *simulated* individual whose characteristics match the average for the population being studied (as described in, for example, Deaton 1992, chapters 1 to 4), creating someone who “is neither young nor old, ... male nor female, and has a uniform and more or less constant number of perpetually youthful children, all of which can be ignored by the estimation” (Deaton 1992:138). However, many of the modelling assumptions and exclusions of control variables that this approach allows may be “convenient for aggregate data” but are “nonsense at the micro level. Age and family composition matter, as do a host of other possible variables such as race, education, place of residence, and occupation” (Deaton 1992:138). Taking national averages loses a lot of the nuanced information available in nationally representative individual level data, such as that collected in panel surveys. Average data mask the complexities of distributions and correlations between variables which would in principle allow a detailed analysis of the determinants of emissions, and estimation of the effects of changing their values. Individual level variables are thus relevant

for predicting consumption, so it makes sense to look at individual effects rather than approximating based on national-level means of population characteristics (Deaton 1992:138). Nationally representative panel data giving details of household members, their incomes and expenditures are readily available in the case study countries of this research, the UK and the Netherlands.¹⁷

The literature reviewed in the previous chapter also shows how different demographic groups (such as households with children, and older workers) have different opportunities, capabilities, values, attitudes, habits, and behaviours. As such, they could alter their consumption in different ways under different changes in working patterns, and be affected by, and respond to, working time policy instruments in substantially different ways. Looking at micro data allows these things to be considered, allowing a look not just at overall effects of working pattern changes on greenhouse gas emissions, but at changes in different groups of the population, helping to inform the detailed structure of policy instruments (Atkinson 2005:8).

At the micro level, this research takes the household, rather than the individual, as the unit of analysis. This follows other research on household behaviour, which find or assume that choices around consumption and working patterns are co-determined by the household members, particularly the head of household and partner (for example Becker 1981; Phipps and Burton 1998). Analysing at the household rather than the individual level seems most appropriate for this research therefore.

3.3 Measuring household greenhouse gas emissions

In high income countries, the large majority of greenhouse gas emissions arise as a result of market activities (see chapter 2, section 2.1.1.1). The production of each good and service leads to greenhouse gas emissions as part of the process of production, distribution and disposal of that product. In estimating emissions from a particular country, two approaches are possible: either the emissions a country emits as a result of its production of market goods and services can be measured, or of its

¹⁷ Details of the datasets used are presented in the next chapter.

consumption of such goods. The latter assigns the impacts of producing and distributing different goods and services to the final consumer, who are considered to be the driver of production – without their act of buying a product, its production and associated environmental impacts would not occur (Hertwich 2005b; Satterthwaite 2009)¹⁸. As such, the actual geographic location where the emissions occur may not be within the country in which the consumer resides, in contrast to the production-based approach. In this consumption-based approach, emissions, wherever they arise, are attributed to the individual, household or government (public sector) that purchases the final product (Satterthwaite 2009; Hertwich and Peters 2009).

The environmental benefits argued for working time reduction in the literature take the perspective that reduced working time reduces consumption, as households adjust their expenditure behaviour to be in line with their reduced income. It makes sense to use the consumption-based approach in this research therefore, as it is the household's consumption activities rather than production activities that are being considered. In contrast with production emissions, which are in decline in both the case study countries, consumption emissions have generally been on the increase, as the share of household consumption coming from imported products is increasing (e.g. see Druckman and Jackson 2009 for the UK).

Consumption based, household level analyses can be used to explore and describe the patterns of consumption and resultant greenhouse gas emissions of households and different demographic groups, as described in more detail in the next section. The effect on a household's emissions of different predictor variables can be modelled. Based on these models, changes in emissions arising from different scenarios of change can be estimated (Hertwich 2005a:4675). The approach is thus suitable for all the aims of this thesis.

The measurement of consumption-based environmental impacts now has a well-established literature, and methodology and data are becoming increasingly robust and standardised (Wiedmann 2009:219). Methods either present aggregate data,

¹⁸ Or, more accurately, future production of these goods and services would be reduced to be in line with levels of demand.

usually for nations, or break these totals down to the household level. The latter approach is followed in this thesis. Household level analyses use widely available household expenditure survey data, combined with environmental impact intensity data calculated by various authors (e.g. Vringer et al. 2010). Household expenditure surveys provide data on household expenditure in many different categories of goods and services (e.g. shoes, tomatoes, electricity) combined with sociodemographic variables describing the household, for a representative sample of the population. The environmental impact intensity data meanwhile present the environmental impacts per unit price for different products, for the same categories of goods and services as found in the household expenditure survey. Combining the two allows a household's greenhouse gas emissions or other impacts to be calculated. More details of the datasets used in this thesis are given in the next chapter.

3.4 The choice of dependent variables

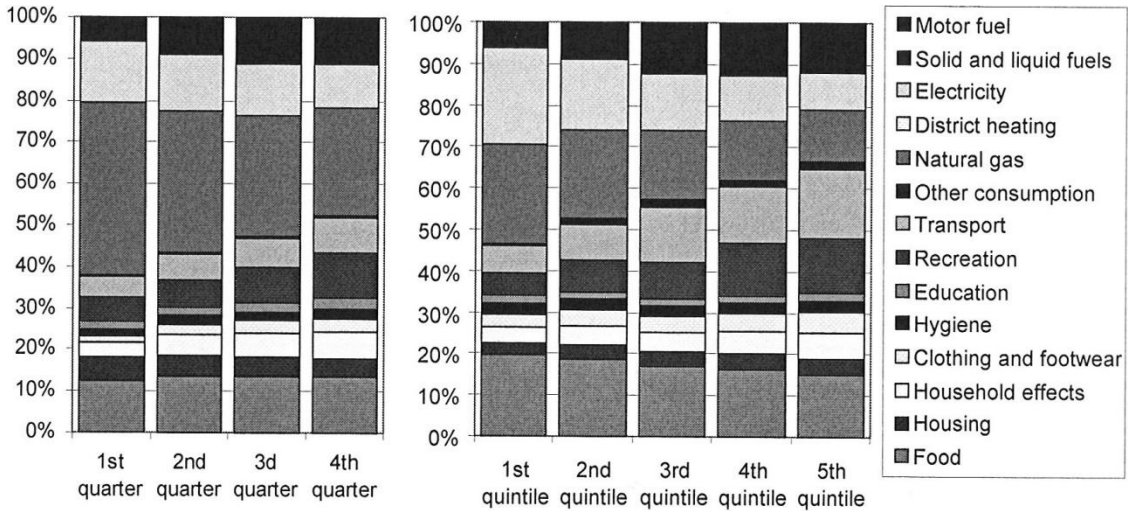
The existing literature on household environmental impacts look at various environmental pressures, including greenhouse gas emissions, various other air pollutants, impacts on water bodies (such as acidification and eutrophication), and use of material, land, water and energy (Wiedmann 2009:212–3). Analysing and presenting the results of these multiple dependent variables can be complicated. To some extent this issue is simplified in this thesis as it focuses on just one of these impacts, greenhouse gas emissions.

Using a household's total greenhouse gas emissions as the dependent variable is clearly valuable, as it is this that is being studied. However, as with other research on household environmental impacts, it is also useful to understand more about why greenhouse gas emissions are varying. The level of expenditure of the household is clearly a major explanatory variable: the more a household buys, the higher its emissions. But *what* a household buys is also important, as different products and services have substantially different emissions intensities, that is, the greenhouse gas emissions emitted per pound or euro spent on a product varies substantially. Although there is significant variation in the raw data and methods used in different studies, areas of high impact intensity are consistently found to be mobility

(automobile and air transport), food (meat, poultry, fish, and dairy followed by plant-based food) and residential energy use in the house (heating, cooling, electrical appliances, and lighting), whilst services, covering things such as insurance, mortgages, hairdressing, education and healthcare, in particular have a comparatively low impact intensity (Tukker, Eder, and Suh 2006:183).

Research also shows that the share of household expenditure going on different types of products varies with expenditure. As total expenditure rises, spend in some product categories such as food and home energy use (electricity and gas, for heating and lighting) increase only slowly, whilst others such as recreation activities, transport, clothing and household effects increase more rapidly (Kok et al. 2003:53). Figure 3.2 shows how these variations in expenditure translate into changes in the share of total household energy use arising due to different consumption categories for the UK and the Netherlands. As most energy generation is still largely from fossil fuel combustion, this gives a fairly good indication of which product categories contribute most to a household's emissions at a given income level. Figure 3.3 shows how this affects *total* energy use: as income and expenditure rise, total energy use increases too, primarily due to expansion in the categories of food, recreation and transport. Total energy use (and by extrapolation greenhouse gas emissions) increases with expenditure, but not as rapidly as expenditure increases (Biesiot and Noorman 1999:374; Moll et al. 2005:269), as many of the largest increases in expenditure occur in categories with mostly low energy use and emissions intensities (e.g. housing, recreation). In short, due to changes in the relative share of a household's expenditure going on different categories of product at different expenditure levels, household energy use and emissions do not increase as quickly as expenditure.

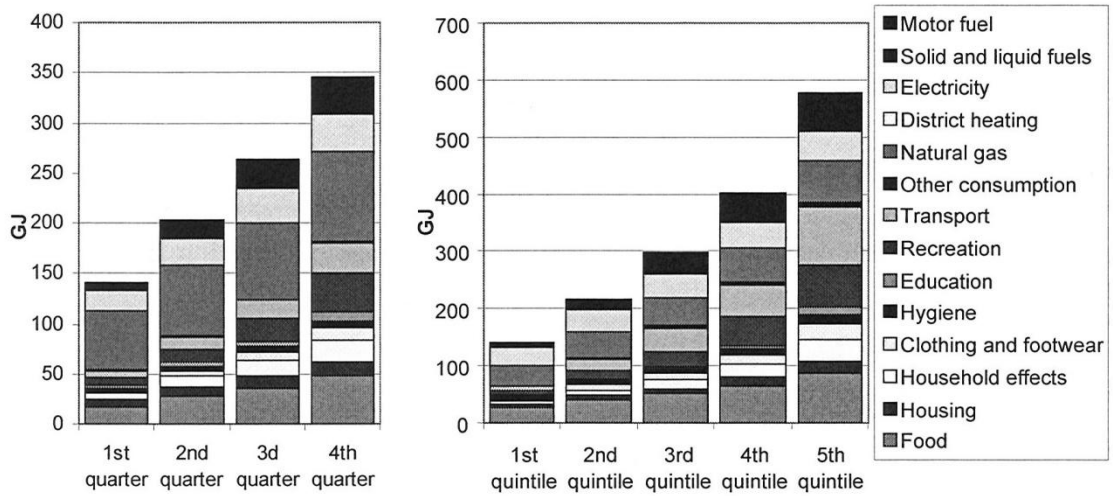
Figure 3.2 Share of different product categories in the energy requirement of households with different incomes, in the Netherlands (left) and the UK (right)



Source: Kok et al. (2003:55)

Figure 3.3 Energy requirement of different household income groups in the Netherlands (left) and the UK (right)

GJ = Gigajoules of energy



Source: Kok et al. (2003:54)

This shows that the effect of changes in the types of goods and services bought is also significant, that is, a household’s greenhouse gas emissions can vary substantially even controlling for total expenditure, based on the types of goods and services they purchase.

This fact presents an issue for this research regarding which dependent variables to analyse. Using total greenhouse gas emissions alone loses rich data about how varying patterns of expenditure in different consumption categories contribute to the total. However, disaggregating the results down into categories presents its own issues. On the one hand, Nijdam et al (2005:166–7) conclude from their study that while environmental impacts calculated for large “domains” of consumption (such as clothing, housing, food, etc) can be considered fairly reliable, data and analytical limitations mean that results for particular products (such as tomatoes, or shoes) can only be seen as “indicative”. Hence there is a limit to the extent to which consumption categories can be disaggregated and analysed whilst still producing valid conclusions about the associated environmental impacts. The limits of sample sizes, in terms of the number of households in the datasets used, also limit analysis of consumption at the individual product level, as there are insufficient data.

There are also practical problems with presenting results for many product categories and many socio-economic predictor variables: in effect, the output becomes a huge matrix of results that is difficult to present (Ferrer-i-Carbonell and van den Bergh 2004:369).

Compromised solutions in the literature vary. Vringer and Blok (1995) present results for 13 categories. Kalwij, Alessie, and Fontein (1998:571–3) meanwhile present graphs for six. Druckman and Jackson (2010) present results for nine, but break four of those responsible for large shares of total emissions down further. While such attempts to rationalise the results presented can be criticised for being “ad hoc” (Ferrer-i-Carbonell and van den Bergh 2004:369), this is only the case if there is no rationale to the process. Nijdam et al (2005), and Vringer et al (2003), for example, use seven categories in their research on the Netherlands on the grounds that these are compatible with Dutch government sustainable consumption strategies (Nijdam et al. 2005:149). Keeping in mind the aims of the research can thus help determine an appropriate approach to presenting these complex results.

A simple approach is taken in this thesis, to focus purely on the factors of relevance to the research hypotheses. Total greenhouse gas emissions is a dependent variable that should be analysed as it is the subject of the research hypotheses. However, this is affected by both the level of total expenditure, and by the exact mix of different goods and services a household buys, i.e. the share of spend on different product categories, and within each category, on different types of product. This mix, as we have seen, affects the ratio of the household's total greenhouse gas emissions to its total expenditure, i.e. the intensity of emissions per pound or euro that it spends. Both of these factors could be expected to change if a household member alters his or her working hours. A reduction in working hours, for example, could mean a reduced income and so a reduced expenditure. It would also mean more time outside of paid work, so different behaviours that would affect what is bought, e.g. less money spent on travelling to work, more on home heating as the person is at home more, less on convenience foods as there is more time at home to cook, etc.

Two variables can be used to capture the effects of changes in overall expenditure and in consumption patterns:

Total expenditure, in monetary terms

Household Emissions Intensity: an aggregate figure showing the household's emissions per pound or euro spent, i.e. kg CO_{2e} per £ or €

Hence for the household:

Total greenhouse gas emissions
= total expenditure x Household Emissions Intensity

In short, expenditure and Household Emissions Intensity (HEI) allow the effects on household greenhouse gas emissions of two different aspects of consumption to be investigated: firstly, total expenditure; and secondly, the effect of the mix of goods and services the household spends its money on. Changes in either can alter a household's total greenhouse gas emissions substantially. Considering both these variables alongside greenhouse gas emissions in this thesis is helpful to understand

how working patterns and other predictor variables affect household emissions: that is, the extent to which changes in emissions are the result of changes in total expenditure or in the mix of goods and services bought (proxied by the HEI variable).

3.5 Models and predictors of household consumption

This section develops a functional model for testing hypothesis 1, that reductions in the paid working hours of household members will reduce the greenhouse gas emissions arising from that household's consumption. The model will allow the statistical significance of this relationship to be tested using household expenditure survey and product emissions intensity data, following the approach described above.

This hypothesis is equivalent to stating that there are predictable changes in total household expenditure and/or in Household Emissions Intensity. In short, for the hypothesis to hold, the household's patterns of consumption of market goods need to change in predictable ways which are correlated with working patterns, either through total expenditure changes or changes in the relative proportions of that total expenditure that is spent on different categories of goods and service.

To develop this model therefore, it is valuable to look at the literature on consumer behaviour to find significant variables which predict expenditure patterns, and to find models of how the variables relate to one another statistically. The next section looks at models explaining how households determine their patterns of expenditure. Following that, the main variables for predicting both the total expenditure on goods and services, and the types of goods and services bought, are investigated. The focus is on the working hours of household members and how this variable is moderated and mediated by other variables, particularly the relationship between working hours, income and expenditure. Control variables are also considered. As well as helping to improve model fit, the control variables selected also allow identification of different demographic groups which are likely to have different preferences, capabilities and opportunities to shape their work life balance, and different responses to policy instruments which aim to alter their paid working patterns. The

final result is a model of household behaviour linking working patterns to final outcomes in terms of the household's greenhouse gas emissions. This model is used in chapter 5 to test hypothesis 1.

3.5.1 *Models of household consumption*

Fine and Leopold (1993:40–43), in their indepth book reviewing the consumer behaviour literature, note that work draws on a multitude of disciplines, from economics to psychology and sociology, although there is a lack of “grand theory” to integrate different strands into a coherent framework. Indeed, they note Engel's (1981:12) critical description of the field as “a fishing expedition throughout the social sciences”.

They go further, highlighting strong incompatibilities between approaches, particularly the strong contrast between economic and psychological approaches to understanding consumer behaviour:

“Neoclassical economics single-mindedly focuses on one essential principle – the maximisation of utility subject to price constraints. Psychology rushes to the opposite extreme, embracing as many motivational factors (and constraints) as it can muster to explain the diversity of consumer behaviour” (Fine and Leopold 1993:55)

Existing economic theory of consumer behaviour “constructs a self-contained and narrow notion of consumer behaviour, both in terms of its objects of analysis and in terms of its associated causal factors” (Fine and Leopold 1993:49), showing a preference for simplicity of assumptions over realism (Mason 1998). Models tend to focus only on income and prices, assuming that individuals or households are rational actors, in the sense that they will work and consume so as to maximise their utility following exogenous preferences, within their budget and other constraints (Ferrer-i-Carbonell and van den Bergh 2004:370). The influential Life Cycle and Permanent Income Hypotheses (Johnson 1971:66), for example, theorise how a household will attempt to achieve a constant rate of expenditure or consumption over the life course using borrowing and saving to smooth out variables in income at different stages of life. Some economic approaches do go further, and attempt to

consider “leisure” (a term used to cover all non-paid time regardless of the use to which it is put) as a source of utility as well as market goods, and estimate the optimum balance for the individual or members of a household between paid work and leisure (see Becker 1981 for a classic development of the economic model of the household, particularly chapters 1 and 2 which most relate to this discussion).

Nevertheless, these models tend to “ignore behaviour other than individual utility maximisation and ... refuse to explore the origins of (changing) preferences” (Fine and Leopold 1993:49), to the extent that many of the variables potentially explaining consumption behaviour are ignored in models using the “representative agent” described earlier.

Preferences are by no means a black box that is constant over time, or which at least changes predictably, as assumed in such models. Psychological approaches try to explain these preferences by incorporating more explanatory variables. However, such approaches are also strongly critiqued by some: Fine and Leopold (1993:58–9) argue that the literature seeks to encompass ever more psychological factors and patterns of behaviour, resulting in “an eclectic agglomeration of hypotheses ..., creating and investigating causal factors and corresponding concepts that are almost as numerous as the number of goods available for purchase.”

A final issue that needs considering is how consumption decisions are made in houses with more than one family member, e.g. how do couples choose what and how much to buy? Who earns money, who decides what goods are to be bought, who actually buys them, and who consumes them, are all distinct issues, and different models assume different ways in which they are decided upon. Whilst Becker (1981) famously proposes that households have a common utility function, so that the source of income (and who spends it) is irrelevant as all income is put towards maximising this same utility function, other theoretical models, more supported by the empirical evidence, posit that different household members have different preferences and relative levels of negotiating power, at least in part determined by how much they earn, so that who earns money has an effect on how

the money is used (see, for example, Phipps and Burton 1996, 1998 for a review of models and empirical research).

Certainly for this research, taking an abstract, consumption-maximising “representative agent” hardly seems an appropriate approach, given the importance of individual characteristics to wellbeing emphasised in the literature review. At the same time, the diversity of models of consumer behaviour from the psychological perspective is unhelpful too. For these reasons, it is considered prudent for this research to take a simple statistical approach to modelling household consumption behaviour, including predictor and control variables of interest in a linear model. As Ferrer-i-Carbonell and van den Bergh (2004:371) say, not considering existing theories of consumption, in terms of the interaction effects between different variables, means any analysis loses “*a priori* information, which may affect the accuracy and efficiency of one’s statistical estimates... If, however, the traditional assumptions were wrong in the first place, they would affect the quality of the estimates negatively anyway”. Whether they are wrong or, in the case of the representative agent, merely inappropriate for micro level analysis, the simpler approach seems more appropriate.

To this end, an approach similar to that take by Phipps and Burton (1998) is used as a starting point. The next paragraphs describe this. They refer to a household in which the head lives with a partner (a “couple household”)¹⁹, but single households can be modelled similarly.

For a given product category, *c*, expenditure by the household on it, *E_c*, is taken to be a function of male income, *Y_m*, and female income, *Y_f*, controlling for a set of *i* other socio-economic characteristics, $\sum_1^i A_i$. Hence:

$$E_c = f(Y_m + Y_f + A) \tag{1}$$

Giving: $E_c = a_c + b_c \cdot Y_m + c_c \cdot Y_f + \sum_1^i d_{ic} \cdot A_i + e_c \tag{2}^{20}$

¹⁹ The equations refer to mixed-sex couples, but would apply equally to same-sex couples.

²⁰ Adapted from Phipps and Burton (1998).

Equation [2] is a linear model, onto which data can be regressed, in which there are i different control variables, a_c is a constant, b_c , c_c , and $\sum_1^i d_{ic}$ are constant beta values, and e_c is an error term. For single households, a single income variable, Y_h , for the head of household is included in place of Y_m and Y_f .

Total expenditure, $\sum_1^c E_c$, can be seen to follow the same formula, being the sum of all E_c for all product categories, c , i.e.:

$$\sum_1^c E_c = a + b \cdot Y_m + c \cdot Y_f + \sum_1^i d_i \cdot A_i + e \quad [3]$$

Total greenhouse gas emissions and Household Emissions Intensity are taken in this research to follow the same model, as it is found in the following sections that many of the variables found to influence consumption behaviour affect both how much is spent (total expenditure) and what types of things are bought (which determines HEI), and hence also affect greenhouse gas emissions.

Hence:
$$D = a + b \cdot Y_m + c \cdot Y_f + \sum_1^i d_i \cdot A_i + e \quad [4]$$

Where D is the dependent variable being modelled: total greenhouse gas emissions, total expenditure, or Household Emissions Intensity.

Paid working time, a key variable for this research, is included in two places in the model. It is included in the set of variables $\sum_1^i A_i$. It is also included as a determinant of income for the male and female, Y_m and Y_f . The way income and time are incorporated into the above model, along with the other independent variables $\sum_1^i A_i$, is discussed more in the next section.

3.5.2 Independent variables

The sections below discuss a variety of variables that the consumption behaviour literature indicates influence both total expenditure and the types of products bought.

Income (Y_m and Y_f in the model) is, inevitably, of primary importance when estimating household expenditure, and is discussed first.

Time use meanwhile is of primary interest for the hypotheses in this thesis, and is discussed next.

The rest of the section discusses further key variables which are likely to be relevant, which are used to populate the above model [4] with the independent variables A_i . They are grouped into broad categories for simplicity of summarisation, but these categories are not intended to be a rigorous classification and have no bearing on how the variables are treated in the model.

It is worth discussing the rationale by which variables are selected for the model. The primary function of the model is to allow estimations of the effects of changes in working patterns on household greenhouse gas emissions, in line with the hypotheses presented above. A distinction needs to be made between such *estimation* (as I will call it here), and the *prediction* as discussed by, for example, Pedhazur (1997:195–240), as criteria for selecting variables for the two approaches are quite distinct. The aim of *prediction* is to develop a model for a given characteristic (the dependent variable) of one survey sample that has as high a model fit (adjusted R^2) as can be achieved using other available variables, and using it to predict the values of this same characteristic in a separate sample. This research by contrast uses the same sample and estimates the effects of hypothetical changes in the values of certain independent variables (i.e. working hours) on the dependent variable (greenhouse gas emissions, expenditure or Household Emissions Intensity). For prediction, independent variables are best chosen based on some theoretical idea of why they should be of relevance, but this is not necessary: it is only necessary that they are empirically found to correlate with the dependent variable (Pedhazur 1997:195–8). The reason for the correlation is not important, nor necessarily even known or theorised upon. For *estimation* meanwhile, it is necessary to be able to argue that the independent variables *explain* the value of the dependent variable, i.e. that changes in the value of the independent variable affect the value of the dependent variable.

Selection of the variables discussed below employ a mix of these conditions. Working time is assumed to affect earned income, which then leads to a change in greenhouse emissions (by altering total expenditure and/or Household Emissions Intensity). For the other variables in the model, the less stringent requirement that they correlate with greenhouse gas emissions is all that is required (i.e. that they are predictor variables, rather than explanatory variables, in the sense used by Pedhazur).

3.5.2.1 Income and the ability to consume

Income is found in studies to predict a high proportion of total household expenditure. Elasticity is generally found to be less than one, that is, a doubling of (gross) income results in a less than doubling of expenditure, the remainder paid as an increasing percentage of income tax, or being saved or used to pay off debts.

As already mentioned, the proportions of total expenditure going on different products and services varies substantially with income too: as income and expenditure increase, a smaller share of total expenditure goes on high impact intensity product categories (such as food, gas and electricity), as Figure 3.2 in section 3.4 showed earlier.

The end result is that as income increases so too do total greenhouse gas emissions, but the elasticity is also less than one, both because expenditure increases more slowly than income, and because a greater share of expenditure goes on products with relatively lower emissions per unit price.

Also mentioned earlier, there is evidence too that the sources of income are important for predicting expenditure. Income from different household members might be used differently in terms of how much of it is spent or saved, and on what (Phipps and Burton 1998 find this, for example). As well as who receives income, the nature of the income source may have an effect: earned income may be spent or saved differently from income from benefits payments, for example. Means-tested benefits receipt could imply a greater propensity to save rather than spend the money

due to lower income security, or alternatively imply the contrary, a greater likelihood of spending the money rather than saving it, as it correlates with lower incomes and hence lower likely capability to save (Phipps and Burton 1998:603 include benefits receipt as “a potential indicator of economic stress”). Either way, it may be spent differently to other forms of household income. The number of income earners in the household meanwhile could be a significant indicator of income security and associated propensity to spend rather than save.

In short, the literature suggests that total household income, who receives it, and the sources from which it comes, should be included as separate predictor variables, as it may be spent or saved at different rates, and on different goods and services.

3.5.2.2 Paid and non-paid time

Paid working time influences expenditure primarily through its influence on household income. Gross earned income for an individual is, by definition, the multiple of paid working hours by hourly gross wage rate. Household income is the sum of earned incomes, non-earned incomes, and benefits received by the household and its members.

It can also affect types of expenditure. Time pressure from long paid working hours increase the consumption of convenience goods and services intended to save time: restaurants, takeaways and processed food or pre-prepared meals, microwaves and dishwashers, home cleaning and childcare services (Coote et al. 2010:17). This is as predicted by economic models of the household: market goods and services can act as substitutes for goods and services that the household could alternatively use its non-paid time to produce (Becker 1981).

Time spent outside of paid work can also imply the need for different kinds of consumption of market goods: greater time spent on childcare for example can imply an increased need to spend on heating the home (as it is occupied for more of the day), but reduced need to spend on childcare services. These effects have environmental consequences, as they change the relative levels of expenditure on

different goods and services, potentially altering Household Emissions Intensity. As another example, a three month career break spent on a multi-stop flying trip around the world would result in much higher greenhouse gas emissions than the same length of break spent in a well-insulated home writing a novel and eating only locally produced and home cooked vegetarian foods, even if the amount of money spent is the same. These environmental effects are fully captured by the model without including non-paid time use as a separate variable, as they are the greenhouse gas emissions arising from the consumption of market goods and services rather than from the time use per se.

It is however possible that non-paid time uses have environmental impacts associated with them above and beyond those caused by any market goods and services consumed. Non-paid work in particular potentially has positive environmental consequences: voluntary work in the community implies activities are performed which increase the wellbeing of others without the need for private material consumption; voluntary work with nature should in principle lead to direct positive benefits for the environment, assuming the projects worked upon are well designed. Activities in non-paid time could have negative impacts too: the time could, for example, be spent in gathering or harvesting resources available freely in the natural world, such as timber for firewood and local plants and animals for food.

Data limitations mean that these environmental effects of non-paid time use must be ignored, and be considered to be negligible: there is seemingly no dataset which provides a statistically representative sample of a population with detailed data on both household expenditure and time use. It would, anyway, be no simple feat to estimate the greenhouse gas emissions arising from, or offset by, such activities. Whilst these effects would be an interesting area of research, it is assumed in this thesis that households have no impacts on greenhouse gas emissions other than those associated with their consumption of goods and services from the market, i.e. that their time use, independent of its effects on levels and patterns of expenditure, is not a significant predictor variable of greenhouse gas emissions.

3.5.2.3 Gender

The gender of the person spending money has a significant effect on patterns of expenditure (Phipps and Burton 1998), and thus can be expected to influence greenhouse gas emissions. Men and women have historically, and continue to have, distinct social roles, group identities, and needs and preferences, evolving over time and co-created, reproduced and altered by individuals, cultural norms, mass media, marketing, and physical differences, which influence the goods they choose to consume from the market (Bocock 1993:95–108).

Patterns of employment, income earning, and childcare are also strongly gendered. In couple households, Alessie, Crossley and Hildebrand (2006:4) find that “in most [European Community] countries, the share of household income provided by the female partner is a significant determinant of her share of household consumption”, that is, it influences the share of household expenditure she controls, thus having implications for the products bought, suggesting that subdividing household income based on whether it accrues to the man or woman of the couple would lead to an analytical model that explains more of a household’s greenhouse gas emissions.

3.5.2.4 Household structure and the need to consume

As well as the household’s ability to consume, which relates to its income, its *need to consume* is also likely to be an important factor affecting expenditure.

The household’s need to spend is a complex issue, affected by its structure, such as the number of adults and children, and their ages, affecting both total expenditure and the types of things bought. The need to spend does not increase proportionally with the numbers of family members however, as there are also large returns to scale from cohabiting (Alessie et al. 2006).

Such cohabiting effects are environmentally significant, with significant differences in expenditure and energy requirements in the areas of transport, recreation (holidays), food, electricity, heating and household effects being observed between single-person and multi-person households (Biesiot and Noorman 1999:374). That

said, the same study also finds that once income is controlled for, “there appears to be no correlation between household size and total energy requirement” for households with two or more persons (Biesiot and Noorman 1999). This could possibly be because households with more than two persons typically consists of an adult couple, who provide the household’s income, and (child) dependents who do not: while the dependents may increase the need to spend, they do not increase income substantially (although child benefits do increase in line with the number of children), or ability to spend, so that total expenditure is constrained.

The number of adults and children, and their age profile, within a household also affects decisions around time use for paid work and for care. Care commonly needs to be provided for children and dependent parents or partners, either by the parents, other trusted adults, or through paid care services (either paid privately or state-funded) (Kooreman and Wunderink 1997:141). The presence of young children could thus be expected to create pressure on the one hand to increase expenditure, as there is a new life to support and nurture, and on the other to reduce expenditure, borrow more or save less, as the capacity of the household to spend time in paid work is reduced as there is a new demand on time also. This is the “rush hour of life” referred to in the life course literature: time and financial pressures on the household both increase during this period. Kooreman and Wunderink (1997) however note that the number of children is not a fully exogenous variable: adults have a large degree of control over the number of children to have. The household’s finances can therefore, at least in principle, be planned over a longer term of many years to try to accommodate planned pregnancies and children (although other care responsibilities may be less predictable).

3.5.2.5 Socioeconomic and cultural variables and preferences for consumption

Various other demographic and socioeconomic characteristics of the household and its members, such as age, education level, social class, employment status/occupation, ethnic origin, the type of home dwelling and tenure, rural or urban location, and area of the country are commonly controlled for in studies of household

consumption (e.g. Druckman and Jackson 2008a; Ferrer-i-Carbonell and van den Bergh 2004:372, 384–5; Phipps and Burton 1998:601).

Whilst this is standard practice in social sciences, there are also theoretical reasons to expect these to influence both total expenditure and the types of goods and services bought. Such variables might serve as proxy indicators of individual consumption preferences which are shaped by subjective factors and values not measured in household expenditure surveys. They could capture at least in part the formative values household members were exposed to in early childhood, their current relative affluence compared to peers, their degree of exposure to materialistic values and behaviours, and so on, which can shape their consumer attitudes and preferences (e.g. Bocoock 1993:82–4, and see chapter 2, section 2.1.1.2). Cultural and geographic variables in particular could also shape the types of food eaten, types of leisure activities, the amount of home heating required, the propensity to save, etc. Households in rural locations are also found to have generally higher emissions intensities, and so greenhouse gas emissions for a given level of expenditure, due to larger and harder to heat housing, and restricted access to gas as a, comparatively low emissions intensity, heating source (Thumim and White 2008:4).

Whatever the underlying reasons, lifestyle and sociodemographic variables are indeed found to influence consumption patterns, and hence household greenhouse gas emissions (e.g. Baiocchi, Minx, and Hubacek 2010 find this for UK households), particularly for the categories of leisure and energy expenditure (Ferrer-i-Carbonell and van den Bergh 2004:385). Age and cohort effects are also found in consumption patterns. These effects are well known in the consumption literature, with a well-observed “hump” in average expenditure levels across the lifecycle which peaks approximately in the 40s, even controlling for factors such as income level and the presence of children (Bullard and Feigenbaum 2007).

3.5.2.6 Macro effects

Many other, larger scale, factors can also affect individual decisions around consumption. These include “economic development, technological change,

institutions, landscapes, demographic distributions, education systems, communication systems, and cultures” (Michaelis 2000:75, 79), to name but a few. Macro level variables regarding the national and local economic climate, and general confidence about future economic and employment prospects, affect levels of household expenditure, with the continuing fallout of the 2008 financial crisis for example leading to reduced private spending (ONS 2010).

Patterns of expenditure are shaped by the physical environment around, such as the availability, placement and labelling of products in shops (Thaler and Sunstein 2009; Jackson 2005b), and the design of physical infrastructure: a city designed to be navigable only by car compels its residents to commute to work, whilst the quality of public transport infrastructure shapes individual decisions regarding modes of transport, shaping levels of expenditure on car fuel or less damaging buses and trains. The increasing emphasis on mobility for work, the rise of dual earner households, and the increase in the relative cost of public transport, have seen the share of money spent on private travel and commuting increase too over time, an expense that can be seen as “locked in” rather than a luxury, i.e. driven by structural factors rather than individual preferences (Jackson and Papathanasopoulou 2008). Dominant values and messages in a society also have an effect: the pervasiveness of Western values and advertising promotes conspicuous consumption, even for those at the lowest end of the income scale (Mason 1998:141), and can be shaped further by media, government and corporate elites which control communication channels (Michaelis 2000:81–82).

For the purposes of my analysis, such macro-level variables can largely be considered as constant factors across all households in the datasets I use for each country, and can thus be excluded. The exception to this is the geographic region, a variable which is available in the UK dataset and has been incorporated as a variable proxying for some of these macro level factors.

3.6 The final household model

The final model of predictors of household greenhouse gas emissions can now be presented, based on equation [4] presented above in section 3.5.1, and populated with the independent variables just described. The final model extends equation [4] in two ways. Firstly, it splits income not just into male and female sources (in couple households), but by type of income too: earned, private non-earned and benefits. Income earned by other household members is also included as a further variable.

Secondly, paid working time is then included as an explanatory variable of income. This is moderated by wage rate: by definition, working time multiplied by gross wage rate equals gross earned income. As well as this indirect influence of working time on emissions, direct effects are also estimated by the model.

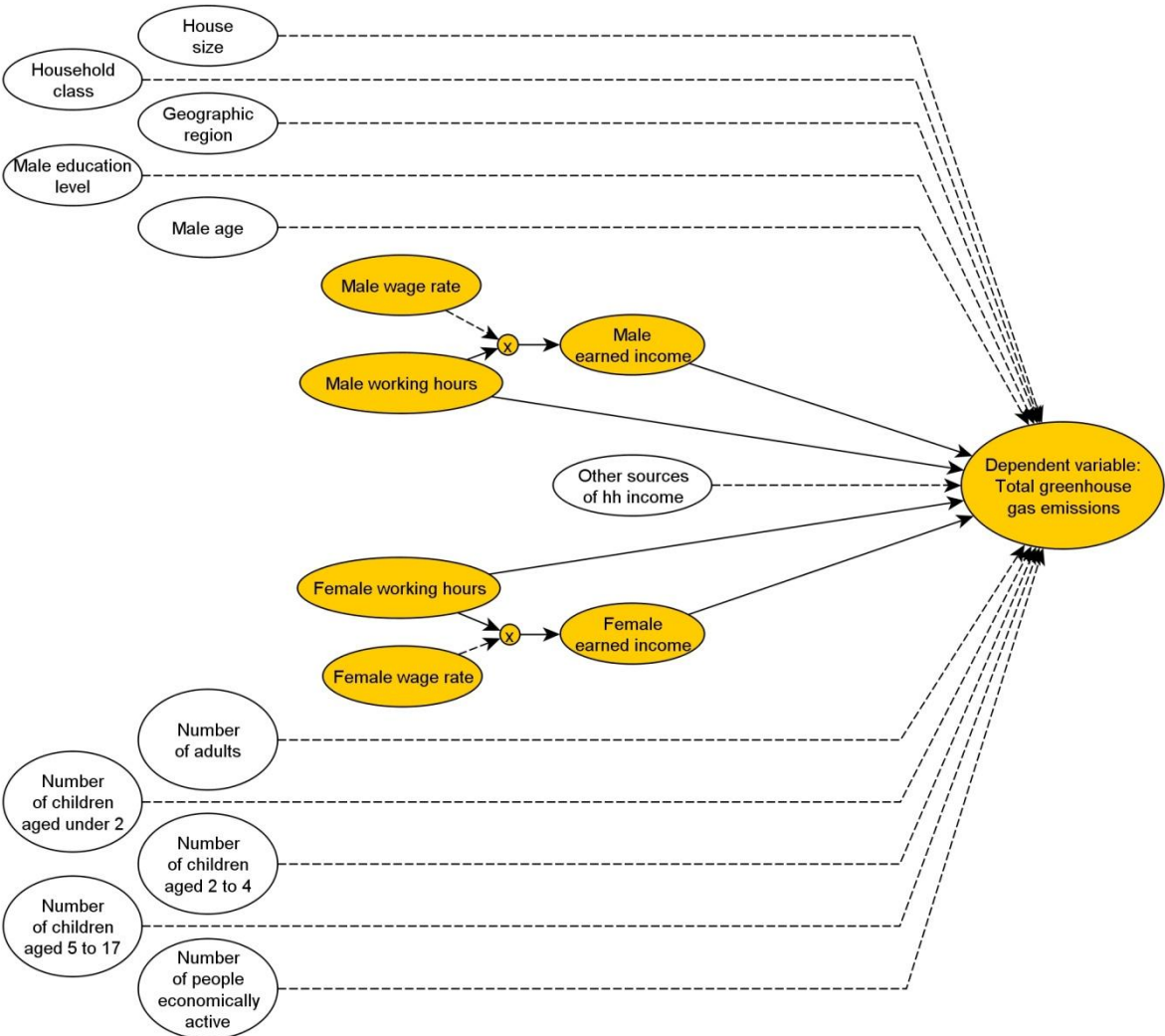
For clearer presentation, the final household model is presented graphically in Figure 3.4 below. This “path model” (Pedhazur 1997:ch 18) shows the hypothetical relationships between the dependent variable and all the independent variables discussed in the previous section that are available in the datasets used in this thesis. The variables can all be included in a linear regression model based on equation [4]. In addition to this, the working hours of the male and female are not only taken to influence emissions directly, but also indirectly, as in conjunction with wage rate they determine the male and female’s earned incomes. Solid lines in the figure indicate the alternative routes, direct and indirect, by which working hours may affect the dependent variable, whilst yellow highlighted variables are all those that influence this relationship. Note that, as male and female education level and age strongly correlate in couples living together, male data for these variables are used as proxies for both. Employment status, although discussed above, is omitted from the model: including it would complicate the scenario modelling in later chapters as it would then require not just working hours changes but (uncertain) employment status changes to be modelled.

This figure is for a household in which the head of household lives with his or her partner, as well as any number of other dependent children and (dependent or non-

dependent) adults. For a household in which the head of household does not live with a partner, the variables wage rate, working hours and earned and non-earned incomes for the partner are omitted.

The same model is used for each dependent variable: total greenhouse gas emissions, expenditure, and Household Emissions Intensity. It is assumed that the same predictor variables are all of potential significance to explaining these dependent variables, but beta values will be different between them.

Figure 3.4 Path model showing hypothesised relationships between the dependent variable, working time and other independent variables



NB. There are variations between the UK and the Netherlands in the precise set of variables that are used in the analyses in this thesis, due to differences in the available data. In the UK, “Other sources of household income” in the figure is further subdivided into male non-earned income, female non-earned income, male benefits, female benefits, and other sources. In the Netherlands, the variable “Geographic region” is not available.

The statistical predictive power of the model is tested in chapter 5, which tests hypothesis 1, that the working patterns of the household members predict the greenhouse gas emissions arising from household consumption.

3.7 Scenario modelling: Estimating the effects on national greenhouse gas emissions of hypothetical changes in working time

Hypotheses 2 and 3 argue that increases or decreases in working time in the population will, respectively, increase or decrease emissions from households. The thesis aims to test this by estimating the effects on greenhouse gas emissions of different scenarios of change in the working patterns of the population. Estimated mean changes in household emissions are used to calculate the total change in national emissions that results, i.e. from the sum of all households.

The use of such scenario analysis (Hertwich 2005b) to estimate the greenhouse gas effects of different paid working patterns in the population is a relatively uncommon use of such a methodology. Scenario modelling allows the effects of different, alternative, courses of action, such as policy measures, to deal with (unsolved) problems, to be assessed, courses of action which have not necessarily yet been taken (Hertwich 2005b:4079). The scenario modelling approach used in this thesis uses the regression model calculated in chapter 5 (as just described), which predicts household greenhouse gas emissions based on various independent variables. Using the same datasets upon which the regression is fitted, the values of the working time variables in the datasets are altered for particular individuals in line with the scenario being modelled, and the effects on household emissions are calculated based on the regression model.

A central advantage of such an approach for this research is that it allows an assumption of *ceteris paribus* to be made, that is, other variables (including macro-level time-variant factors such as policy, cultural values, economic conditions, and so on) can be held constant as parameters of the model, and the effect on a dependent variable of altering one independent variable, in this case the working hours of certain members of the population, can be estimated (Lelkes and Sutherland 2009:18–19; Sartori 1994:22). Analyses of historical data often have difficulty in defending conclusions about the effect of one given independent variable on the

dependent variable being analysed, as there are multiple variables changing in non-linear ways over time, with interaction effects that are difficult to analyse, and with uncertainty that all relevant independent variables have been validly measured and included in the analysis. Careful selection of “most similar” cases so that most of these variables are similar across the cases can help (Sartori 1994:22), but predicting the outcomes of hypothetical scenarios allows these variables to be held constant, thus allowing simpler, more parsimonious modelling to be undertaken. A disadvantage is that this simplification decreases the realism of the model, although this is true of analyses of past events too and does not necessarily imply results are less accurate. Indeed, all models attempt to accurately explain or predict aspects of reality with the most parsimonious approach possible: that is, with the fewest explanatory variables and simplest model assumptions (Mulligan and Wainwright 2004:8). Parsimony is not purely for elegance of explanation, but also because increased model complexity frequently adds little if any predictive power, due to, for example, an increasing likelihood of cross-correlation between variables, and inaccuracy of the assumed relationships between variables (Mulligan and Wainwright 2004:16).

The use of scenario modelling is common in environmental policy research, where many environmental problems remain unsolved, but where untried solutions exist (Hertwich 2005b:4679). Many ecological economics and environmental analyses use scenario modelling to model and predict the environmental sustainability of different scenarios of changing economic growth rates, technological developments, and population changes, among other things. Major examples of this include reports from the Intergovernmental Panel on Climate Change on scenarios of future climate change (e.g. Intergovernmental Panel on Climate Change 2008), the Stern Review on the future economic effects of such climate change (Stern 2007), and WWF reports on how our global ecological footprint might change (e.g. WWF 2010:80–87). Spangenberg et al. (2002) and Victor (2008, 2011) meanwhile model scenarios of transition to sustainable economies in Germany and the Netherlands, as mentioned in chapter 2 (section 2.1.2). However, these tend to focus on macro, national level, analysis rather than the micro, household level. Of the research on household-level

environmental impacts, little goes beyond describing and explaining household impacts on to suggesting policy implications, modelling particular policy options, or evaluating existing policies (Kok, Benders, and Moll 2006; Hertwich 2005b:4679), largely because the work involved in developing the capacity for description and explanation has been in itself a major achievement and contribution. Hertwich (2005b:4680) identifies a small number of articles that do undertake modelling of hypothetical situations. For example, Biesiot and Noorman (1999) estimate the environmental impacts of particular behavioural changes in household consumption. Lenzen and Dey (2002) model the greenhouse gas, energy and other effects of different changes in Australian diets and transport patterns, among other things. Druckamn and Jackson (2008b) meanwhile model the effect on carbon emissions if UK households changed to live on a minimum income considered necessary to flourish (also as mentioned in chapter 2).

Neither is such scenario modelling very common in social policy research, which instead tends to evaluate existing policy instruments and their outcomes against a given set of criteria, such as stated policy goals or normative values. There are some exceptions to this, and “micro-simulation models”, scenario models at the micro, individual, level, are becoming more commonly used for the assessment of, in particular, the income effects of social policy, something encouraged for example for the assessment of policy impacts on child poverty and social exclusion (EU Task-Force on Child Poverty and Child Well-Being 2008:134). Research in this area tends to focus on income distributions in populations. Meyer, Bridgen, and Riedmüller (Meyer, Bridgen, and Riedmüller 2007) for example simulate the pensions received under different welfare state systems in the European Union based on models of welfare state rules. The outcomes for different hypothetical individuals having specific “risk biographies”, that is, idealised career and lifecourse trajectories, are predicted. Work following a similar approach has been undertaken for child benefit receipt in selected EU countries (Bradshaw and Mayhew 2006). The UK’s Department for Work and Pensions uses PENSIM2 and other dynamic micro-simulation models to explore the impacts of different policy reform options on pension distributions (Emmerson, Reed, and Shephard 2004). More closely related

to this thesis' research, other work uses models (POLIMOD and EUROMOD) and household-level survey data to simulate effects on a dependent variable (household disposable income) under different hypothetical scenarios of changes in the tax and benefit system, both looking at aggregate effects and breaking down results by demographic group (Sefton, Hills, and Sutherland 2009; Sutherland 2009). Such models have been used to simulate the effects on specific policy goals (in this example, reducing poverty among the elderly) of policy instruments (here, a European Minimum Pension guarantee) which have not necessarily been proposed nor implemented by policymakers (e.g. Atkinson et al. 1999).

Whilst scenario models are used in environmental research, and to some degree in social policy research, the precise use in this thesis to model the greenhouse gas effects of changes in working time appears to be an original contribution to the literature.

3.8 Modelling assumptions

Scenario modelling is a useful approach for this research. As with all modelling, assumptions are made to make the models simpler and manageable, whilst nevertheless aiming to capture some of the characteristics of the reality being modelled, so as to be able to make useful conclusions about how things behave in the real world. Assumptions relate to which variables to include in and omit from the model, and how those included relate to one another. It is necessary to keep in mind that “[t]he key to successful modelling is to know which assumptions are likely to be wrong and to ensure that they are not important for the purpose for which the model is intended. ... [A]ssumptions must be well understood and explicitly stated with reference to the conditions under which they are valid and ... under which they are invalidated” (Mulligan and Wainwright 2004:15–16). In particular, as the values of variables are being altered in the scenarios, within what boundaries do the assumptions of the model hold? How far can the working times of household members be altered and the regression model still produce feasible results? The model is also a static one: what are the implications of this for the scenario modelling? This section discusses some key assumptions of the modelling.

Importantly, it is worth noting that appropriate design of policy instruments will influence whether the model assumptions hold or not: they can in principle be designed so that they ensure the assumptions hold and hence that the model's outcomes occur.

3.8.1 Household decision-making around work and spend

The household model presented earlier ignores how household members decide their balance of paid working hours and expenditure. Household expenditure and leisure time are to some extent substitutable goods, that is to say, increased expenditure can in principle compensate for reduced time outside of work (Bullard and Feigenbaum 2007), as discussed earlier. Hence the household's members have to determine their own optimal balance between paid work (and thus income and ability to spend), and non-paid time, so as to maximise wellbeing. As already discussed above and in chapter 2 (section 2.1.3.2), there are arguments why the optimal balance for society, the environment, and even for the household itself, may not be chosen.

The model developed above assumes that the household (or rather, the individuals within it, by whatever means) has already made this decision, and its expenditure patterns, and the greenhouse gas implications of these, are analysed based on the paid working hours reported in the datasets. This does not affect the results of regression analyses to fit the model and test the significance of different independent variables in predicting household emissions. It does however have potential implications for the results of the scenario modelling. The scenario modelling assumes that a household's emissions can be predicted based on these regression results, so that if a household member changes his or her paid working patterns, the household emissions will alter as predicted by the model. This assumes that the, unobserved, reasons behind a household's working pattern changes in the scenarios have no effect on its emissions, affecting neither total expenditure levels nor the patterns of goods and services bought (or more accurately, that the net effect across all households of these unobserved variables is negligible, i.e. is part of the error term). Where policy instruments, in the scenarios, have led to these hypothetical working time changes, households may in reality behave differently to those that are observed in the datasets

as the policy environment and other conditions are different, and these may be predictors of household emissions. This has had to be ignored in the modelling.

Another issue is that wage rates are not independent of working hours: higher wage rates, associated with more senior jobs, are typically also associated with full time work. Employers frequently report that they consider more senior, higher paid jobs to be incompatible with part time work (European Commission et al. 2005). This relationship is partly countered by more senior workers being expected to work unpaid overtime (or feeling obliged to to progress their careers), so that the effective hourly wage rate including these unpaid hours is actually lower than the contractual rate (Schor 1999:142–143). Actual normal working hours, including any unpaid overtime, is what is used as the predictor variable in this research. Any correlation between this and wage rate is ignored in the model. This does not affect regression estimates. Rather, it again has relevance for the assumption that households reducing working time as a result of a policy instrument will behave the same as households observed in the datasets who already have shorter working hours. Policy would likely need to ensure that working hours reductions do not affect real hourly wage rates.

3.8.2 Delayed effects of working patterns on greenhouse gas emissions

The model developed here is a static rather than dynamic one, meaning that feedback mechanisms over time are not included. A key assumption in the model is thus that these delayed feedback mechanisms are not significant. That is, values in given predictor or dependent variables in the model at point t in time do not significantly alter the other predictor variable values at a later point in time, $t+i$. This is either because there is no significant effect, or because other factors (such as policy design) precisely counter any effect that arises. This is also assumed in other static models such as EUROMOD (Atkinson 2005:7). This section looks at two mechanisms by which significant delayed effects of working time on consumption emissions can be expected to arise, that is where working time reduction at one point in time may affect emissions in the future, not just in the present period. It looks at the potential

of policy and other factors to counter them so that the model assumption that these effects are not significant can be held.

The first mechanism relates to how a household balances income between expenditure now and saving for the future. Current rates of expenditure are likely to be affected by the household's level of capital: its financial capital, in terms of debts or savings; and its physical capital, in terms of its durable goods, large items that need only infrequent replacement, such as white goods, televisions, cars, etc, that provide utility over an extended period of time, in turn affected by past levels of income. The expectations of the household members about their future income and future needs to spend (e.g. if they are planning a child or to buy or renovate a house) also potentially affect the current balance between expenditure and saving. Similarly, the variables described above which affect expenditure will also affect savings rates, as saving is the remainder of net income minus expenditure (hence the finding that many of the same variables described above also predict household saving rates: Harris, Loundes, and Webster 2002). The life-cycle and permanent income hypotheses, the respective work of Modigliani, Brumberg and Ando, and Friedman, essentially argue that an individual, or household, will attempt to smooth his or her utility over time, to provide a constant utility from consumption (from expenditure and from the household's existing physical capital) over time such that their long term expenditure matches their long term income (Johnson 1971:66–8). There are various problems with this idea in practice; for example, there is a very high level of uncertainty about future incomes, whilst both the need to spend and people's preferences vary with time, also, to a significant extent, unpredictably. The access of households to debt facilities may be constrained by various factors so that they cannot borrow optimally. Savings rates by individuals/households are found to be lower if those involved are financially optimistic, a characteristic which is not determined by how accurate their past financial forecasts have been (Brown and Taylor 2006; Harris et al. 2002). It is also questionable the degree to which people plan, and how: recent literature suggests savings behaviour, as with consumption behaviour, is shaped by socio-cultural values and wider norms and conditions, whilst it seems individuals consider and plan for the short and long term, and for different

reasons, in different ways and to different degrees (Alessie et al. 2006). Poverty, job loss, past failures with plans, and the presence of children all inhibit people's planning behaviour (Anderson et al. 2002, 2005).

Regardless of the degree to which the life-cycle and permanent income hypotheses hold, households on low incomes are found to typically save less than those on high incomes, so that the working time reduction scenarios modelled are likely to result in average savings rates falling, depressing (future) expenditure further than predicted by the models. This likely means that the greenhouse gas emissions reductions predicted in chapter 7 are also underestimates as some reductions in emissions in the future would occur which are not included in the model, and similarly, the emissions increases predicted in chapter 6 are also likely to be underestimates.

The second delayed effect of working time reduction is that such a reduction made at one point in time may affect future career trajectories and employability. Working time at time t can be expected to affect both working time and wage rate at a later time, $t + i$, as a period of reduced or no employment impacts on the chances of re-entry to the labour market and the prospects for the type of job found, or of receiving promotion. A career break or period of reduced working time is likely to result in not just immediate reductions in expenditure and greenhouse gas emissions therefore, but also delayed reductions, as future income is also reduced.

The assumption that there is no effect on future working time is not a critical one, as values for this variable are determined exogenously from the model as a characteristic of the scenarios. However, the effect on future wage rate is important. Research supports the idea that career breaks, including those supported by policy, such as maternity leave, can and frequently do result in negative career impacts later in time, including permanent exit from the labour market (at least in a full time, skilled job) (O'Reilly and Bothfeld 2002) and reduced earning potential (wage rates), in part due to human capital depreciation (skills becoming forgotten or obsolete) and due to reluctance from employers to recruit people to high skilled posts after a gap in employment.

Although such delayed effects of a period of reduced working time could lead to significant effects on greenhouse gas emissions, they have not been included in the modelling. Building a model which accurately predicts such complex dynamic interacting effects is unlikely, and data to fit it to are not available. Moreover, policy instruments could again in principle be designed and implemented to counter such delayed effects, by minimising the long term career impacts of working time reduction: this is one of the central concerns of life course policy, to prevent a career break turning into long-term exit from, or disadvantage in, the labour market. Policy instruments in the Netherlands already aim to ensure part-time workers have the same rights as full-time workers (Fouarge and Baaijens 2004:3). Other policies have also had some success in overcoming barriers to men's use of paternal leave, such as a father-only "quota" in parental leave entitlement in Nordic countries, which has seen men's takeup rates increase from 6% to 80% (Smith and Williams 2007:189). Wide-scale reductions in working time would also normalise such working patterns, and thus preclude discrimination against, and the concerns about career impacts of, individuals based on the decision to reduce working time.

If policy instruments were not able to fully counter these delayed effects, the result would be that total reductions in greenhouse gas emissions from a given reduction in working time would be greater than what is predicted in this thesis, although there might also be negative impacts on households due, for example, to reduced job security.

3.8.3 Systemic effects

As well as delayed effects, there are also wider effects on other parts of the economy, in particular, the tax and benefits system and public sector finances, which are not modelled. Cuts in working time imply drops in tax revenue from income tax if no other changes are made, potentially problematic for welfare state sustainability, especially if the highest income groups (and highest income tax contributors) are encouraged to cut income the most. Again, policy can respond to this issue. Cuts in private expenditure via working time reduction policy do not necessarily imply cuts

in public expenditure, but a big question becomes how to adjust the tax system in a politically acceptable way so as to maintain the welfare state's core functions (including redistributive) even without the GDP growth upon which it is currently dependent (Gough 2010). This is especially pertinent if the likely future expansion of climate change mitigation, and other environmental, expenditure by the state in future is not to compete with and undermine the welfare state (Marden and Gough 2011). In short, the modelling approach used throws up implications for public sector finances that are outside the scope of the thesis to consider in detail, but which would require policy instruments to address.

Another systemic effect relates to changing product prices arising from reduced demand in the economy. Reducing demand would depress prices, even globally due to the level of global economic integration, so that "rich world frugality" could stimulate increased consumption and hence environmental impacts elsewhere in the world (Alcott 2008). In principle, this effect on prices would be cancelled out by concurrent reductions in production as people work less, so that both product demand and supply fall in conjunction. In practice, the result would be more complex, particularly as the areas of reduced demand would not match areas of reduced supply. Similarly, labour wage rates could be affected by falling labour supply, in principle being driven upwards as supply reduces relative to demand.

All these systemic effects are complex and by no means unimportant, and limit the reliability of using the linear modelling approach in this thesis for modelling radical changes in working patterns. The response taken in this research is to model working time changes that are relatively modest. Although by no means insignificant, they are substantially smaller than the working time reductions proposed by Coote et al (2010) for example, or which were envisaged for us nearly a century ago (Keynes 1930).

3.9 Selection of particular demographic groups for more detailed analysis

Households with different opportunities, capabilities, preferences and strategies with respect to their working patterns and consumption are likely to respond to, and be affected by, working time policy instruments in different ways. They might change their working time in different ways, with consequences for the environmental outcomes in terms of the changes in their greenhouse gas emissions. Breaking down the population into these separate groups would be of value, as it makes it possible to see the contribution of different demographic groups to the total change in emissions that is predicted, and to look at income and expenditure impacts on different groups. This is helpful to inform policy proposals based on the research results, which may differ according to the group to which the policies apply to ensure that the diverse environmental, social and economic goals of working time policy can be reconciled across the population. Policy can then, for example, target those demographic groups responsible for the highest shares of total national emissions (Druckman and Jackson 2009).

The same issue described above for dependent variables applies here: the more the population is broken down into different groups for separate consideration, the more complex are the results needing to be presented and interpreted. Equally, the more the population is broken down in this way, the less reliable are the results upon which conclusions are based, not least because they are estimated based on increasingly small survey sample sizes. As such, the population is broken down for this research into only a limited number of groups which are likely to make the results more useful for policy analysis but keep results manageable. The population is broken down against the following variables, with the rationale described below: household income band; whether the head of household lives with a partner or not (“couple” or “single” households); whether dependent children live with the head of household or not; and the age of the head of household. Note that the terms couple and single are here used only to refer to whether the head of household lives with a partner or not: there may be other household members present, such as dependent children, and other adults.

Income band is likely to be of paramount importance. From the environmental perspective, a given reduction in working hours is likely to have substantially different implications for greenhouse gas emissions depending on the reduction in earned income it implies (in turn depending on the wage rate of the person reducing their working hours). From the household's perspective too, low income households will tend to have much more limited capabilities to reduce working time, and hence further reduce earned income, without unacceptable impacts on material wellbeing. A reduction in greenhouse gas emissions due to reduced working time in a low income group might thus not occur in practice, as they are unable to reduce their working time in the manner assumed in the scenarios. Breaking down results by income can allow the policy implications of this to be considered.

Of the other demographic groups being considered, couple and single households inevitably have different conditions from one another that would make their work and expenditure patterns different: different returns to scale of consumption; different total time availability; different income security; and so on. Whether the head of household lives with a partner or not fundamentally alters the opportunities, capabilities and preferences of the household to alter its working patterns, as couples have two potential sources of income, and "linked lives" (Schippers 2004), collectively deciding on and negotiating work life balance arrangements. They also require different models to predict their greenhouse gas emissions in this research, as discussed above.

The presence of children, and the age of the head of household, are also important, as these factors alter income and working time behaviours and opportunities. Existing working time policy also focuses particularly on two groups: those with children, and older workers (aged over 50 and below retirement age). For the former, a range of policy instruments allow and support parental leave, provide childcare opportunities with different degrees of financial support, and so on. For older workers, policies provide different opportunities for pre-retirement and encouragement and support to remain in the labour market. Disaggregating the population by these variables will

help tailor policy advice to these groups. Households above retirement age are excluded from analysis as they are generally not in work, and so not affected by working time policy.

Clearly, it is possible to disaggregate the population along other lines that would provide policy-relevant results. Current policies target other groups not mentioned here: the incapacitated, ethnic minorities, the long term unemployed, low skilled and others considered to have too low employment rates (see, for example, Department for Work and Pensions 2007:8). Gender is also a key consideration, but as most households consist of mixed sex couples, it is not possible to disaggregate households by gender. Gender effects within households are however considered. Those of different education level are also likely to have different capabilities to make use of working time reduction policy: for example, “the well educated are seeing rapid income growth and are under constant time pressure because of demand for their services, while the less-educated see falling wages and are working harder to maintain income” (Michaelis 2000:79).

Nonetheless, with the focus of this research being on the environmental implications of working time policy, it makes sense to identify groups which represent major contributors to total national emissions which might also require differing consideration by working time policy to meet other policy goals. Breaking the population down by single and couple households, age band, presence of children and income band should contribute to that aim in a way that keeps the results manageable for analysis.

3.10 Summary

Reductions in paid working time have been argued to be one part of a solution to reducing the environmental impacts of high income societies, in a manner potentially compatible with other social and economic goals such as increasing wellbeing and reducing poverty. Thus far, however, there has been no known attempt to quantify the contribution working time reductions could make to such environmental goals. This thesis seeks to address this issue and thus contribute to the literature.

To that end, this chapter has developed a framework for the analyses in this thesis. Testable hypotheses have been set out regarding the relationship between working patterns and environmental impacts, focusing on greenhouse gas emissions from household consumption.

As paid working time is an individual-level variable, whilst consumption expenditure is co-decided primarily at the household level, a household level analysis is indicated. National-level emissions can then be extrapolated from household-level means.

Methods of measuring the greenhouse gases arising due to household consumption are well established. An analytical model was presented of the predictors of household greenhouse gas emissions, drawing on the literature on the consumption behaviour of households. Doubts regarding the validity of complex assumptions regarding consumption behaviour require that this be a comparatively simple model.

Once fitted to actual data, this model can be used to estimate the changes in emissions due to different scenarios of change in paid working patterns of the study populations. The scenarios to be considered relate to the research hypotheses, and will be defined so that it can be argued that they stay within the boundaries of the model's validity to test. They relate firstly to testing the environmental implications of existing government goals regarding paid working patterns in the population, which are to increase total work by increasing labour market participation rates; and secondly to exploring the greenhouse gas reductions that could be achieved using policy to reduce average working time.

As long as the scenarios stay within certain boundaries, the assumptions within the model are unlikely to substantively affect the validity of the results. Additional policy instruments could be used to deal with time-delayed effects of working time reduction that are not modelled. The possible shape of these instruments is discussed more in the results chapters.

Chapter 4 Context of the research: Data preparation and existing patterns of household greenhouse gas emissions in the UK and the Netherlands

The argument that changes in paid working patterns in a population will affect their consumption, and so environmental impacts, has a general applicability to all economies. The further contention that reducing working time is a desirable route to take in tackling environmental issues, and could even bring wellbeing benefits along with it, focuses primarily on high income countries where there is strong evidence that consumption levels are environmentally unsustainable (certainly if they were to be replicated across the rest of the world too), and further evidence that these levels are doing relatively little to improve levels of happiness, as chapter 2 (section 2.1.1.2) described. What then is the rationale for choosing the UK and the Netherlands to test these arguments and assess the policy implications? How do patterns of emissions look in these two countries? This chapter responds to these questions.

The chapter introduces the two study countries, and the time period in which the baseline data is drawn (the early 2000s), discussing the reasons behind their selection for study in this work. It goes on to introduce the datasets used, and details their preparation for analysis. The chapter then draws on these data to take a first look at the patterns of greenhouse gas emissions in the two countries. This provides a view of how the dependent variables introduced in the last chapter (household greenhouse gas emissions, total expenditure and Household Emissions Intensity) relate to one another, and presents how emissions vary between different demographic groups (such as parents with dependent children, and older workers) and by income in the populations, of particular relevance to working time policy, and hence to this research. This gives an indication of the scale of greenhouse gas emissions reductions necessary in the two countries, and provides context to the chapters which follow. The chapter ends with a brief summary.

4.1 Study location and period

4.1.1 Choice of countries: the UK and the Netherlands

The choice of the UK and the Netherlands as the case study countries for this research is based on their value in contributing to the research aims. The use of two case study countries provides “data triangulation” (Fielding and Fielding 1986:25) so that the validity of the research hypotheses can be tested in different contexts, which in turn provides some indication of their generalisability (Sartori 1994:15, 23). The countries selected need to meet certain conditions as the arguments regarding working time reduction (as presented in chapter 2), which underpin the hypotheses being tested in this research, relate only to a certain class of country. The argument discussed in chapter 2 (section 2.1) that reducing paid working time, and hence income in proportion, could be used as an approach to reducing household greenhouse gas emissions is made with a focus on high income, high consuming countries, in which it is argued such reductions in work, income, and so expenditure would not necessarily impact on wellbeing and could well even improve it, as basic material needs could still be comfortably met (by most people) and they would have more time available to pursue other, non-material, routes to wellbeing. High income (and hence high emitting) countries are required for the research therefore. A high level of variation in paid working patterns would also be helpful as it makes the testing of the thesis’ hypotheses easier, by allowing the model of how household emissions vary with working hours to be fitted to data such that it holds across a range of working patterns. The UK and the Netherlands fit well in these respects. The Netherlands has by far the highest incidence of part time work in the EU, and the UK, historically in a more distant second place, has increasing levels too (Fouarge and Baaijens 2004:3; Inman 2010). The Dutch experience is unusual in that part time jobs are frequently of high quality too, compared to the often marginal nature of them in many countries, reflecting how employers there have increasingly seen the organisational advantages of part time work too (Fouarge and Baaijens 2004). Part time work is also unusually common among women, leading it to be described as a “one and a half earner” model as opposed to dual earner (Maier et al. 2007:349).

Case selection also requires consideration as to which characteristics are and are not similar, and which should and should not be similar for the purposes of the research (Sartori 1994:17). Taking a “most similar” approach allows many possible explanatory variables to be excluded (as they are the same in both cases), reducing the complexity of analysing the reasons for differences in a dependent variable (although of course there still remain many variables which do differ) (Przeworski and Teune 1970:32; Mackic and Marsh 1995:178–179). The UK and the Netherlands are quite suitable countries to compare in this respect. They are similar in relation to paid work in several ways. Income levels are high and similar, as are education and skill levels in the workforce. They both have high variation in paid working hours in their populations, with substantial shares of part time workers. Participation rates in the labour market are high and increasing, for both men and women, and policy goals are to maintain that increase. The once strong support in both countries for full-time caregiving by women has firmly given way to the adult worker model, or “employment for all” (Orloff 2006:230). They are addressing similar demographic and cultural issues surrounding paid labour, including retirement ages and pension sustainability in the light of an ageing workforce, gender equality concerns around childcare and paid work, and so on. Both being members of the EU means a wide variety of policy instruments are similar between the two countries. This all makes the two countries suitable choices for comparison.

At the same time, they also make interesting cases for the discursive elements of this research in which the implications of the empirical results for working time policy are discussed. For this element, countries with innovative working time policies would be interesting. From this policy perspective, two countries in particular have strong, innovative policy instruments that allow working time reduction (reduced weekly working hours, or periods of career break) for any reason. The Netherlands is one of these. Belgium is the other. Their policies are discussed later in chapter 7, which focuses on policies for working time reduction, their effect on greenhouse gas emissions, and the implications of this research for their design. Belgium however apparently lacks the product emissions intensity data required to test the research hypotheses of this thesis, so cannot be used as one of the case study countries. The

Dutch policies explicitly follow the life course perspective discussed in chapter 2, making it particularly interesting for this research. The UK makes an interesting comparator to the Netherlands from this policy perspective because, despite also having high levels of part time work, its working time policies are substantially less developed overall (as presented in chapter 7), as would be expected in a liberal welfare state model such as the UK's (Esping-Andersen 1990, 1999; Smith and Williams 2007). There are, also, notable differences in paid working patterns, as Table 4.1 demonstrates: in both countries, women (particularly mothers) are far more likely than men to be working part time, but in the Netherlands the level of part time work for both genders was until recently far higher than the UK's (whose own levels are already rather higher than most European countries'). The Netherlands has been described as the "first part time economy in the world" (Visser 2002), with high levels of employee autonomy and strong support from direct supervisors and co-workers for adopting (part time) working patterns that meet employee work life balance preferences contributing strongly to this (den Dulk 2008:143). The UK's male and female rates are, slowly, converging, whilst in the Netherlands there is divergence. There are thus quite interesting differences between the two cases with respect to working patterns and working time policy instruments.

Table 4.1 Part time employment as a percentage of total employment, by gender

	Men			Women		
	1985	1995	2005	1985	1995	2005
UK	4	8	10	45	44	43
Netherlands	14	17	23	58	67	75

Source: den Dulk (2008:135)

The two countries thus make quite interesting comparison cases. They are countries to which the arguments regarding working time reduction should in theory apply, and hence for which the research hypotheses would be expected to hold, and are similar in many respects, allowing many possible explanatory variables to be controlled for. The use of two countries helps to give an indication of the robustness of the research results to different conditions. Inasmuch as they can be considered representative of high income, high consuming countries, then the thesis' results and discussions can tentatively be considered generalisable to other such countries, with due

consideration of how similar or different they are from the UK and the Netherlands (Bechhofer and Paterson 2000:37–39). At the same time, the quite different national working time policies allow an exploration of what the results imply for policy advice relevant to quite different national policy contexts.

4.1.2 Choice of survey years

The research uses data from the year 2004-5 for the UK, and 2000 for the Netherlands. The choice of survey years was informed by the availability of product emissions intensity data: the most recent available emissions data (at the time of analysis) were selected for both countries. Choosing the most recent year possible should help increase the relevance of results to the current policy context. As methods for calculation of these data are in constant development, the most recent data are also likely to provide the most robust figures, improving the reliability of the results presented in this thesis.

Using different survey years for the two countries could pose problems with comparability between the two countries. Two options would have been available to use the same survey year. Firstly, 2000 data for the UK could have been used. However, as this is a rapidly developing field, the 2004-5 data would be more methodologically advanced and likely be more accurate as a result. The other alternative would be to convert the 2000 Dutch product emissions intensity data to 2004 values by adjusting for price inflation, so that they could then be combined with the 2004 Dutch household expenditure survey²¹ data, and have results for both countries for the same year. However, the 2004 Dutch household expenditure survey data omits key independent variables essential for the data analyses, which are present in the 2000 dataset: gross household and individual incomes, and the working hours of household members. At the same time, converting the product emissions intensity data based solely on inflation figures would have been methodologically too simplistic, ignoring changes in underlying production technologies, sources of imports, and resource prices that could also affect intensities from year to year.

²¹ Household expenditure survey datasets are one of the main data sources used in this thesis, and are described in the next section.

Dutch Consumer Price Index inflation figures, which would be needed to convert the product emissions intensities, follow a categorisation of products and services highly different from that used in the Dutch household expenditure survey dataset used, and with poor comparability, so that using these figures would also have introduced errors.

It was decided in the end that the four year difference in survey year between the UK and the Netherlands is unlikely to substantially alter either the results or their comparability between the two countries, which can anyway only be descriptive due to the differences in the secondary data being used. The reduced comparability between the UK and the Netherlands was considered to be insignificant, as the research is already using distinct, unstandardised household expenditure survey data for the two countries, and product emissions intensity data produced using different raw data and methods.

4.2 Data used in the research

4.2.1 Dataset choices

Certain aspects of the research questions largely determine the datasets that are required for this research, as discussed in the Analytical Framework chapter (chapter 3). The greenhouse gas emissions of a nationally representative sample of households is needed, along with other variables (including the working hours of the household members) to allow the predictors of these emissions to be studied, and the emissions of different demographic groups to be investigated. The Analytical Framework already mentioned an existing body of research which studies the environmental impacts of households in this way. The methodology used combines household expenditure survey data with data on product emissions intensities, and is considered to be “firmly established” (Reinders, Vringer, and Blok 2003:140).²² A range of reasons means it is sensible in this thesis to follow and build on this

²² For a description of the history and development of these methods for the analysis of household emissions and other environmental impacts, and of the variations in methods and data between different studies, see the literature reviews of Hertwich (2005b), Kok, Benders, and Moll (2006) and Wiedmann (2009).

research. Firstly, this existing research represents the most robust estimates of household greenhouse gas emissions that currently exist, the product of laborious data collection and development of novel methods. There is little added value in attempting to “reinvent the wheel” by repeating any of this work, indeed the results would likely be substantially less robust. Secondly, it is beyond the scope of this thesis to do so. Finally, following the same approach means results from this research build on and contribute to existing work.

A final dataset is needed to convert household level emissions results to the national level in a way that produces cross-nationally comparable emissions totals. The method by which this is done is discussed below, in section 4.3.3. The method requires a secondary dataset of cross-nationally comparable national greenhouse gas emissions, showing total national emissions from households for the UK and the Netherlands.

Three datasets are thus required for this research: household expenditure survey dataset, data on the greenhouse gas emissions intensity of products, and the cross nationally comparable total household emissions. Suitable datasets are described in the next three sections.

4.2.2 Household expenditure survey datasets

Household expenditure surveys are conducted in all the EU Member States. In most countries, including the UK and the Netherlands, the data are collected annually. Data are collected from a sample of households, with the sampling method dependent on the country. The sample is intended to be representative of the national population living in private households, but excludes collective households and institutional accommodation such as “old persons’ homes, hospitals, hostels, boarding houses, prisons, military barracks” and so on. Homeless people are also excluded. Data cover all expenditure of household members over a defined period, usually collected via a diary kept by the participants. Various socio-demographic and income variables are also usually collected, via interviews with the household members (Eurostat 2005a).

These data allow different categories of household, that is, different demographic groups, to be identified (based on, for example, income band, age of the head of household, the presence of children, or social class), various aspects of their typical (mean) living conditions to be investigated, and so on. The data collected are also used to weight various macroeconomic indicators such as Consumer Price Indices and national accounts (European Communities 2003:9). There is some attempt to harmonise data outputs (as opposed to data collection methods and survey questions) across the EU (European Communities 2003:7–11; Eurostat 2005b:302), although only national datasets are available for research use (at the discretion of each Member State); the harmonised data are not available. This is not a problem for this research, as both the UK and the Netherlands make their data available for research, and indeed the product emissions intensity data with which they are combined in this research are designed to be used with these national datasets rather than the EU harmonised data (in particular, the UK and the Netherlands use different categories of product and service into which to group items of expenditure, to which the product emissions intensity data are tailored in the two countries).

The UK and the Netherlands collect the data for their household expenditure surveys as part of larger annual household surveys: the Expenditure and Food Survey in the UK, and the Budget Survey in the Netherlands. For simplicity, these datasets are generally both referred to as household expenditure surveys throughout the thesis.

The next two sections described some of the characteristics of the UK and Dutch datasets such as their sample size, response rate and collection methods.²³

4.2.2.1 The UK Expenditure and Food Survey

The UK Expenditure and Food Survey was conducted from 2001 to 2007. It was formed through the merging of two earlier surveys, the Family Expenditure Survey (which ran from 1961-2001) and the National Food Survey (1974-2000). In 2008 it

²³ Details of particular variables and how they are operationalised for use in this research follow in sections 4.3.1 and 4.3.2.

was again renamed as the Living Costs and Food Survey, becoming one module of the larger Integrated Household Survey (Economic and Social Data Service 2010a). The Office for National Statistics (ONS) manages and primarily funds the survey, with the Department for Environment, Food and Rural Affairs funding the food data.

As well as the national accounts and other purposes described earlier, the data can be used to investigate nutrition and eating habits, and is freely available for academic research (Economic and Social Data Service 2010b). ONS produces an annual report summarising household expenditure and income patterns in the data, dividing households into different demographic groups (e.g. by income, age, composition, geographic region) and describing trends (see ONS 2006c for the report based on the 2004-5 dataset used in this research).

The data are provided to researchers as a complex set of six separate files, variously containing raw data (e.g. individual questionnaire responses) and derived variables (such as household expenditure by product type), and coded at the household or the individual level. User guides provide some guidance as to the contents of the files and how they can be used²⁴. Very helpful email support is also available.

Survey data are released as datasets spanning 12 months, effectively making the survey repeat cross-sectional in nature, although the data are collected continuously so that seasonal variations in spending and other patterns are averaged out. A “multi-stage stratified random sample with clustering” is taken of households, selected from the Post Office’s list of addresses. Of 11,053 eligible addresses selected for the 2004-5 period, 6,265 responded sufficiently fully to be included in the dataset (a 57% response rate, similar to other years). Northern Irish households were deliberately oversampled to provide sufficient cases for separate analysis, with 533 of a sample of 1,032 responding (52%) (ONS 2006a:part 4).

Data collected is via a questionnaire and a diary. Interviewers conduct face to face interviews with all the household members aged 16 or over, to collect details of

²⁴ Accessible at <http://www.esds.ac.uk/findingData/snDescription.asp?sn=5375> (accessed 28 Jan 2011).

income and household variables such as household composition, regular bills, etc. All individuals aged 16 or over are also asked to keep a diary of expenditure for two weeks²⁵, and many children aged 7 to 15 are asked to keep a simplified version, the results of which are used to derive mean weekly expenditure on different product categories for each individual and for the household overall. More details of the survey design and process are found in ONS (2006a:part 4).

4.2.2.2 The Dutch Budget Survey

The Dutch Budget Survey (*budgetonderzoek*) began in 1978 and is conducted annually, with waves covering a calendar year. The data covers household expenditure, income and other socio-demographic variables. It is used to inform national statistics on consumer price indices and so on, and is also available for academic research purposes on request from Statistics Netherlands, the body which carries out the data collection.

Data are provided in one dataset providing household level data (one case per household), with key individual level variables provided for each household member (numbered 1 through to 6) given in separate variables for each person in the household.²⁶ Data, and the user guides provided with them, are available mostly in Dutch only, although email support is available in English for non-Dutch speakers too.

Households are sampled “from all Dutch households”, excluding people in institutions and care homes. Households are contacted from the address file using cluster sampling (firstly, 250 municipalities are selected, from within each of which households are randomly sampled). For households containing self-employed people, further participants are also selected from reference to a general business register (this is to increase the number of respondents who are self-employed, who have a lower response rate, as described below). Until 1999, the sample also included households that previously participated (hence it was a longitudinal study

²⁵ A sample of the diary can be seen in Rafferty and ESDS Government (2009:46–7).

²⁶ Households with more than 6 individuals are anonymised, so that data for the 7th person onwards is not provided.

with fresh sampling for attrition). From 2000 onwards (and hence for the data used in this research), previous participants were not asked again to participate. The sampling has thus been repeat cross-sectional since 2000.

The sample size was increased to 2400 (from 2000) for the year 2000 survey and onwards. This is the number of households which actually respond. The response rate is low, at 25% of households contacted (and only 10% for self employed households). This issue is discussed in 4.2.2.3 below.

Data collection consists of a questionnaire of income, socio-demographic and regular expense questions. Data on all expenditures are recorded in a diary over 10 days. Additionally, data on all expenses over 15.87 euro are supposed to be kept for an entire year, including expenditure whilst on any holidays.

More details are found in CBS (2002) (in English), and in much greater detail for the 2000 survey used in this research in CBS (2000) (in Dutch, accompanying the datasets).

4.2.2.3 Common data issues

Eurostat note that the “high incidence of non-response is a common and major problem” in household expenditure surveys. The problem is particularly severe for the Netherlands (and Belgium), likely because of the high demand placed on participating households, i.e. the need to record expenditure data for an entire year in the Dutch case (Eurostat 1997:20).

Low response rates raise questions about the representativeness of these datasets of the populations from which they are sampled. To address this issue, weighting variables are provided in both the UK and Dutch datasets that are intended to adjust results obtained from the sample of respondents so that they are representative of their respective populations. The weights are calculated based on comparison of the samples with their respective national populations. The UK weighting variable adjusts for non-response bias and for population totals, so that weighted totals from

the survey match national totals along lines of geographic region, age band and sex. The variable for the 2004-5 wave is calculated in comparison with the results from a mix of the 1991 and 2001 censuses (ONS 2006c:198–9). The Dutch data meanwhile are weighted to match the values of several variables in the survey, namely “household income, size of the household, sex (in one-person households), socio-economic category of the main breadwinner, [and] whether the occupant rents or owns the house” with the characteristics of the population as described in several other datasets²⁷ (CBS 2002:§ 3.3).

Selection biases may still remain along lines of other variables (CBS 2002:§ 3.3), and there are no variables in either dataset to control for the non-random sampling methods. However, the use of the survey data in official national statistics (such as the Consumer Price Indices) and other research described earlier is taken to indicate that the data are sufficiently representative of their respective national populations to be used as such in this research.

Differences in the income and expenditure data are also substantial and a potential issue. As noted by ONS (2006c:171–2), it is not intended that the data provide a “balance sheet” for the household. Income and expenditure do not equal one another, not least because they refer to different periods: income is asked for in the questionnaire as an average over the previous months, whilst expenditure is recorded over a specified period following the questionnaire. Neither necessarily includes all sources of income or expenditure, for various reasons (Dunn and Gibbins 2007:176–9). Households can also “smooth” their expenditure: saving or borrowing so that income and expenditure only come closer to matching over the longer term. In addition to these reasons, Deaton (1992:138) notes that “[n]o one who has looked at the year-to-year variation in reported consumption and income in a microeconomic data set comes away without being convinced that much of the variation is measurement error”. Again, apart from for specific situations described below, the effect of such measurement error on results in this thesis must largely be considered negligible.

²⁷ The Income Survey, the Household Survey and the Housing Demand Survey.

4.2.3 Data on the greenhouse gas emissions intensity of products

The household expenditure survey data described above is combined with data on the greenhouse gas emissions intensity of products. This is a measure of the level of the emissions that arise in the production and distribution of a product or service. The measure is given in terms of greenhouse gas emissions per unit of market value of the product, kg CO_{2e} per pound or euro. Hence, the figures given are intensities. Although these data exist for other environmental impacts too, this thesis is focusing on greenhouse gas emissions.

As these data are affected by economic and structural factors, they are specific to particular countries and time points. Robust data are available for far fewer countries than are household expenditure surveys. Both the Netherlands and the UK however have ongoing and long-established research developing these data. The availability of these data was also a consideration in the choice of case study countries. In the Netherlands, various academics including Vringer, Blok, Kok, Nijdam and others have worked both separately and together to develop the methodology and produce robust figures (see, for example, Vringer and Blok 1995; Kok et al. 2003; Nijdam et al. 2005; Vringer et al. 2010). In the UK, researchers at the Stockholm Environment Institute-York have similarly worked on producing these data for the UK as part of the wider work of Footprint Analysis (Wiedmann and Barrett 2005; Stockholm Environment Institute-York 2010). These data are used in their REAP (Resources and Energy Analysis Programme) software, which can be used to model the environmental effects of different policy options at local, regional or national (UK) levels in areas such as energy, transport, food, housing and planning.

Data for both UK and Dutch product emissions intensities were calculated using “hybrid” methodologies. More details of methods for calculating these data are given in Appendix 1. The data provide greenhouse gas emissions per unit price for the same categories of product and service as are used in the classification systems of the UK and Dutch household expenditure surveys. The data are thus tailored to and compatible with these surveys, allowing them to be combined with these data and

hence used to calculate the greenhouse gas emissions of the households in the survey samples.

The product greenhouse gas emissions intensity data used in this thesis were calculated by the research groups described above. For the UK, data are those calculated by researchers at the Stockholm Environment Institute-York, and are for the year 2004. The Dutch data were calculated by Vringer and colleagues, as described in Vringer et al. (2010), and are for the year 2000.

The product emissions intensities, i.e. the greenhouse gas emissions per pound or euro of market price, vary substantially between different products categories in both datasets. Two factors affect the emissions intensities of a product (such as a pair of shoes, for example). Firstly, the more greenhouse gases that are emitted during production and distribution per pair of shoes, the higher their emissions intensity. Secondly, the higher the price at which the pair of shoes is sold, the lower the emissions intensity (as the emissions per unit price is lower the higher the total price). Emissions intensities are thus affected by manufacturing and distribution methods, including the amount of fossil fuel energy used, and by market prices for the product in question.

In the Dutch data, emissions intensities are calculated for all 365 product categories used in the Dutch household expenditure survey. Values vary from a low of 0.1kg CO_{2e} per euro (for wages for domestic servants) to a high of 13.3kg CO_{2e} per euro (for matches and candles), although the next highest category, natural gas, has a value less than half this, at 6.5kg CO_{2e} per euro. Highest values are generally for direct energy use (petrol, electricity, solid and liquid fuels and natural gas have values between 4.7kg and 6.5kg CO_{2e} per euro). Food products have values varying from around 1.8kg up to 5.5kg CO_{2e} per euro, with fish and dairy products at the higher end of the range, and impacts from rice particularly high at 5.3kg CO_{2e} per euro. Meat is, unusually for such data, at the lower end of the range for food. Most foods have impacts around 1.5-2kg CO_{2e} per euro. Services mostly fall at the low

end of the overall range of intensities, whilst clothing and other material purchases are typically spread around the 1.0kg CO_{2e} per euro mark.

The UK data includes values for 54 different products and services²⁸, representing larger product categories than those used in the Dutch data. Patterns for the UK are similar to the Dutch data, with figures ranging from approximately 0.1kg CO_{2e} per pound (for house rental and mortgages) to over 6kg CO_{2e} per pound (for electricity, gas and other fuels).²⁹ A notable difference to the Dutch data is that meat products are reported to have the highest emissions intensities among foods. The highest emissions intensity products, electricity, gas and other fuels, have emissions intensities which are nearly double the next highest values (water and air transport).

One issue with these data is that all products within a given product category are taken to have the same product emissions intensity, whilst in reality they may vary greatly. A 50% sale will double a product's emissions intensity, for example. More importantly, luxury goods in a given product category, hand made rather than mass-produced, may have substantially lower emissions intensities, selling for a high per unit price with little difference in per unit emissions compared to mass-produced versions. As these are more likely to be bought by higher income earning households, this suggests results may systematically overestimate high income household emissions and underestimate low income emissions (Vringer and Blok 1995; Hertwich 2005b:4679).

4.2.4 Data on national total emissions from households

Cross-nationally comparable data on total emissions from Dutch and UK households are the final data required for this research. Although various studies have included emissions from both countries as part of comparative studies, only one was found by

²⁸ The nine categories of food for which intensities are calculated also have separate values for organic and non-organic foods, but food is not disaggregated in this way in the Expenditure and Food Survey. As such, overall figures for these categories are calculated by combining the organic and non-organic emissions intensities weighted according to the relative market shares of organic and non-organic foods in each category. Market share data were also supplied to the author by Stockholm Environment Institute-York.

²⁹ As part of the conditions of use of the UK data, the author is not permitted to give precise raw figures.

the author which uses multi-region input-output (MRIO) methods and data (as discussed in Appendix 1 in relation to the product emissions intensity data discussed above), and which also disaggregates national totals to provide total emissions from household consumption (the public sector and investments are the other components of total national emissions presented by the dataset). This is the Carbon Footprint of Nations project (www.carbonfootprintofnations.com, and see Hertwich and Peters 2009). The website provides access to the calculated data for all nations, including the UK and the Netherlands, whilst Hertwich and Peters (2009) describe the methods in more detail and discuss the results. The study uses input-output tables for 72 countries and a further 15 aggregated regions drawn from the Global Trade Analysis Project, combined with carbon dioxide emissions also from the same project, and non-CO₂ greenhouse gas emissions from other sources, calibrated and supplemented by the authors, where possible, with national and other more accurate emissions data (*ibid.*). Based on the MRIO methods and data used, the results can thus be expected to be the most robust cross-nationally comparable set of data on national emissions and emissions from household consumption available, and so represent a suitable dataset to draw on in this research.

4.3 Data preparation

The UK and Dutch datasets required differing degrees of data preparation before use. The final dataset needs to have the household as the unit of analysis (i.e. one case entry per household, rather than per individual), and to have the dependent and independent variables operationalised. Various checks of data validity are also required. The process of preparing the data also included substantial cross-checks and verification to ensure errors in recoding were spotted and corrected. All initial data preparation and testing was performed in SPSS 14.0.1 for Windows, using syntax developed by the author. The syntax included extensive testing and debugging to minimise the risk of calculation errors. The detailed procedures performed, and their purpose, were also recorded in a “diary” to have a record of what was done and enable the author to go back and perform checks as necessary.

Specific details of the preparation of the dependent and independent variables are given below.

4.3.1 Dependent variables

Three dependent variables are used in the thesis: household expenditure (expressed as pounds or euro per year); household greenhouse gas emissions (kg of carbon dioxide, or equivalent, emissions per year); and Household Emissions Intensity (greenhouse gas emissions per pound or euro spent by the household). The rationale for analysing these variables is discussed in the previous chapter. The preparation of these variables is described below, noting particular issues with the data used.

4.3.1.1 Household expenditure

For the purposes of this research, household expenditure is used as a dependent variable, here meaning the total expenditure by the household per year (in pounds Sterling or euro per year). For both the UK and the Netherlands, the household expenditure surveys include this variable.³⁰

The datasets also subdivide household expenditure into more detailed product categories. A complete list of these categories is available in ONS (2006b) for the UK and CBS (2000) for the Netherlands.³¹ The final data supplied to Eurostat from these surveys are converted into the international standard COICOP³² categorisation of products and services, but neither the UK nor the Netherlands follow this standard in the initial data collection (the UK largely follows it but has various modifications), and it is not standardised in the datasets provided for analysis.

To validate the total expenditure variable supplied in the datasets, one can also sum the expenditures on each individual product category to ensure that the totals match.

³⁰ For the UK, the provided data give a weekly expenditure, which I convert to annual. For the Netherlands, the dataset gives figures in Dutch Guilder, which I convert to euro based on the currencies' official fixed exchange rate, Dfl 1: €2.20371.

³¹ In Dutch. An English-language table for the codes was also helpfully provided to the author by Kees Vringer (2009, pers. comm.).

³² Classification of Individual Consumption by Purpose

There is commonly some underreporting of purchases of infrequently bought goods (such as large items: white goods, furniture, cars, etc), as there is a strong likelihood that none are bought in the data collection period (although this is less problematic in the Dutch data given that it is collected for a full year).

4.3.1.2 Household greenhouse gas emissions

Household greenhouse gases emissions are calculated by the author as another dependent variable. This variable is expressed in the thesis in terms of kg CO_{2e} per year.³³

A household's total greenhouse gas emissions are a product of the individual emissions arising from each item that it purchases. That is, the emissions arising due to the production and distribution of that item are attributed to the household which purchases it. To calculate the greenhouse gas emissions of a household in the household expenditure surveys, the product emissions intensity data described above are matched with the equivalent category of expenditure in the expenditure survey datasets. As, in both countries, the categories used in the emissions intensity data are designed to match the expenditure survey categories of expenditure, this is not a complex procedure (although there are some minor complications for the UK due to the fact that the two datasets do not follow the same categorisation of products fully). Greenhouse gas emissions can thus be calculated for each household for expenditure in each product category. For example, in the UK, for the category of clothing (COICOP code 3.1), expenditure is given in the expenditure survey by variable FS31. The greenhouse gas emissions associated with that are calculated and stored in a new variable, GHG_FS31. The total greenhouse gas emissions of each household are then calculated by summing the emissions from each of these product categories.

³³ Tonnes rather than kg are used for presenting total national emissions from all households. CO_{2e} refers to "carbon dioxide equivalent", a standardised unit for equalising emissions of different climate changing gases, described in chapter 2, footnote 5.

The calculated greenhouse gas emissions are affected by the same issues of underreporting that affects the expenditure data upon which they are based. An additional issue is that the greenhouse gas emissions figures calculated are estimates of the actual household emissions, as opposed to household expenditure figures, which, excepting measurement errors, are in principle what the household actually spent. The figures are estimates of actual emissions for two reasons. Firstly, the product emissions intensity data are average emissions per pound or euro spent on a particular *category* of product: they do not go down to the level of individual products, nor take into account sale prices on items a particular household bought, which could lead to systematic errors in the emissions estimates for particular demographic groups as described above.

Secondly, even if this could be taken account of, the issue remains that it is not possible, in reality, to “correctly” calculate the emissions arising as a result of producing and distributing any given product. Certain decisions have to be made in the calculations of product emissions intensities about where emissions are allocated to, and about the production efficiencies of other countries’ economies based on data that is quite aggregated (Vringer et al. 2010).

Despite these provisos, the greenhouse gas emissions variable provides the best available estimate of the greenhouse gas costs of a household’s consumption behaviour. It is widely used in other studies, as has already been described, and still enables what seem to be reasonable estimates to be made of the greenhouse gas emissions of different households and demographic groups.

4.3.1.3 Household Emissions Intensity

The third dependent variable used in the research is Household Emissions Intensity. Household Emissions Intensity is a measure of the household’s greenhouse gas emissions per pound or euro that it spends. It is measured in kg CO_{2e} per pound/euro (as with product emissions intensities). Household Emissions Intensity is calculated for each household simply by dividing its total greenhouse gas emissions by its total

expenditure for a given period. The accuracy of the variable is thus dependent on the accuracy of the two variables from which it is derived.

4.3.2 Independent variables

Chapter 3, section 3.5.2 presented the variables which the consumer behaviour literature suggests could influence household greenhouse gases, expenditure and Household Emissions Intensity. Where they are available in, or can be derived from, the data used here, they are included as independent variables in the analyses in this thesis. This section details the process of preparing these independent variables, as inevitably the data available is not always in the format required. Chapter 3 mentioned other variables which could have added to model fit but which are not available in the datasets; they are not recapped here.

The household expenditure surveys used do collect a wide range of variables about the household and its members in addition to their expenditure patterns. By selecting the survey years discussed earlier (2004-5 for the UK, 2000 for the Netherlands), both countries' datasets include the variables required to test the research hypotheses, namely the working hours and earned incomes of members of the household. Further variables are also present that are useful to enrich the results and the discussion of their implications for policy. Where the variables pertain to individuals within the household (e.g. working hours, income), they are included in the model only for the head of household and, if present, his or her partner. It is an assumption of the model that variations in these characteristics for other household members contribute only a small amount to model variability and so are omitted for reasons of parsimony.

Note that there is a common procedure applied to all individual-level variables: for couple households, variables were recoded for the male and for the female, which in this research are considered joint heads of household. This differs from the approach taken in the datasets, which define a head of household (in the UK, the Household Reference Person; in the Netherlands, the main breadwinner, *hoofdkostwinner*) based on gender neutral criteria such as who is the principle income earner or house owner.

Recoding variables to have male and female separately allows gender effects to be analysed.³⁴

4.3.2.1 Income

Existing research finds that different sources of income affect the dependent variables above in different ways. In households with a male and female couple living together, income is found to have different effects depending on whether the male or female, or another household member, receives the money, and on whether the income is earned through paid work or received as benefits (see section 3.5.2.1).

For this research, model explanatory power will therefore likely be improved if these variables are included in the model, instead of using one variable for total household income, which would be an alternative approach. The household's total income is therefore disaggregated into several variables. For both the UK and the Netherlands, male and female earned incomes are included as separate variables. For the Netherlands, a third variable then represents all other sources of household income. It is not possible in the Netherlands to disaggregate the data any further: the three variables combined equal total household income. For the UK, this is possible, and "all other sources of household income" is further subdivided into the following variables: male non-earned private income (e.g. pension income, share dividends, interest on savings, property rental income), male income from benefits, female non-earned private income, female income from benefits, and income from other sources (which is primarily from other household members). Table 4.2 below summarises the income variables used for the UK and the Netherlands for couple and single households: note that "income from other sources" in the Netherlands includes income that is split into several variables in the UK (five in couple households, three in single households).

³⁴ In same-sex households, variables for the individual defined in the survey as the head of household are classed as the male variables, for their partner, the female variables. These households are however excluded from regression analyses for couple households (in chapter 5) as they would affect the conclusions regarding gender differences in the effects of predictor variables on the dependent variables.

Table 4.2 Gross income variables used in analyses: couple and single households

Couple households	
<i>UK income variables</i>	<i>Dutch income variables</i>
Male earned income	Male earned income
Female earned income	Female earned income
Male non-earned private income	
Male income from benefits	
Female non-earned private income	
Female income from benefits	
Income from other sources	Income from other sources
Sum of above equals total household income	Sum of above equals total household income
Single households	
<i>UK income variables</i>	<i>Dutch income variables</i>
Head of household earned income	Head of household earned income
Head of household non-earned private income	
Head of household income from benefits	
Income from other sources	Income from other sources
Sum of above equals total household income	Sum of above equals total household income

The income variables used are gross (before tax deductions). Gross income is used in this research for several reasons. Primarily this is because this research uses scenario models, in which hypothetical reductions in the working hours of particular household members are modelled. The effect of a 20% reduction in working hours (for example) would be a 20% reduction in gross earned income. Using net income would entail that both the UK and Dutch income tax systems need to be accurately modelled, something that would be prohibitively complex for the research, especially as there would not be any clear benefits for the conclusions reached. A further reason gross income is used is more practical: while the Dutch dataset provides gross and net income for the household as a whole, for individual household members only gross income figures are provided. This means gross income must be used for the Dutch analyses, and so for comparability the same is used for the UK.

As well as gross income, which is used in the modelling in the subsequent chapters, equivalised income is also used to present some results throughout the thesis. Equivalised income takes account of the argument that the more people that live in a household, the less money is needed per capita to reach a certain level of material affluence. This is based on the assumption that a certain proportion of household expenditure is on goods and services whose utility can be shared by the household

members (such as heating, living space, economies of scale in food purchasing, etc), and also that children need fewer resources than adults. This equivalised income is also calculated by the author for use in the research, using the modified OECD equivalence scale developed by Hagenaaars, de Vos and Zaidi (1994). Under this scale, household income is divided by an “equivalence factor”, which is the sum of the values from the following: the first adult in the household has a value of 1; subsequent adults (aged 14 or over) have a value of 0.5; children (13 and under) have a value of 0.3. The equivalised income is essentially an attempt, albeit approximate, to compare households with equivalent living standards, measured as an equivalised per capita income. However, many different equivalence scales exist, and for all of them the weighting of different household members is essentially arbitrary, with the potential to over- or under-estimate living standards in different countries or for particular demographic groups. The modified OECD scale is used in this research as it is the standard scale used in EU income studies, including other work on the household expenditure data used in this research (Chanfreau and Burchardt 2008; Dunn and Gibbins 2007). Equivalised income is *not* however used in the regression models because both the total expenditure and total greenhouse gas emissions from a household, the two main dependent variables analysed in the models, are expected to correlate linearly with its total income, without equivalising it for the number of household members, following the model of the household developed in chapter 3, section 3.5.1, itself drawing on the approach of Phipps and Burton (1998).

Income data may suffer from underreporting by some groups. This can especially be the case for the self-employed, for whom even knowing what constitutes income may be difficult (Deaton 1992:139), and for the lowest (reported) income households. No adjustments are made for this issue in the analyses in this research. The implication is that the results in this research are less accurate for households with the lowest incomes than for other groups. However, this issue has little effect on the conclusions drawn in the thesis: in terms of their greenhouse gas emissions, these households still contribute less than other households, and changes in their working patterns have the least effect on national emissions in the scenarios modelled in chapters 6 and 7. In terms of the policy implications discussed too, these are still

likely to be the households with the fewest capabilities to make use of the opportunities provided by policy to reduce their working hours or take career breaks, as their income is still the lowest and least secure. The overall impact of the underreporting issue is therefore likely to be negligible.

4.3.2.2 Paid working time

In both countries, variables are included in the data for the usual paid working hours of household members.

In the UK dataset, four working hours variables are included. Three are for employees, being usual working hours (excluding breaks and overtime), hours of paid overtime usually worked, and hours of unpaid overtime usually worked. For self-employed people, one variable is included for usual working hours, with no separate variables for overtime (which is arguably not considered a meaningful concept in this context). In no cases are there simultaneously non-zero values for the employed and self-employed working hours variables, i.e. if an individual has hours as an employee recorded, the value for self-employed hours is always zero, and vice versa. As type of employment is not considered in the research, the variables were summed into one for each individual included in the models. This creates a variable showing the individual's total working hours, regardless of whether they are from employment or self-employment, or whether they are normal hours, paid overtime, or unpaid overtime. This also increases comparability with the Dutch variables, discussed next.

In the Dutch data, only one variable is included for working hours for each household member, being the average working hours per week of the individual in all forms of employment or self-employment. Use of the variable is complicated by the fact that all values below 13 hours per week are coded as zero, apparently because this is considered as not employed by the definitions of Dutch unemployment benefit rules. Values over 97 hours per week are also anonymised, coded as 98 hours. Although this in principle means the variable cannot be used as a continuous one, in practice it was found that using it as a continuous variable had

little effect on regression model results (as compared to recoding it as a set of dummy variables representing a categorical variable). Chapter 5, in which the regression models are fitted, discusses this issue in more detail.

These working time variables are inevitably estimates of what individuals actually work. Not everyone has regular work, or fixed, regular hours, especially when it comes to overtime and for the self-employed. The variables also make no consideration of differences in annual holiday leave entitlements, which are relevant for this research as leave effectively reduces the average hours per week worked over the year. Nevertheless, these variables are the best estimates of people's average weekly working time that can be made based on the data available.

4.3.2.3 Hourly wage rate

No wage rate variable is provided in the datasets, but it can be easily derived from the data on working hours and income. The gross wage rate of individuals is, by definition in this research, the individual's total gross earned income divided by the usual working hours. This provides a variable that is a reflection of the actual hourly wage rate of the individual. This may differ from what would be present in their employment contract, as this may exclude overtime either paid at a higher rate or unpaid, or instead be an annual amount not closely connected to hours worked.

4.3.2.4 Other independent variables

Various other variables are included in the modelling in this research that are likely to increase model fit, and which are useful for identifying different demographic groups whom are likely to make different work life balance decisions. The variables included are discussed in the previous chapter in sections 3.5.2.3. to 3.5.2.6. Here, their operationalisation from the available data is discussed.

Firstly, various "household structure" variables are included; that is, variables describing the numbers and ages of household members. The number of adults is included, a variable which includes all individuals aged 18 or over, including the head of household and partner, if present. The numbers of children are also included.

As there is evidence that the age of children is important, both for patterns of expenditure (as it effects their material needs), and for work life balance decisions, three variables capture the numbers of children aged under 2, aged 2 to 4, and aged 5 to 17. These age bands were chosen as these variables are already presented in the UK dataset and can be easily derived from the Dutch data.

The age and education level of the head of household were also included. For couple households, as there is a high correlation between values for male and female, the male data were chosen as a proxy for the couple. An alternative would have been to calculate average values for the male and female, but for education level, a categorical variable, this is problematic. Age is included as age in years, data that are provided in both countries' datasets. Data on education level are not comparable between the UK and Dutch datasets, but nevertheless are included as control variables. For the UK, the variable is a numeric one representing the age at which the individual left full time education. For the Netherlands, a complex categorical variable representing educational attainment level and subject area is provided (following the SOI-1998 classification; see Moens 1999 for details of it). This is simplified and recoded by the author into a categorical variable showing the highest education "level" attained, dummy variables for which are used in the analyses.

The number of people economically active, or number of income earners, in the household is also included, i.e. the numbers engaged in paid employment or self-employment. These variables are present in the datasets.

A household "class" variable was included. In both countries, this variable is categorical, and relates to the type of occupation of the head of household (the Household Reference Person in the UK, and the main breadwinner in the Netherlands). For the UK, a version of the National Statistics' standard Socio-economic Classification is used, as provided in the dataset. For the Netherlands, the most comparable variable was selected, being the nature of the work of the main breadwinner. The variables are not however directly comparable between the two countries, with more categories in the UK variable than the Dutch one, but for both

they broadly range from lower, manual and unskilled work, to higher, professional, skilled work. The UK also includes students as a separate category. For both countries, dummy variables were prepared by the author from these variables for use in the analyses.

The physical size of the household was included. Various variables could have been used to describe this for the UK, however for maximum comparability number of rooms was used for both countries. For the UK, the variable was described as the number of rooms occupied, whilst for the Netherlands the variable was the number of rooms in the dwelling. As this Dutch variable is top-coded at 6 (i.e. values of 6 or higher are all recorded as 6 for the purposes of respondent anonymity), dummies for both countries were prepared for 3, 4, 5, and 6 or more rooms, with 1 and 2 rooms set as a reference value.

Finally, the geographic region of the household was included in the UK analyses. The dataset includes a variable placing households within 12 broad “government regions” of the country. This is the most detailed geographic data available, but is still clearly fairly crude. Dummy variables were prepared by the author from the categorical variable provided in the dataset. No geographic information is supplied in the Dutch data, so there is no equivalent used in the Dutch analyses.

4.3.3 Estimating national emissions based on sample means

The greenhouse gas emissions variable can be used to calculate mean emissions from households, or from particular demographic groups (such as households with dependent children, for example).

Total national emissions from all households are also discussed in the thesis, as are total emissions from all households in particular demographic groups. In principle, totals can be calculated simply by multiplying the mean household greenhouse gas emissions in the survey data by the number of households in the country. This latter figure can be easily calculated based on Eurostat data on the national population, divided by mean household size. In practice, results calculated in this way differ

substantially from other estimates of national greenhouse gas emissions from households. Product emissions intensity data, and resultant estimates of household emissions, are intended primarily for micro-level research. They provide an accurate way to compare relative emissions levels between products or demographic groups, but are not intended for calculating national estimates, as small measurement errors and rounding of figures multiply up into substantial errors. This in part reflects differences in household expenditure calculated in this way or estimated at the national level (see, for example, Buiten 1994 for a discussion of why mean household expenditure calculated from household expenditure survey data cannot be used to infer total national expenditure accurately).

Instead, to produce meaningful estimates of national level total greenhouse gas emissions from private households, the household level data calculated in this thesis are calibrated against secondary estimates of national total emissions from households, following the approach taken by Vringer et al (2010). In short, the national total emissions from households, calculated as part of the Carbon Footprint of Nations project, as described above in section 4.2.4, are used. These are then divided by the mean emissions per household calculated in this thesis based on the household expenditure survey and product emissions intensity data. This provides a multiplication factor for both the UK and the Netherlands which can be used to convert estimates of mean household emissions into national totals.

A small issue with this approach is that the national level data from the Carbon Footprint of Nations project refer to the year 2001, whilst the household level data refer to 2004-5 and 2000 (for the UK and the Netherlands, respectively). The national results from the Carbon Footprint of Nations project are used because they represent among the most comparable cross-national data on household emissions available³⁵. This comparability is useful for comparing results between the UK and the Netherlands in this research. This difference in survey years is unlikely to affect results substantially. Consumption and emissions levels will not have changed much

³⁵ Other comparative research which includes both the Netherlands and the UK either use product emissions intensities from one of the study countries as proxies for another, or only include CO₂ and not other greenhouse gases (e.g. Kerkhof, Benders, and Moll 2009).

over the short periods involved. Additionally, the primary value of the household level results is to allow changes in emissions between different scenarios to be calculated, and to compare differences between demographic groups, and these relative changes and differences are unlikely to have changed much either over such a short timeframe.

4.3.4 Validity of data comparison within and between countries

The differences between the UK and Dutch raw household expenditure data and, particularly, product emissions intensity data, in terms of raw data sources and methods used to calculate the figures³⁶, also have some effects on which results can be validly compared between countries in this research. The principle proviso is that mean greenhouse gas emissions figures cannot be reliably compared between the UK and the Netherlands: the mean household figures are approximate and may be systematically under or overestimated comparing the UK and the Netherlands, and indeed with other studies using different data and methods. Hence, comparing the mean household *tonnage* emissions results between the UK and the Netherlands in this research would not be valid. What are more reliable are the following: firstly, at the household level, the *percentage* differences in emissions between types of household (demographic groups) within-country; secondly, the percentage change in household emissions between the different scenarios of changing working patterns, both within and between countries; and finally, at the national level, the tonnage greenhouse gas emissions, and the tonnage and percentage change in these emissions under the different scenarios, can be reliably compared within and between countries, as they are calibrated to a cross-national comparative dataset that can be considered one of the most robust available.

With respect to the mean household emissions calculated in this research, the figures for the Netherlands do nevertheless compare well with other published sources, which use the same datasets. Vringer et al. (2010), for example, calculates mean household emissions of 28.4 tonnes CO_{2e} per annum in the year 2000, similar to that calculated in this research, as presented below in Table 4.5. UK figures published

³⁶ These differences were discussed above in sections 4.2.2 and 4.2.3.

elsewhere are somewhat higher than those presented here, e.g. Druckman and Jackson (2008b:14), using different data and methods to those used here (as described above in section 4.2.3), estimate household mean emissions to be 26 tonnes CO_{2e} per annum in 2004, some 29% higher than the result here, also as shown in Table 4.5. Gough et al (2011:9) calculate mean figures for 2006 for the UK that are even higher, 28.9 tonnes CO_{2e} per annum, some 43% higher than the results in this research. While they use similar data drawing on the same datasets, but the following year's wave, they use a substantially different method of calculation, and acknowledge that their results are rather high compared to other work (ibid.). These differences highlight the necessity to take household mean tonnage emissions in this research as indicative, and rely only on those results outlined in the previous paragraph.

4.4 A first look at the data: Patterns of greenhouse gas emissions from households

In both the UK and the Netherlands, households contribute the major share of total national greenhouse gas emissions. The Carbon Footprint of Nations project estimates that, in 2001, UK household consumption emissions were 694.6 millions tonnes CO_{2e}, 76.1% of the national total. For the Netherlands, households accounted for emissions of 175.1 millions tonnes, 65.5% of the national total (www.carbonfootprintofnations.com, and see Hertwich and Peters 2009). The remainder of emissions arises from government activities and capital investment.

It would provide useful context to the research in this thesis to take a more detailed look at these household emissions. This section first looks at how a household's greenhouse gas emissions are affected by its total expenditure and by its Household Emissions Intensity, hence looking at how the three dependent variables interrelate.³⁷

It continues with an overview of how emissions vary between different demographic groups which are frequently distinguished and treated differently by work life

³⁷ Some basic distributional data for the dependent variables (mean, median, skew and kurtosis) are provided in Appendix 2 for reference. Greenhouse gas emissions and expenditure are highly skewed and kurtic, particularly in the UK, with a long tail of high spending, high emitting households. Household Emissions Intensity is more normally distributed.

balance policy, to gain a first understanding of how policies to influence working patterns might in turn affect emissions.

A household's greenhouse gas emissions correlate quite strongly with total expenditure, as can be seen in Figure 4.1 and Figure 4.2 below. 75% of the variance in UK household greenhouse gas emissions, and 86% of variance in Dutch household emissions, can be predicted using expenditure alone.³⁸ However, there is also clearly substantial variation in household emissions at any given level of expenditure. This variation is what is captured in the variable Household Emissions Intensity (recall that total household expenditure x Household Emissions Intensity = total household greenhouse gas emissions), and is the result of differences in the types of goods and services that households buy. A household with a relatively high level of emissions for its level of expenditure might spend more on heating the home, on vehicle fuel (for private travel), on flights, and on meat and dairy products, for example, whilst another household with the same expenditure level but relatively low levels of emissions might spend less on these, preferring to have a cooler or more insulated home, travelling by public transport, bicycle or on foot, eating a vegetarian diet, but spending more instead on the mortgage, on IT equipment and clothing, and on goods for cultural activities.

Table 4.3 below shows the correlations between pairs of the three dependent variables for the UK and for the Netherlands, respectively, tested using Spearman's rho tests. In keeping with the result mentioned above, strong correlations are found between household greenhouse gas emissions and expenditure in both countries, with Spearman's rho test correlations of 0.902 in the UK and 0.952 in the Netherlands. There is also negative correlation between expenditure and Household Emissions Intensity in the UK, i.e. HEI falls as expenditure increases. Negative correlation is to be expected, considering that both are also clearly correlated to income, as is seen in the next chapter (expenditure being positively correlated with income, and HEI

³⁸ This is based on the adjusted R^2 calculated using OLS linear regression of the natural logs of the variables, to regress household greenhouse gas emissions onto household total expenditure. As total emissions = expenditure x Household Emissions Intensity (HEI), taking the natural log of the variables allows a linear regression to be performed and the relative importance of the two independent variables to be estimated (as $\ln \text{emissions} = \ln \text{expenditure} + \ln \text{HEI}$).

negatively correlated with it). Negative correlation between these two variables is found for the Netherlands too, but the result is not significant. Household emissions correlate with HEI positively in the Netherlands, as would be expected (a higher HEI means higher emissions for a given level of expenditure). The correlation is not strong enough to be significant in the UK however, so the negative correlation reported in the table is not reliable.

Table 4.3 Correlations between the dependent variables household greenhouse gas emissions, household total expenditure and Household Emissions Intensity for UK households, 2004-5, and Dutch households, 2000

	UK	Netherlands
Annual greenhouse gas emissions (tonnes CO _{2e} per annum) X Total annual expenditure (£/€ per annum)	0.902*	0.952*
Total annual expenditure (£/€ per annum) X Household Emissions Intensity (kg CO _{2e} per £/€ expenditure)	-0.411*	-0.040
Annual greenhouse gas emissions (tonnes CO _{2e} per annum) X Household Emissions Intensity (kg CO _{2e} per £/€ expenditure)	-0.022	0.240*

* Significant at above the 0.1% level.
NB. Results show Spearman’s rho correlations, two-tailed, cases excluded pairwise. 0 = no correlation; 1 = perfect correlation.

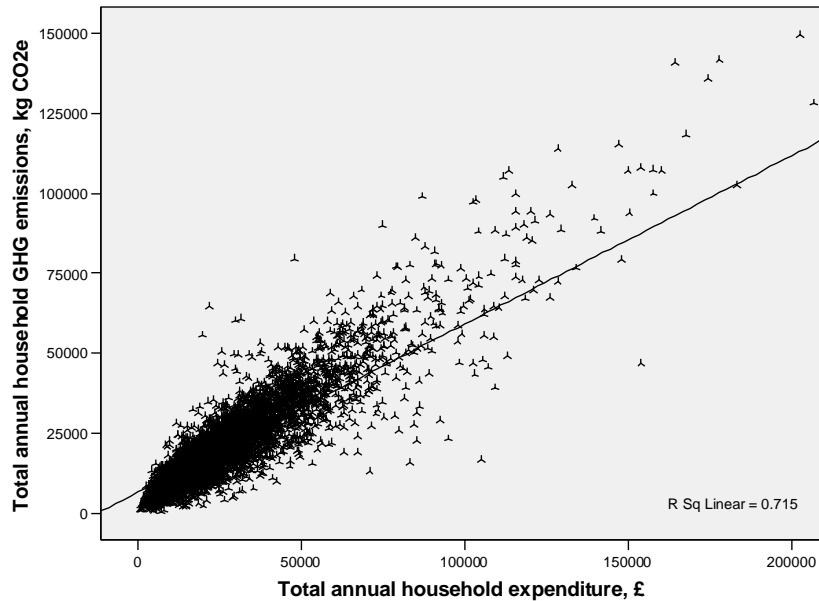
The fact described earlier that Household Emissions Intensity varies substantially between households means that there is value for this research in analysing greenhouse gas emissions, rather than taking a simpler approach of using expenditure as a proxy for the emissions of a household. At the same time, the strong correlation between expenditure and emissions adds weight to the theoretical argument that changes in working patterns will predictably alter greenhouse gas emissions. This is because the link between expenditure and emissions is one of the important assumptions underlying this hypothesis, which argues that:

Reduction in paid working time → Reduction in income → Reduction in expenditure → Reduction in greenhouse gas emissions³⁹

³⁹ Where the arrows indicate the direction of the theorised relationship. This argument was described in chapter 2.

Figure 4.1 Scatter graph of UK household greenhouse gas emissions against expenditure, 2004-5

N = 6,798

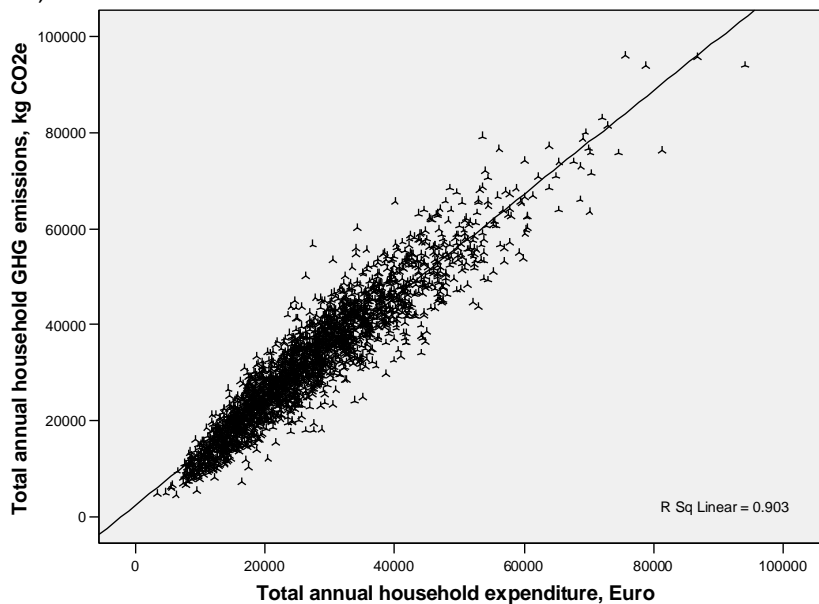


NB. Cases with emissions above 150,000kg CO₂e per annum or expenditure above £200,000 per annum are excluded from the figure.

Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 4.2 Scatter graph of Dutch household greenhouse gas emissions against expenditure, 2000

N = 2,395



NB. Cases with emissions above 150,000kg CO₂e per annum or expenditure above €100,000 per annum are excluded from the figure.

Source: Author's own calculations. See section 4.2 for details of datasets used.

How do patterns of emissions vary by demographic group? Working time policies generally do not (only) have a goal for the whole population, but rather target specific demographic groups with distinct goals. Variables such as whether the occupants are a single or a couple, whether they have children, and their age band, determine what working time policies a household will be subject to, and how it might respond to them. It is instructive, therefore, to divide the population along these lines to get an understanding of the contribution different groups make to national emissions. Figure 4.3 and Figure 4.4 below do just that, and show total household emissions from the UK and Dutch populations, disaggregated by age and household type. Household type contains four categories, defined by whether it is a couple or single household and whether there are dependent children (aged 0 to 17) present or not. Note that these households may also include other household members (e.g. adult children still resident, parents of the head of household and partner, more distant relatives or unrelated residents). Age refers to the age of the male in couple households, or of the head of household in single households.⁴⁰

The figures show how different demographic groups contribute to greenhouse gas emissions in the two countries. This gives some indication of the importance of considering these emissions in the design of working time policies which target these different groups. As an example, a policy which aims to increase the participation rate of single parents may, or may not, have a big effect on the social goal of reducing child poverty but, regardless, as this group's total level of greenhouse emissions is small (as the figures show), it is unlikely to have a large impact on national greenhouse gas emissions. As such, it could be argued that it is less important to consider this environmental effect in the design of such policies for single parents. For other groups of the population, such as couple households, or older worker households, their total emissions are much larger and so arguably demand greater consideration in policy design.

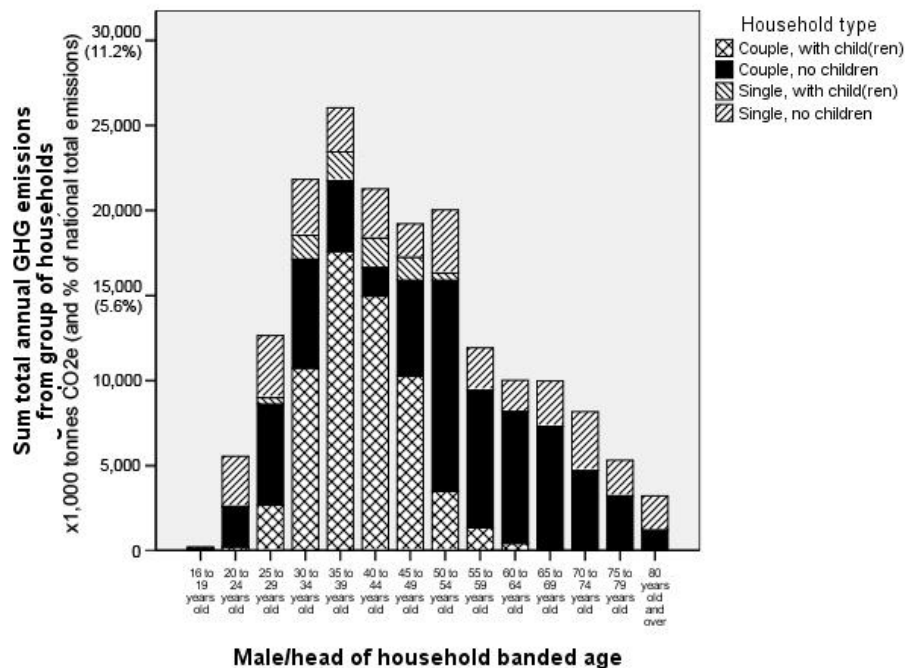
⁴⁰ In couple households which are a same-sex couple, age also refers to that of the head of household.

Working time policies by definition affect only those households of working age (although they can, of course, alter what working age actually is, by changing the retirement age for example). Based on current retirement ages, in the graphs below those of working age are approximately those in which the head of household is up to 64 years of age.⁴¹ It can be seen that two groups most targeted by working time policies – households with children (via policies on parental leave and working time flexibility), and older worker (age 50 to 64) households (via retirement and other older worker employment policies) – constitute a large proportion of the total greenhouse gas emissions arising from working age households. Working time policy could in theory therefore have a very large effect on greenhouse gas emissions.

⁴¹ For couple households, those where the male is aged 65 or over are still classed as working age in this thesis if the female is below retirement age (below 60 in UK, below 65 in the Netherlands). As such, some households in the graphs in age bands 65 and over are of working age based on the definition used in this thesis. This only applies to a small percentage of the households and does not result in substantial differences in the conclusions drawn from the figures.

Figure 4.3 Total annual greenhouse gas emissions from UK households, by age and demographic group (household type), 2004-5

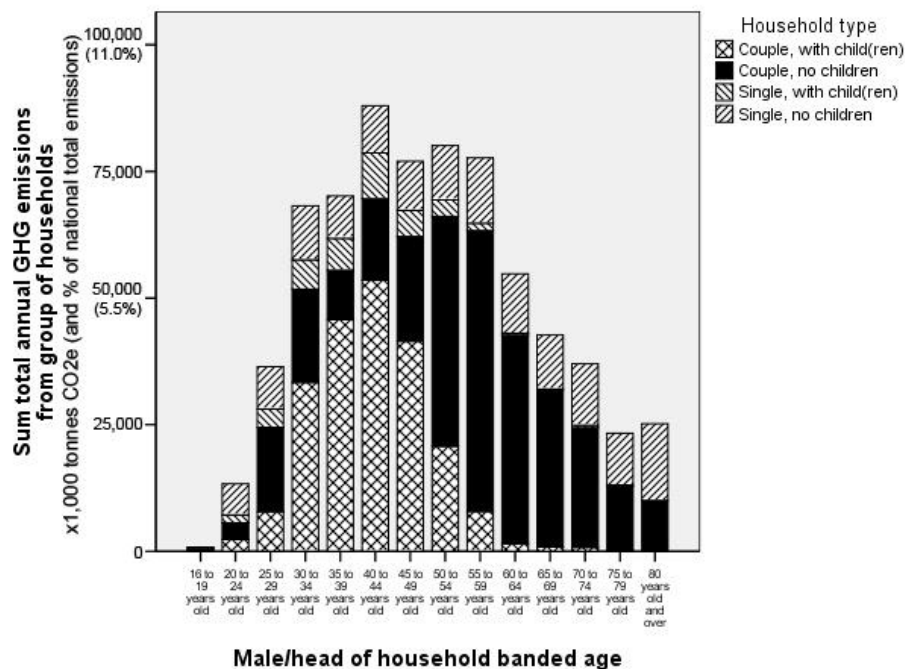
N = 6,798; weighted.



Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 4.4 Total annual greenhouse gas emissions from Dutch households, by age and demographic group (household type), 2000

N = 2,395; weighted.



Source: Author's own calculations. See section 4.2 for details of datasets used.

Table 4.4 provides further details of the contribution of different demographic groups to greenhouse gas emissions, and what shares of the population they represent.

Working age households account for 82% (UK) and 88% (NL) of all household emissions, the large majority. In both countries, they also represent approximately 60% of national emissions from all sources (i.e. including public sector and investment emissions too).

Within working age households, the big demographic groups which working time policies tend to target represent a large share of total emissions, as the graphs above also indicated. Households with children constitute about 45% of working age household emissions in both countries. Households containing at least one older worker (between 50 and official retirement age) out of the head of household and partner (if there is one) account for 39% (UK) and 32% (NL) of such emissions. Altering their working patterns, which current working time policies aim to do, could therefore have substantial effects on national total emissions. On the other hand, as suggested earlier, single households with children account for just 5-6% of total emissions, so working time policies targeting this demographic group are unlikely to have a large effect on national emissions.

Two other things are apparent from the table. One is that the distributions of emissions and of the working age population between demographic groups are very similar between the two countries. This aids with comparisons between them in subsequent chapters: as the baseline situation is so similar, certain demographic characteristics can be discounted when analysing the source of differences.

The tables also show that the share of emissions from a particular demographic group matches quite closely the share of the working age population that it represents. Emissions are not so affected by the presence of dependents meanwhile – the presence of children appears to have little effect on emissions, based on the data in the table.

Table 4.4 Greenhouse gas emissions data and population distributions for different demographic groups, for the UK (2004-5) and the Netherlands (2000)

Demographic group	Total emissions from all households (millions tonnes CO _{2e} per year)		Share of total national emissions from all sources		Share of emissions from all working age households*		Proportion of total number of working age households		Proportion of all working age individuals in sample	
	UK	NL	UK	NL	UK	NL	UK	NL	UK	NL
All households										
All households	695	175	76%	66%	-	-	-	-	100%	100%
Working age households										
All working age* households	567	154	62%	58%	100% (82% of all household emissions)	100% (88% of all household emissions)	100%	100%	98%	100%
Of which:										
All couple** households	450	122	49%	46%	79%	79%	67%	66%	76%	79%
<i>Couples with children</i>	215	62	24%	23%	38%	40%	31%	31%	35%	38%
<i>Couples without children</i>	235	60	26%	23%	41%	39%	36%	34%	41%	41%
All single** households	117	33	13%	12%	21%	21%	33%	34%	22%	21%
<i>All single with children</i>	37	7	4%	3%	6%	5%	9%	6%	6%	4%
<i>All single without children</i>	80	25	9%	10%	14%	16%	24%	29%	16%	17%
Older** households	220	49	24%	18%	39%	32%	36%	31%	37%	32%
<i>Older couple households</i>	187	40	21%	15%	33%	26%	27%	22%	31%	26%
<i>Older single households</i>	33	8	4%	3%	6%	5%	9%	9%	6%	6%

* Working age households defined as: of the head of household and, if present, partner, at least one below official retirement age, signifying aged up to 64 for male, and aged up to 59 (UK) or 64 (Netherlands) for female.

** Couple household: head of household lives with partner, and other individuals may also be resident in household.

Single household: head of household not living with partner, but other individuals may be resident in household.

Older household: at least one of head of household or, if present, partner, is of older working age (age between 50 and official retirement age).

NB. Rounding may mean the sum of results in the table for different demographic groups do not match the totals for all working age households exactly.

Source: Author's own calculations; except total emissions from all households in UK/Netherlands, which are as per www.carbonfootprintofnations.com; see also Hertwich and Peters (2009). See section 4.2 for details of datasets used.

Table 4.5 below shows mean emissions per household and per capita, given for different demographic groups. In both countries, mean emissions *per household* are substantially higher in couple as opposed to single households. However, if emissions *per capita* are looked at, it can be seen that per capita, emissions are actually quite unaffected by whether the household is a couple or single one.

The effect of being an older household on overall and per capita emissions seems to be negligible. The effect of dependents meanwhile can be seen through comparison of households with and without children: households with children produce somewhat higher emissions, but taken per capita, households with children actually have much lower emissions than those without children. Again, this is consistent with the presence of dependent children increasing the *need* to spend but not the *ability* to do so – when a household has a child, expenditure (and so emissions) per capita fall whilst the household's total emissions remain similar, as total expenditure doesn't change much, even if the types of things bought might.

Table 4.5 Mean annual greenhouse gas emissions per household and per capita, and mean household sizes, in the UK (2004-5) and the Netherlands (2000), by demographic group

Demographic group	Mean emissions per household (tonnes CO _{2e} per year)		Mean emissions per capita (tonnes CO _{2e} per year)		Mean household size (all residents)	
	UK	NL	UK	NL	UK	NL
All households						
All households	20.2	29.1	9.3	12.8	2.387	2.274
Working age households						
All working age* households	22.6	31.2	8.4	12.6	2.700	2.466
Of which:						
All couple** households	26.6	37.5	8.4	12.2	3.159	3.063
<i>Couples with children</i>	27.5	39.9	6.8	9.8	4.056	4.054
<i>Couples without children</i>	25.9	35.3	10.9	16.3	2.383	2.167
All single** households	14.2	19.1	8.1	14.4	1.761	1.328
<i>All single with children</i>	16.1	25.3	5.7	9.1	2.820	2.782
<i>All single without children</i>	13.5	17.9	10.0	17.1	1.354	1.042
Older** households	24.4	31.6	10.2	15.6	2.383	2.031
<i>Older couple households</i>	28.0	36.8	10.3	15.4	2.714	2.388
<i>Older single households</i>	14.0	19.0	9.7	16.5	1.434	1.149

* Working age households defined as: of the head of household and, if present, partner, at least one below official retirement age, signifying aged up to 64 for male, and aged up to 59 (UK) or 64 (Netherlands) for female.

** Couple household: head of household lives with partner, and other individuals may also be resident in household; single household: head of household not living with partner, but other individuals may be resident in household; older household: at least one of head of household or, if present, partner, is of older working age (age between 50 and official retirement age).

Source: Author's own calculations. See section 4.2 for details of datasets used.

Different demographic groups are likely to have differing opportunities, capabilities and indeed preferences for working time. The implication for policy targeting is that certain groups may be harder to influence than others. To identify, for example, couple households, or households with children, as the major source of national emissions is not to show that they are the ideal group to target with working time policy to achieve reductions in emissions. The household's situation is of importance for targeting. As seen above, for example, households with children already have substantially lower emissions per capita (and consumption per capita) than those without children, which may limit their capabilities to reduce consumption further.

One other factor, aside from the presence of children, that is clearly likely to affect how household members respond to working time policy, is the household's level of income. The household's current level of income will likely affect its preferences and capabilities to alter working hours, as this would have effects on their income. To look at this issue, Figure 4.5 and Figure 4.6 present per capita emissions against equivalised income⁴² for different household sizes.

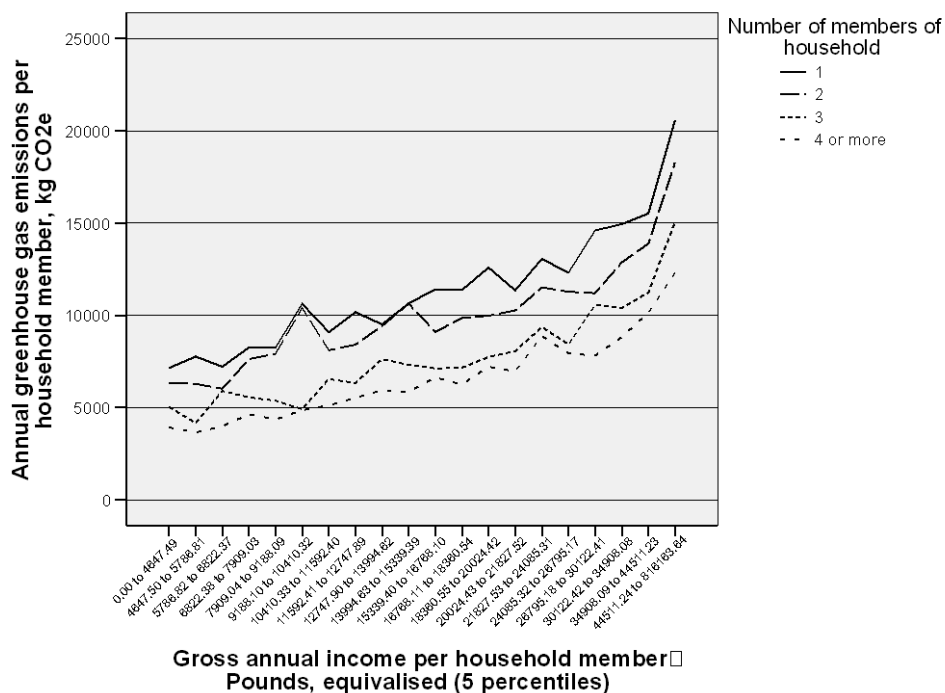
The two figures show the results that would be expected: the higher the number of people in the household, the lower the emissions at any given equivalised level of per capita income. In short, individuals in shared households reach the same level of material comfort with less consumption, and so lower greenhouse gas emissions.⁴³ This tentatively suggests that people in shared households might be more willing to reduce their working hours than those living singly, as they need less money to reach a certain level of material affluence.

The level of (equivalised) income is also likely to be important, with higher income households more likely to feel able to reduce working time than lower income, and, conversely, lower income households more likely to wish to increase working time and/or labour market participation to earn more money, affecting their willingness to take up different types of opportunities offered by policies. Policy to reduce working time might therefore be utilised more by higher income households. This raises issues of justice on the one hand, as it presents the possibility of a new inequality in free time arising, with more affluent households better able to afford time out of paid work (Schor 1999:150–152). On the other hand, high income households are also the high spending ones, and so the biggest source of greenhouse gas emissions: from the environmental perspective, this makes them a priority group to target to reduce their paid work, income, and consumption, if working time reduction policy is used to reduce consumption.

⁴² Equivalised using the modified OECD equivalence scale described above in section 4.3.2.1.

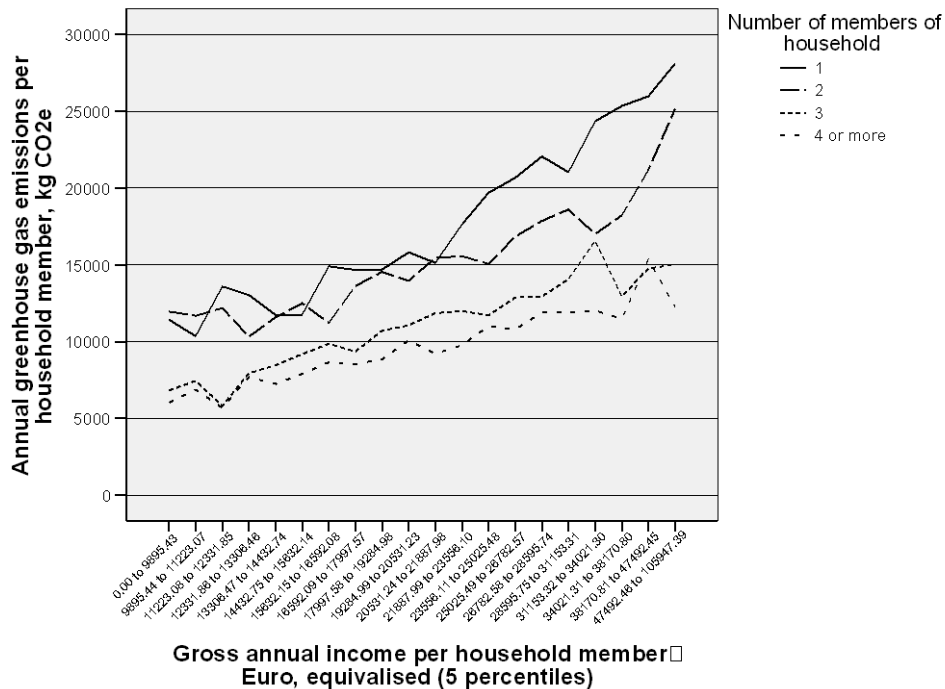
⁴³ Note that, due to UK and Dutch living patterns, households with one and two occupants are predominantly comprised, respectively, of single and couple households without children. Higher household sizes are predominantly couple households with children. The graphs therefore also show the environmental benefits of living as a couple compared to singly.

Figure 4.5 Total annual greenhouse gas emissions per person against equivalised annual income per person, by household size, for working age UK households



Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 4.6 Total annual greenhouse gas emissions per person against equivalised annual income per person, by household size, for working age Dutch households



Source: Author's own calculations. See section 4.2 for details of datasets used.

4.5 Summary

The UK and the Netherlands represent two highly suitable countries for testing some outstanding issues relating to the environmental benefits of working time reduction. The high level of variation in the current working patterns of the two populations, combined with suitable household expenditure survey and product greenhouse gas emissions intensity data, make them suitable for testing the hypothesis that differences in paid working hours affect household greenhouse gas emissions. These data allow investigation of mean emissions per household, either for a sample representative of the national populations, or for particular demographic groups within the population. These results, combined with data on total emissions from all households in the two countries, also allow investigation of the contribution to national emissions made by different demographic groups. Whilst there are difficulties of reliability with the data used for several different reasons (low response rates, underreporting, measurement error, issues in principle with allocating greenhouse gas emissions to households, etc.), data are robust enough to inform a substantial body of existing literature, and in the absence of more reliable data, these issues must simply be kept in mind when analysing the research results.

Households are a major source of national greenhouse gas emissions in both the UK and the Netherlands. Household emissions are strongly related to their total expenditure, although variation in emissions at any given expenditure level (measured by the variable Household Emissions Intensity) is still substantial. The implication is that working time policies, inasmuch as they actually manage to affect working time (and hence income, and hence expenditure), could have big environmental effects. If working time policy were to be used to reduce working time in order to reduce greenhouse gas emissions, then which demographic groups to target would need to be considered: whilst households with children and older workers constitute the majority of greenhouse gas emissions among the working age population, the former group might be constrained from reducing working time and income by the higher financial demands of having dependent children to care for. High income households meanwhile are likely to be able to reduce their working time more easily than otherwise equivalent lower income households. As they also

represent the bigger source of total emissions due to their higher consumption levels, this suggests they may be an ideal group to target with policies to encourage reduced working time. There is a justice issue associated with such targeting however, as it could lead to increasing inequality in work life balance, with only those on higher wage rates able to afford more time outside of paid work.

The effects of working time policy on greenhouse gas emissions is dependent on there being a predictable relationship between the working hours of household members and the household's greenhouse gas emissions. The presence of this relationship is the subject of the next chapter, which tests the hypothesis that reducing working time predictably reduces a household's greenhouse gas emissions.

Chapter 5 The greenhouse gas emissions of households in the UK and the Netherlands: the effects of working hours and earnings

The measurement of the greenhouse gas emissions, and environmental impacts more generally, arising as a result of a household's consumption patterns now has a well established methodology and body of literature, reviewed in chapter 3 (section 3.3). Household consumption, both in terms of the total expenditure and the types of product categories on which it spends that total, affect the household's emissions, as different types of product lead to different amounts of greenhouse gas emissions per unit value in their production and distribution. The methodology used in these studies allows the estimation of emissions from a sample of households representative of their national population, as it makes use of household expenditure survey data that is regularly collected in many countries. The range of sociodemographic variables collected in such surveys also allows some of the determinants of a household's emissions to be tested, and statistically significant correlates with emissions to be revealed. To date however, no research has established the correlation between paid working time, the explanatory variable of interest in this research, and greenhouse gas emissions.

This chapter tests this relationship, drawing on the model of the household developed in chapter 3 (section 3.5). Formally, it tests the hypothesis that:

Reductions in the paid working hours of household members will reduce the greenhouse gas emissions arising from that household's consumption

(hypothesis 1, as described in chapter 3, section 3.1). The main mechanism by which this effect occurs is through the effect reducing paid working time has in reducing income, in turn reducing expenditure/consumption, and so emissions. The strength of this relationship is tested using household expenditure survey and product

emissions intensity data for the UK and the Netherlands, analysed using regression modelling.

The first section of this chapter recaps the relevant theory and analytical framework that were presented in chapters 2 and 3. Following this, the research design is presented, recapping on the data used, and describing the sample selection and statistical method used to test the hypothesis. The next sections present the results for the predictors of household greenhouse gas emissions, and then for the predictors of household expenditure and Household Emissions Intensity, the two other dependent variables which influence emissions. The results in the body of the chapter focus on couple households (i.e. those in which the head of household lives with a partner and any number of other children and adults), as these contain the majority of the population and produce the majority of greenhouse gas emissions (see chapter 4, section 4.3.4). Regression model results for single households are presented in Appendix 3: although not discussed in this chapter, they are used in the scenario modelling in chapters 6 and 7. A discussion of the results follows, before a summary of the chapter's findings and their relevance to the thesis aims.

5.1 Summary of theory and analytical framework

Various authors have proposed working time reduction as a way to decrease levels of resource consumption in rich countries to help them become more environmentally sustainable (e.g. Jackson 2005a; Robinson 2006; Schor 1995; Speth et al. 2007). Chapter 2 discussed the literature on this proposal and the rationale behind it in detail (section 2.1). In short, the proposal assumes a deterministic relationship between working time and environmental impacts: at the individual or household level, reduced working time leads, primarily through reduced income, to reduced expenditure (consumption), which in turn therefore requires fewer natural resources to be used and pollution to be generated, i.e. reduced environmental impacts. This chain of influence between working time and environmental impacts is supported by evidence, at least for the case of greenhouse gas emissions. Working hours affect a person's earned income (by definition in this thesis, working hours, along with gross hourly wage rate, fully determine gross earned income). The influence of income on

expenditure is already well established in the literature (e.g. Phipps and Burton 1998). Chapter 4 meanwhile demonstrated that total expenditure by a household is a major determinant of its emissions (section 4.4). However, the size of this effect of working time on household emissions is apparently untested to date, and addressing this gap is the origin of the research hypotheses of this thesis (presented in chapter 3, section 3.1).

This chapter tests the first hypothesis of the thesis, as just described above. The household model used to test this hypothesis was developed in chapter 3 (section 3.5): with reference to the consumer behaviour literature, the relationship between working patterns and household greenhouse gas emissions was elaborated into a functional model of the household. Figure 3.4 there presents the model graphically for couple households. This was also expressed as an equation, which to recap is the following:

$$G = a + b \cdot Y_m + c \cdot Y_f + \sum_1^i d_i \cdot A_i + e$$

Where: G is total greenhouse gas emissions; Y_m is male income; Y_f is female⁴⁴ income; $\sum_1^i A_i$ is a set of i different other independent variables, A_i ; a is a constant; b , c , and $\sum_1^i d_i$ are constant beta values; and e is an error term.

The Analytical Framework also discussed that not just total expenditure, but also the mix of products a household spends this money on, can both affect emissions. This is because different products and services lead to different levels of emissions per pound/euro spent on them, as the production methods and resources needed to produce each unit, and the unit market price, both vary. Meat and meat products, air transport, direct heating and lighting of homes, and vehicle fuel, for example, all produce high levels of emissions per pound/euro spent on them, whilst many services have much lower emissions per pound/euro spent on them (see Analytical Framework, chapter 3). As such, a change in the precise mix of goods and services bought by the household can significantly alter its emissions even if its total

⁴⁴ Where either the male or the female is the head of household, and the other is his/her partner.

monetary expenditure is unchanged. In chapter 3, the variable Household Emissions Impact was developed to capture this effect, which is a measure of the average greenhouse gas emissions per pound/euro spent by a given household, calculated by dividing its total emissions by its total expenditure.

By definition:

$$\begin{aligned} \text{Total household greenhouse gas emissions} \\ = \text{Total household expenditure} \times \text{Household Emissions Intensity} \end{aligned}$$

Expenditure and HEI were both found in the Analytical Framework to be affected by similar predictor variables as for total greenhouse gas emissions. Chapter 4 found them both to be significant contributors to variation in household emissions, although total expenditure is the most important predictor. Both are thus also tested in this chapter to increase understanding of the mechanisms by which working patterns affect emissions, through affecting total expenditure and by altering the mix of products bought.

5.2 Research design

Chapter 4 described the case study locations (the UK and the Netherlands) and periods (2004-5, and 2000, respectively) selected for testing the research hypotheses, and the rationale for these choices. The arguments in favour of working time reduction for environmental ends relate to high income countries, so the UK and the Netherlands are suitable in this respect. The substantial variation in working time within their populations helps fit the model of household emissions such that it holds across a range of working conditions. As countries to compare, they are interesting as there was in the period of study a great difference between the mean working hours of their populations, and also was and still is substantially different policy support for working time flexibility. How the results are affected by these factors, and the implications for policy proposals based on the results, can be investigated to see how generalisable the research conclusions might be.

5.2.1 Data used

The data used in this research, and its preparation for use, was described in the last chapter (sections 4.2 and 4.3). Data from the 2004-5 UK Expenditure and Food Survey, and the 2000 Dutch *budgetonderzoek* are used, which provide nationally representative samples of the two country populations, and provide data on expenditure on different products by the households. The survey data are combined with data on the greenhouse gas emissions arising per pound/euro spent on the same categories of product. Combined, the data allow an estimate of the greenhouse gas emissions arising as a result of household consumption to be made for each household in the UK and Dutch datasets.

5.2.2 Sample selection and sizes

Households with at least one working age adult out of the head of household and partner (if present) are selected for analysis. In the UK, retirement age in the study period was 65 for men, and 60 for women, so that households including a man aged 64 or below and/or a woman aged 59 or below as the head of household or partner are included. For the Netherlands, retirement age was and is 65 for both men and women, so that the sample selected is not strictly comparable to the UK sample.

All other households, in which the head of household and partner (if present) are over retirement age are excluded from analysis. Even if still in paid work, they have different work life balance opportunities afforded them by policy (i.e. retirement rights). They were thus excluded from analyses as the principle aim is to consider the implications of results for working time policy for the majority of people that it will affect (i.e. those of working age).

The resultant samples, weighted using the weighting variables in the datasets, are representative of UK and Dutch households in which the head of household or partner is of working age. This is approximately equivalent to including all working age adults and their dependents, as there are few households in which both the head of household and partner are over retirement age but in which there is another adult of working age.

In addition, for regressions performed for couple households, same-sex couples are excluded from the analyses, so that gender differences in effects of male and female working hours and incomes on the dependent variables can be calculated. Same-sex couple households are included in other results, e.g. those showing mean household emissions data.

5.2.3 *Selecting an appropriate analytical method*

The household model being used to test the hypotheses in this chapter assumes linear relationships between the dependent and independent variables. This would typically imply that a simple ordinary least squares (OLS) regression could be used to test the relationship between the variables. In this case, this is problematic however, as one of the modelling assumptions of OLS regression, that values for the dependent variable are normally distributed, is violated: distributions of the dependent variables greenhouse gas emissions, and total expenditure, are both highly skewed, especially in the UK dataset. Violating this assumption is not necessarily problematic for the robustness of the results, but in this case, when simple OLS regressions were performed, diagnostic tests of the results showed that there were problems.⁴⁵ Whilst this would not affect the validity of the beta values and model fit (adjusted R^2) reported by simple OLS regression, it means that the calculated confidence intervals for the beta values, and hence statistical significance of correlations between variables, are overestimated (that is, results are less significant than reported).

Bootstrap analysis was used in this chapter to address these issues.⁴⁶ Bootstrap analysis is a statistical approach to calculating confidence intervals and other model

⁴⁵ The diagnostic tests used were: analysing the distribution of the regression residuals (the error term values), which should be normally distributed but were not; and various tests which revealed outlying cases in the residual terms (i.e. highly inaccurate estimates of the values of the dependent variable in some cases) as revealed by expected and actual residuals plots, Mahalanobis distances, leverage statistics, and Cook's distances. See de Vaus (2002:93–95) for detailed descriptions of these tests.

⁴⁶ Often when a variable is not normally distributed the log of it, or some other power, which is normally distributed, is used instead in the simple OLS regression. However, this would not be appropriate in this situation as taking the natural log of these dependent variables would alter the model so that it does not represent the theorised relationships between the variables, i.e. the model theorises that greenhouse gas emissions and expenditure are both proportional to income, not to the

parameters which can be used on nonparametric data, i.e. where the pattern of distribution of the variables does not follow a simple distribution such as a normal one, as is the case for the data being analysed here (Bollen and Stine 1990:118). The approach uses substantial computing power to produce statistically significant results with the minimum of theoretical modelling assumptions (Efron and Gong 1983:36,47). The approach calculates a model's confidence intervals using many different subsamples of the data being used (1500 subsamples are used in this research), and produces results of similar or better accuracy than other valid approaches, with less dependence on sometimes untestable assumptions about the distribution of the data, and often less effort (Bollen and Stine 1990:118; Efron and Tibshirani 1986:57). For a sample size n , each subsample also has n cases, but each case is selected into the subsample a random number of times (so that some are not included, whilst others are included 2 or more times) (Efron and Gong 1983:37). The results of the analyses of all the subsamples are then automatically compared: beta values, confidence intervals and model fit will vary marginally for each, but as the number of subsamples increases, the variation in the values for each of these variables will converge on what they should actually be. Beta values and model fit results will be unchanged from those reported by a simple OLS regression, but the difference is that the confidence intervals reported for the beta values will be closer to the correct values despite the non-normal distribution of the dependent variables. Confidence intervals will usually be wider than reported by simple OLS regression, that is, the results are less likely, but more accurately, to be reported as statistically significant.

The working hours and income variables are also non-normally distributed in the datasets, having high numbers of zero values and several extreme outlier cases. Whilst this should in theory not matter for the robustness of results even if simple OLS regression were being used, the use of bootstrap analysis is preferable as this method also addresses the potential problems of multivariate non-normality which this could result in.

exponential of income. An alternative, equally appropriate, approach, used by Phipps and Burton (1998) for example, would be to use White's procedure (White 1980).

5.2.4 Differences in the predictor variables between the UK and the Netherlands

There are two differences in the predictor variables available between the UK and Dutch datasets, as detailed in chapter 4, section 4.3.2.1 and 4.3.2.4. The first difference relates to the income variables. Aside from male and female earned incomes (in couple households) and head of household earned income (in single households), all other sources of income are also included in regressions. In the Netherlands, data limitations mean that these other sources are all included in one variable. In the UK model by contrast, they are further subdivided into the following components:

- Male private non-earned income from investments, pensions and other sources
- Female private non-earned income from investments, pensions and other sources
- Male income from Social Security benefits
- Female income from Social Security benefits
- Income from sources other than the male and female heads of household

The second difference is that the variable “geographic region” is not present in the Dutch dataset so is not included in regressions for the Netherlands.

5.2.5 Details of fitting the models

For each country, for both working age single and couple households, and for each dependent variable in turn, simple OLS regression analyses are initially performed using SPSS version 14 to diagnose the models.

Following Glynn (2004), appropriate weights are calculated and used in analyses for any subsample of the full survey sample of households being used. To do this, the weight variables in the dataset are adjusted to be appropriate for the subsample being analysed: for each sample or subsample the mean value of the weight should be 1 (Glynn 2004).

Producing the final regression models is an iterative process in which variables hypothesised to be significant predictors of the dependent variable may be dropped from the model for two principle reasons: either they are found to not contribute significantly to model fit, i.e. do not increase adjusted R^2 by a statistically significant amount; or they have excessively high multicollinearity, that is, they are overly correlated with one or more of the other predictor variables such that the variables are not really independent of each another (Tacq 1997:162). In SPSS, the contribution to model fit is reported so that those variables not adding to it statistically significantly can be identified, whilst high multicollinearity between predictor variables can also be detected based on Variable Inflation Factor (VIF) results, which test for this (de Vaus 2002:345): values over 10 are generally considered too high, and this was the threshold used in this research to determine which variables to exclude from the models.

The initial model, including all the independent variables that may be significant, is run separately for each of the dependent variables, and for single and couple households. There are various approaches to determining the order in which the independent variables are added and removed from a regression model to produce a final model to be used for predictive purposes. The final choice is based on what is “best” for the research in question, but there is no clear way to determine the meaning of “best”, and different methods of variable selection lead to different outcomes (Pedhazur 1997:211–225). Variables were added in to the model using the blockwise approach with stepwise selection, that is, several OLS regressions are run with more of the variables added each time in “blocks”, each block consisting of one or more independent variables, as described by Pedhazur (1997:227–30). The variables theoretically most important to the study, i.e. male and female working hours, and male and female earned incomes, are entered into the model first. Following these, other income sources are added in this order: variables for the number of adults and children in the household; number of rooms occupied (a dummy variable); number of persons economically active; male age; male education

level dummy variables; household class dummies; and, for the UK, geographic region dummies.

Model diagnostics are used to see if any variables should be removed from the model. In all the models, the house size (number of rooms) dummy variables have extremely high VIF values (between 25 and 60), and so are removed. The only other variable that is removed is number of people economically active. This variable has a high VIF value only in some models, but in no model is it a statistically significant explanatory variable, and in almost no model does it add significantly to the model's explanatory power (adjusted R^2) once other variables are included. Although it could be argued that it could still be left in the model, it is removed, as it would also present additional issues in the scenario modelling to follow (as it is partly dependent on the working hours of the male and female).

As all other variables added significantly to model fit in the order in which they were added, they are left in.

The final model for each of the dependent variables is thus as presented in the path model in chapter 3, Figure 3.4, with the removal of the house size and the number of people economically active variables.

Once the final model was determined using SPSS (i.e. once the variables to include were determined), the final calculation of the model confidence intervals using bootstrap analysis was performed in Stata version IC 11.0 for Windows (32 bit). It was not appropriate to use the Stata command *bootstrap* as this is unable to include a weighting variable that is required. Instead, the open source modules *bsweights* (see Kolenikov 2008) and *bs4rw* (see Pitblado n.d.) are used. Kolenikov (2010) gives details of the use of these commands.⁴⁷ 1500 replications of the analysis were run to calculate the confidence intervals. The *bsweights* module calculates weights to be included in the analysis: weights must be recalculated for each of the replications of

⁴⁷ Bootstrap analysis options were updated with Stata release 11.1: the variance estimation methods introduced in this version are equivalent to the ones used in this research, only the syntax differs (see editor's comments in Kolenikov 2010).

the analysis to take account of the cases omitted in each replication. As no variables are included in the datasets to allow account to be taken of the cluster sampling in the surveys, a simple random sample had to be assumed. The effect of this on results in the research is generally small (ONS 2006c:175–6). The weight estimates were balanced (see Graham et al. 1990 for an explanation of balancing bootstrap weights). Once weights are calculated, regressions are run using the new weights and the *bs4rw* command.

The outputs of this process are, for each model, estimates of the model fit (adjusted R^2) and, for each independent variable, beta coefficients and estimates of the 95% confidence intervals. Where the upper and lower values of the 95% confidence intervals are both of the same sign (both positive or both negative), then there is a statistically significant correlation (at the 5% level) between the dependent and independent variables in question. The final model results are presented and discussed in the results sections which follow.

5.2.6 Robustness testing

Regressions were also performed using categorical variables instead of continuous variables for working hours. This was to assess the impact on results of the issues with the working hours variables described earlier, i.e. the non-normal distribution due to high numbers of cases working zero hours, as well as the coding in the Dutch dataset of all those working 12 hours or less per week as 0, meaning the variable is not truly continuous.⁴⁸ Boundaries for the categories are presented in Table 5.1 below.

Results using the continuous and categorical variables were similar for both countries, in terms of model fit and the beta values of the other independent variables.⁴⁹ This indicates that using the continuous variables, despite their

⁴⁸ In the majority of cases in the Dutch data, working hours are coded as 0 because the individual works 0 hours, but among households selected for analysis, 3.5% of males and 13% of females have working hours coded as 0 but have earned income greater than 0, indicating that they are in fact working.

⁴⁹ Results for the regressions using the categorical variables are not presented in the thesis.

limitations, is valid and produces robust results. This is important as it is the continuous variables that are adjusted to simulate different scenarios of changes to working patterns in the subsequent results chapters. Estimates of their effect on greenhouse gas emissions, as calculated in the regression models, need to be accurate therefore.

Table 5.1 Categories of working hours used in UK and Dutch regression analyses

UK	Netherlands
0 hours*	0 to 12*
0.1 to 12	
Both	
12.1 to 24	
24.1 to 35	
35.1 to 42	
42.1 to 48	
48.1 to 56	
56.1+	

* Used as the reference value for dummy variables representing these categories.

5.3 Results

The results presented in the following sections focus on working age households, as these are the target of working time policies. Working age households are taken to be households in which at least one of the head of household or their partner (if present) is of working age (in the UK, below 65 for men, and below 60 for women; in the Netherlands, below 65 for men and women). Some initial descriptive statistics are followed by regression models, presenting how each of the three dependent variables, greenhouse gas emissions, expenditure, and Household Emissions Intensity are correlated with working time and the other independent variables, following the model developed and presented in chapter 3.

Variation in household greenhouse gas emissions, expenditure, and Household Emissions Intensity with income: Descriptive statistics Some initial descriptive statistics serve to indicate the relationship between household income and greenhouse gas emissions, expenditure, and Household Emissions Intensity. For UK and Dutch working age households, the data⁵⁰ indicate that household emissions increase with income (see Figure 5.1). This is as would be expected: household

⁵⁰ Data as discussed in the research design section above.

emissions increase with expenditure (see chapter 4), and expenditure also increases with income (Figure 5.2, and, for example, Phipps and Burton 1998).

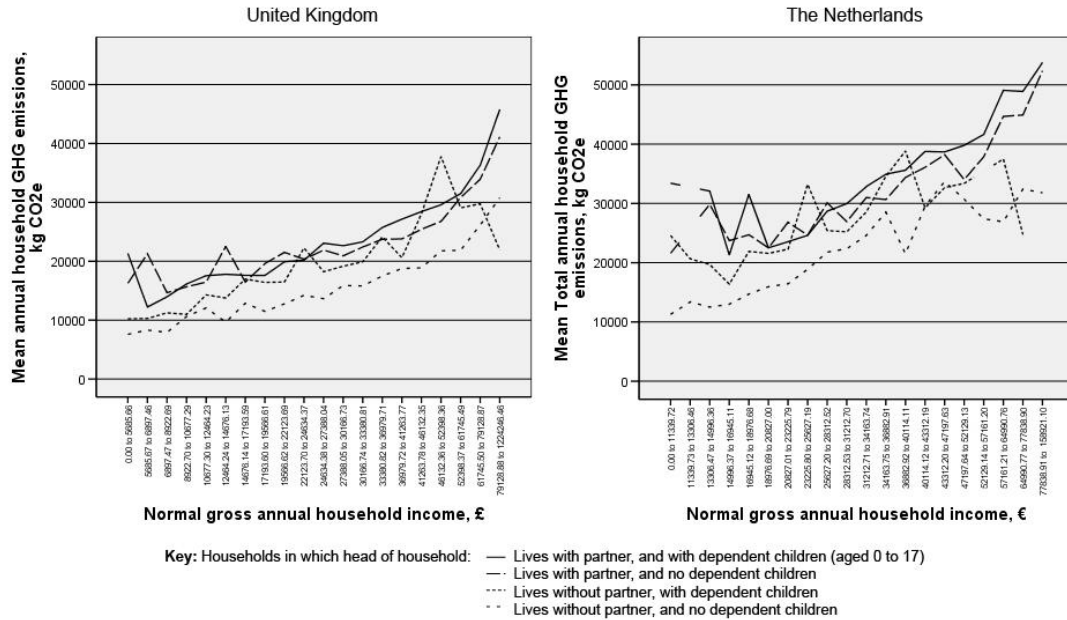
In contrast, Household Emissions Intensity⁵¹ (HEI) can be seen to fall slightly with income (Figure 5.3). The fact that HEI falls with income indicates that households with higher incomes spend a greater proportion of their total expenditure on products with lower emissions intensities (greenhouse gas emissions per pound or euro spent on them), than do households with lower income, consistent with other research (Biesiot and Noorman 1999:374; Moll et al. 2005:269). This indicates that a household's greenhouse gas emissions do not rise as rapidly as increases in expenditure: a doubling in expenditure leads to less than a doubling in emissions, so that the elasticity is less than 1.

The figures also suggest that households in which the head of household lives without a partner and without children have lower emissions for a given income than do other household types, primarily down to lower expenditure rather than lower HEI.

Such figures can only suggest at relationships between variables however. Regression analysis is required to reveal which relationships are significant controlling for other variables, and the strength of such relationships. The next sections present the results of regressions on the dependent variables for the two countries.

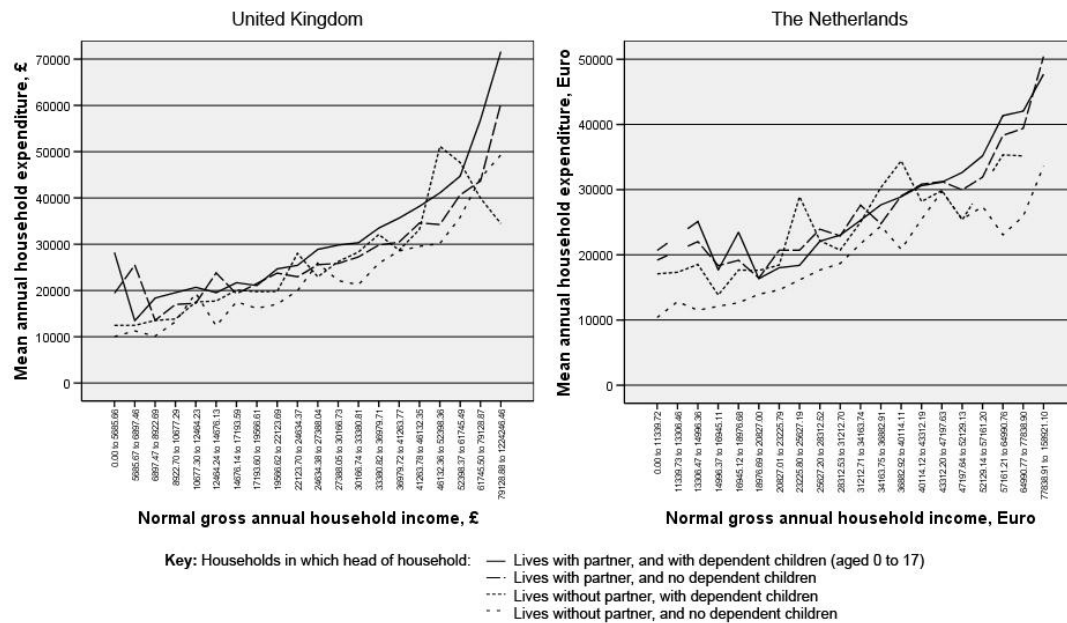
⁵¹ The measure of household emissions per unit expenditure, which is affected by the precise share of different product categories it consumes.

Figure 5.1 Total annual greenhouse gas emissions against gross annual household income, by demographic group, for working age households in the UK and the Netherlands



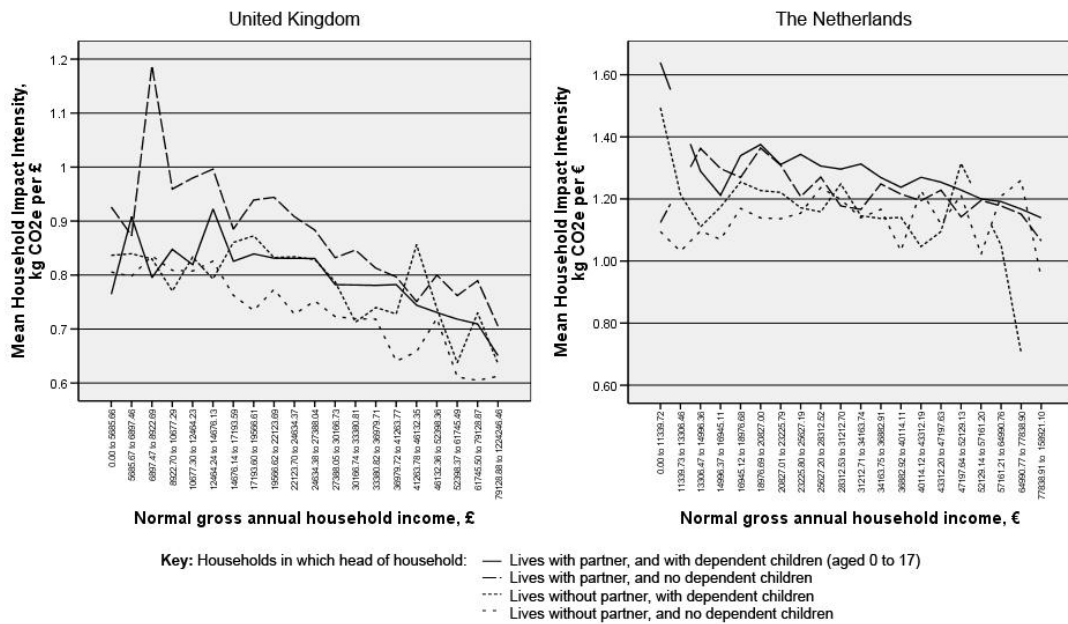
Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 5.2 Total annual expenditure against gross annual household income, by demographic group, for working age households in the UK and the Netherlands



Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 5.3 Household Emissions Intensity against gross annual household income, by demographic group, for working age households in the UK and the Netherlands



Source: Author’s own calculations. See section 4.2 for details of datasets used.

5.3.1 Predictors of household greenhouse gas emissions

This section presents results of the bootstrap regression analyses used to calculate the relationship between working time and greenhouse gas emissions for working age households. Section 5.3.1.1 presents results for the UK, while 5.3.1.2 presents results for the Netherlands.⁵² The following two chapters use the regression results presented here to estimate the changes in household greenhouse gas emissions that would occur if different policy outcomes of altered working patterns were achieved.

The results presented are for households in which the head of household lives with their partner (“couple households”). These households represent the living arrangement for the majority of adults in both countries, and such households are the source of the majority of greenhouse gas emissions from consumption (see chapter 4).⁵³ As the primary research interest is in the effect of working patterns on

⁵² Only the final models are presented, which exclude certain variables as described earlier in the chapter.

⁵³ Results for single households are presented in Appendix 3. They are used in the scenario modelling in the next two chapters but are not discussed further here.

emissions, only working age households are included. Only the effect of working hours of the head of household and partner are considered. The presence and income of other household members are controlled for, but their working patterns are not included as to do so would greatly increase the complexity of the model.⁵⁴ Finally, only households in which the head of household and their partner are of the opposite sex are included. This enables gender differences in the effect of their separate incomes and working patterns to be modelled.

Note that, in the tables of results presented, the unstandardised beta coefficients represent the extra kilograms of CO_{2e} emissions arising per year from a household per unit increase (or decrease for negative coefficients) in the predictor variable. As the units of the predictor variables vary, as do the strengths of their correlations with greenhouse gas emissions, then the magnitudes of the beta values vary substantially between variables too.

5.3.1.1 Results for the UK

The regression model for household greenhouse gas emissions for UK working age households is presented in Table 5.2 below. The model has a high level of fit, predicting 31.3% of variance in emissions (adjusted R² = 0.313).

The results indicate that male and female working hours have no statistically significant direct correlation with greenhouse gas emissions in the UK. Earned income meanwhile has a significant impact on emissions, as would be expected: household emissions increase by 0.20kg CO_{2e} per pound of earned income, and there is little difference whether the male or female earns it. Non-earned income sources meanwhile have a much higher impact per pound spent than earned income (of those with a statistically significant effect on emissions): 0.45kg CO_{2e} per pound for male private non-earned income, and 0.31kg CO_{2e} per pound of female benefits. This could be due to differences in the propensity to spend or save the different sources of

⁵⁴ In the majority of cases, such additional working age adults are either adult children of the head of household and partner, still in full time education, or dependent parents of the head of household and partner, so not in work.

income, or also differences in the types of goods and services bought with the different sources.

Other results follow what would be expected from theory. The number of individuals in the household correlates with emissions even controlling for income: each adult over and above the two that comprise the heads of household (which may be adult children, other relatives, or unrelated) increases emissions by nearly 2,800kg CO_{2e} per year, and each older child by 2,200kg. This is a feasible result, as the number of individuals increases the need to spend regardless of household income, and likely also leads to changes in the types of goods and services bought.

Of the other control variables, household age⁵⁵ increases emissions, by 192kg CO_{2e} per annum per year of age. Highest educational attainment has no statistically significant effect on emissions, controlling for income. Class variables present an unclear picture: the variables suggest that emissions from higher professional classes and small employers are higher than the reference of routine workers, but other classes have no significant effect. Finally, geographic region indicates that households in regions other than the reference category (London) tend to have higher emissions, in the order of several thousand kilograms CO_{2e} per year.

⁵⁵ Household age and highest educational attainment are represented by the male characteristics in the models for both countries, as there is high correlation between the male and female values of both: see chapter 4, section 4.3.2.4 for more.

Table 5.2 Regression estimates for household total annual greenhouse gas emissions, for UK working age couple households

Adjusted R² = 0.313

Weighted, n= 3,289 (of which 1 case excluded due to missing data)

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: 26,615 kg CO _{2e} per annum	Unstandardised beta coefficients		95% confidence intervals	
	Unit: kg CO _{2e} per annum per unit change in predictor variable			
	B	Std. Error		
(Constant)	-5044.66	3928.90	-12745.16	2655.84
Variables regarding head of household & partner:				
Male usual weekly hours (inc overtime), for employed or self employed	-3.87	34.79	-72.06	64.33
Female usual weekly hours (inc overtime), for employed or self employed	1.82	31.54	-60.00	63.63
Male gross annual income from employment and self-employment, £	0.20	0.06	0.09	0.32
Female gross annual income from employment and self-employment, £	0.20	0.05	0.10	0.30
Male gross annual private non-earned income from investments, pensions and other, £	0.45	0.06	0.34	0.57
Female gross annual private non-earned income from investments, pensions and other, £	0.14	0.13	-0.13	0.40
Male gross annual income from Social Security benefits, £	-0.05	0.11	-0.26	0.15
Female gross annual income from Social Security benefits, £	0.31	0.14	0.04	0.58
Variables regarding other household members:				
Gross household annual income from sources other than head of household and partner, £	0.22	0.07	0.09	0.35
Number of adults	2765.91	839.54	1120.45	4411.38
Number of children - age under 2	1440.01	805.36	-138.48	3018.49
Number of children - age 2 and under 5	642.27	685.54	-701.38	1985.91
Number of children - age 5 and under 18	2198.11	328.66	1553.94	2842.28

Table continued on next page

Table 5.2 continued.

	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: kg CO_{2e} per annum per unit change in predictor variable</i>			
	B	Std. Error		
Other control variables:				
Male age, years	191.55	24.99	142.57	240.53
Age male left full time education	109.27	140.95	-166.99	385.53
Household class: (Reference value: routine worker)				
Higher Professionals	3259.17	1558.85	203.89	6314.45
Intermediate	-639.49	990.36	-2580.56	1301.59
Large Employers & Higher Managerial	4237.87	2012.40	293.63	8182.11
Lower Managerial & Professionals	3446.07	1014.26	1458.15	5433.98
Lower Supervisory & Technical	535.49	890.59	-1210.04	2281.02
Never Worked and Long-Term Unemployed	-2018.40	1577.44	-5110.13	1073.33
Semi-Routine	415.84	926.29	-1399.66	2231.33
Small Employers and Own Account Workers	3834.97	1085.67	1707.10	5962.84
Students	-2080.03	3734.39	-9399.30	5239.25
Not classifiable for other reasons	-817.29	1190.35	-3150.33	1515.75
Occupation not stated	1043.80	2888.87	-4618.27	6705.88
Government region of residence: (Reference value: London)				
Eastern	1656.11	1153.72	-605.13	3917.36
East Midlands	2204.36	1156.56	-62.46	4471.17
Northern Ireland	6311.06	1291.42	3779.93	8842.20
North East	2884.91	1339.60	259.34	5510.47
North West and Merseyside	3097.02	1121.94	898.06	5295.98
Scotland	2257.20	1113.44	74.90	4439.50
South East	1494.39	1139.96	-739.89	3728.67
South West	2716.15	1065.56	627.70	4804.60
Wales	1005.64	1060.31	-1072.53	3083.81
West Midlands	1114.17	1097.50	-1036.89	3265.23
Yorkshire and the Humber	3849.05	1241.63	1415.49	6282.61

5.3.1.2 Results for the Netherlands

Table 5.3 below presents the regression results for Dutch working age households. The model predicts a high level of variance in emissions: 45.2% (adjusted $R^2 = 0.452$).

In contrast to the UK data, there is a significant positive⁵⁶ correlation of both male and female working hours with emissions, even controlling for earned income, of 64kg CO_{2e} per year per hour worked each week for women, and 106kg for men.

As with the UK, the results show little difference in the impact on emissions of earned income from the male and the female: both lead to very similar increases in household emissions, of around 0.32-0.34kg per euro. Unlike the UK results, income sources other than wages have lower impacts than earned income in the Netherlands.

As in the UK, emissions increase with the number of individuals in the household, even controlling for income: each adult additional to the head of household and partner increases emissions by about 3,100kg, and each older child by 2,600kg. The effect of younger children is also statistically significant in the Netherlands (unlike in the UK): a baby aged 0 to 1 leads to about 1,300kg of extra emissions per year, and a child aged 2 to 5 to nearly 3,000kg per year.

Household age increases emissions by almost 180kg CO_{2e} per annum per year of age, very similar to the UK. Highest educational attainment has a statistically significant effect too, unlike in the UK data, with emissions being higher the higher the education level. The effect in the Netherlands is surprisingly large, with the highest educational attainment increasing emissions by 7,000kg per annum compared to the reference value of no educational qualifications. These effects are likely countered by the class variables, which compared to the reference value of not working are negative to a similar magnitude, reducing emissions by between 4,600 and 8,200kg per annum, the effect being larger the higher the class.

⁵⁶ The terms positive and negative in the context of the models are used to signify that the independent variable and dependent variable positively or negatively correlate, rather than to indicate that the impact on emissions is positive or negative in the sense of a normative assessment of the effect it has on the environment. Hence a positive effect on the dependent variable (in this case, greenhouse gas emissions), indicates an *increase* in emissions (which is not generally considered good/positive in a normative sense).

Table 5.3 Regression estimates for household total annual greenhouse gas emissions, for Dutch working age couple households

Adjusted R² = 0.452

Weighted, n= 1,626 (of which 17 cases excluded due to missing data)

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: 37,510 kg CO _{2e} per annum	Unstandardised beta coefficients <i>Unit: kg CO_{2e} per annum per unit change in predictor variable</i>		95% confidence intervals	
	B	Std. Error		
(Constant)	2946.24	2199.65	-1365.00	7257.48
Variables regarding head of household & partner:				
Male usual weekly hours	105.59	24.02	58.52	152.67
Female usual weekly hours	63.77	28.48	7.96	119.58
Male gross annual income from employment and self-employment, €	0.34	0.04	0.27	0.41
Female gross annual income from employment and self-employment, €	0.32	0.05	0.23	0.41
Variables regarding other household members:				
Gross household annual income from sources other than head of household and partner's earned income, €	0.21	0.03	0.15	0.27
Number of adults	3099.27	711.62	1704.51	4494.03
Number of children - age under 2	1275.84	552.39	193.17	2358.51
Number of children - aged 2 and under 5	2964.74	530.18	1925.61	4003.88
Number of children - aged 5 and under 18	2607.70	257.00	2103.99	3111.40
Other control variables:				
Male age, years	177.76	28.30	122.29	233.23
Male education level: (Reference value: no educational qualifications)				
Highest educational attainment: level 3	1801.98	914.60	9.39	3594.57
Highest educational attainment: level 4	3478.68	881.08	1751.79	5205.56
Highest educational attainment: level 5	6575.69	1096.30	4426.98	8724.41
Highest educational attainment: level 6	7025.26	1499.21	4086.87	9963.66
Highest educational attainment: unknown	6056.29	2886.93	398.00	11714.57
Household class: (Reference value: unemployed)				
Elementary	-5591.72	1558.16	-8645.66	-2537.78
Lower	-4596.47	1417.09	-7373.92	-1819.02
Middle	-5508.56	1420.52	-8292.73	-2724.39
Higher	-8199.45	1599.55	-11334.51	-5064.39
Academic	-8709.77	2190.70	-13003.46	-4416.07
Unknown	-8332.34	4850.89	-17839.90	1175.22

5.3.2 Predictors of household expenditure and Household Emissions Intensity

The models above conflate the two effects on total emissions of changes in total expenditure and in what is bought, into the one dependent variable.

The two independent effects are represented by total expenditure and by Household Emissions Intensity (HEI) respectively, where:

Total household greenhouse gas emissions

$$= \text{total household expenditure} \times \text{Household Emissions Intensity}$$

The independent variables act on these variables in different ways, as the graphs at the start of the previous section suggest. Understanding the predictors of household expenditure and Household Emissions Intensity separately gives a better indication of *how* total emissions are affected by the independent variables, useful for considering how changes in working patterns might affect emissions.

The next two subsections below show these regression results, first for the UK, then for the Netherlands. Again, households are taken in which there is a partner of the opposite sex living with the head of household, at least one of which is of working age, and which might have any number of others living with them in the household.⁵⁷

The results indicate how the two factors interact to lead to the relationship already presented above between the independent variables and total greenhouse gas emissions.

5.3.2.1 Results for the UK

Starting with the UK, Table 5.4 and Table 5.5 below show the regression results for models of annual household expenditure and Household Emissions Intensity, respectively. Working hours have a significant (negative) correlation with HEI, but

⁵⁷ Regressions results for single households are presented in Appendix 3 for the dependent variable expenditure, as these results are used in the scenario modelling in the following two chapters.

not with expenditure, which translates into no overall significant correlation with total emissions. With the exception of female income from benefits, the same income variables that correlate with increased emissions also correlate with increased expenditure. Other sources of income have no statistically significant effect on HEI (at the 5% level). There are differences in the strengths of correlation between male and female income variables on the dependent variables, but in no cases are these differences statistically significant, so no conclusions can be drawn about the gender differences in effects.

The number of adults and of children (except those aged 2 to 5 years) in UK households substantially increase expenditure independent of income. Babies and toddlers (aged under 2) are the only ones which significantly alter HEI, reducing it substantially, suggesting a substantial change in spending patterns. Regarding male age, the substantial increase in total emissions observed per year of age can be seen to result from increases in HEI rather than in expenditure, hence this is the result in differences in what is bought with age (or cohort), with a shift to higher emissions intensity products with age. The correlation of certain occupations with increased emissions compared to the reference category of routine worker is explainable by corresponding increases in expenditure, rather than HEI, whilst for geographic regions, the higher impacts of many regions compared to the reference category London can be seen to be mostly due to differences in what is bought (HEI) rather than expenditure.

Table 5.4 Regression estimates for total annual household expenditure, for UK working age couple households

Adjusted R² = 0.328

Weighted, n= 3,289 (of which 1 case excluded due to missing data)

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: £35,307 per annum	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: £ per annum per unit change in predictor variable</i>			
	B	Std. Error		
(Constant)	3809.445	6258.578	-8457.142	16076.03
Variables regarding head of household & partner:				
Male usual weekly hours (inc overtime), for employed or self employed	-42.32	68.22	-176.03	91.38
Female usual weekly hours (inc overtime), for employed or self employed	-25.98	54.83	-133.44	81.49
Male gross annual income from employment and self-employment, £	0.34	0.10	0.14	0.53
Female gross annual income from employment and self-employment, £	0.51	0.13	0.25	0.77
Male gross annual private non-earned income from investments, pensions and other, £	0.56	0.11	0.34	0.78
Female gross annual private non-earned income from investments, pensions and other, £	0.37	0.25	-0.13	0.86
Male gross annual income from Social Security benefits, £	-0.15	0.19	-0.51	0.22
Female gross annual income from Social Security benefits, £	0.22	0.18	-0.13	0.57
Variables regarding other household members:				
Gross household annual income from sources other than head of household and partner, £	0.31	0.09	0.13	0.49
Number of adults	2616.22	1065.04	528.78	4703.66
Number of children - age under 2	3362.44	1180.96	1047.80	5677.09
Number of children - age 2 and under 5	1489.22	982.52	-436.49	3414.94
Number of children - age 5 and under 18	3325.77	625.53	2099.75	4551.78

Table continued on next page.

Table 5.4 continued.

Mean value of dependent variable: £35,307 per annum	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: £ per annum per unit change in predictor variable</i>			
	B	Std. Error		
Other control variables:				
Male age, years	44.04	40.17	-34.69	122.78
Age male left full time education	207.52	229.76	-242.81	657.84
Household class:				
(Reference value: routine worker)				
Higher Professionals	3762.46	2494.11	-1125.91	8650.82
Intermediate	-1746.47	1466.83	-4621.41	1128.47
Large Employers & Higher Managerial	8719.67	3931.88	1013.32	16426.02
Lower Managerial & Professionals	3872.77	1638.44	661.49	7084.05
Lower Supervisory & Technical	-422.58	1168.77	-2713.34	1868.17
Never Worked and Long-Term Unemployed	-3542.91	2135.93	-7729.25	643.43
Semi-Routine	-618.21	1206.18	-2982.28	1745.86
Small Employers and Own Account Workers	5165.31	1583.19	2062.31	8268.31
Students	-2241.81	4813.50	-11676.09	7192.47
Not classifiable for other reasons	-404.59	1844.29	-4019.34	3210.15
Occupation not stated	-368.39	3552.00	-7330.18	6593.39
Government region of residence:				
(Reference value: London)				
Eastern	2333.42	2962.26	-3472.51	8139.35
East Midlands	417.25	1870.22	-3248.31	4082.82
Northern Ireland	31.15	1710.56	-3321.49	3383.79
North East	765.27	1964.61	-3085.29	4615.84
North West and Merseyside	1160.54	1702.37	-2176.06	4497.12
Scotland	-967.90	1663.67	-4228.63	2292.84
South East	759.63	1757.54	-2685.09	4204.35
South West	1494.53	1761.57	-1958.08	4947.15
Wales	-2749.82	1693.95	-6069.91	570.26
West Midlands	-987.22	1787.95	-4491.54	2517.09
Yorkshire and the Humber	1464.47	1871.30	-2203.22	5132.16

Table 5.5 Regression estimates for Household Emissions Intensity, for UK working age couple households

Adjusted R² = 0.261

Weighted, n= 3,289 (of which 1 case excluded due to missing data)

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: 0.799 kg CO _{2e} per £	Unstandardised beta coefficients		95% confidence intervals	
	Unit: kg CO _{2e} per £ per unit change in predictor variable			
	B	Std. Error		
(Constant)	0.614	0.041	0.534	0.694
Variables regarding head of household & partner:				
Male usual weekly hours (inc overtime), for employed or self employed	-6.10E-04	2.76E-04	-1.15E-03	-6.85E-05
Female usual weekly hours (inc overtime), for employed or self employed	-1.04E-03	3.03E-04	-1.64E-03	-4.48E-04
Male gross annual income from employment and self-employment, £	-6.95E-07	2.28E-07	-1.14E-06	-2.48E-07
Female gross annual income from employment and self-employment, £	-1.54E-06	3.77E-07	-2.28E-06	-8.06E-07
Male gross annual private non-earned income from investments, pensions and other, £	-1.18E-06	6.10E-07	-2.38E-06	1.31E-08
Female gross annual private non-earned income from investments, pensions and other, £	-4.22E-07	1.58E-06	-3.52E-06	2.68E-06
Male gross annual income from Social Security benefits, £	1.85E-06	2.13E-06	-2.33E-06	6.03E-06
Female gross annual income from Social Security benefits, £	2.89E-06	1.85E-06	-7.43E-07	6.52E-06
Variables regarding other household members:				
Gross household annual income from sources other than head of household and partner, £	-8.08E-07	6.94E-07	-2.17E-06	5.52E-07
Number of adults	0.006	0.010	-0.013	0.025
Number of children - age under 2	-0.025	0.011	-0.046	-3.25E-03
Number of children - age 2 and under 5	-0.014	0.009	-0.031	3.25E-03
Number of children - age 5 and under 18	-4.02E-03	3.97E-03	-1.18E-02	3.76E-03

Table continued on next page.

Table 5.5 continued.

	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: kg CO_{2e} per £ per unit change in predictor variable</i>			
	B	Std. Error		
Other control variables:				
Male age, years	5.86E-03	3.91E-04	5.09E-03	6.63E-03
Age male left full time education	-2.33E-03	1.11E-03	-4.50E-03	-1.61E-04
Household class:				
(Reference value: routine worker)				
Higher Professionals	-0.014	0.016	-0.044	0.017
Intermediate	-3.22E-03	0.017	-0.037	0.031
Large Employers & Higher Managerial	-0.045	0.017	-0.079	-0.011
Lower Managerial & Professionals	-0.019	0.013	-0.044	6.36E-03
Lower Supervisory & Technical	0.014	0.015	-0.015	0.042
Never Worked and Long-Term Unemployed	0.020	0.038	-0.055	0.094
Semi-Routine	0.043	0.016	0.011	0.075
Small Employers and Own Account Workers	-6.07E-03	0.015	-0.036	0.024
Students	-0.054	0.039	-0.131	0.023
Not classifiable for other reasons	-7.62E-03	0.020	-0.047	0.032
Occupation not stated	-4.73E-04	0.050	-0.098	0.098
Government region of residence:				
(Reference value: London)				
Eastern	0.016	0.015	-0.014	0.046
East Midlands	0.049	0.016	0.018	0.080
Northern Ireland	0.174	0.019	0.137	0.211
North East	0.059	0.021	0.018	0.100
North West and Merseyside	0.049	0.015	0.020	0.078
Scotland	0.071	0.016	0.040	0.103
South East	0.009	0.014	-0.019	0.037
South West	0.028	0.016	-3.37E-03	0.058
Wales	0.095	0.018	0.060	0.130
West Midlands	0.060	0.016	0.028	0.092
Yorkshire and the Humber	0.065	0.016	0.034	0.097

5.3.2.2 Results for the Netherlands

Table 5.6 and Table 5.7 below show the regression results for the same two dependent variables, household expenditure and Household Emissions Intensity, for the Netherlands.

For the Netherlands, all independent variables contributed significantly to the model for total greenhouse gas emissions, and all except the class variables had a positive correlation. Changes in expenditure explain much of this result, as can be seen from the model for the dependent variable expenditure in Table 5.6, which is similar to that for total emissions: all independent variables, with the exception of children aged under 2, contribute significantly to the model, and the direction and relative sizes of the coefficients generally follow proportionally those for total emissions. Variation in HEI does still have a significant effect on total emissions in the Netherlands too, falling with income and higher education levels, and increasing with numbers of household members and male age.

Table 5.6 Regression estimates for total annual household expenditure, for Dutch working age couple households

Adjusted R² = 0.499

Weighted, n= 1,626 (of which 17 cases excluded due to missing data)

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: €31,440 per annum	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: € per annum per unit change in predictor variable</i>			
	B	Std. Error		
(Constant)	3489.87	1865.11	-165.67	7145.42
Variables regarding head of household & partner:				
Male usual weekly hours	87.01	20.79	46.26	127.76
Female usual weekly hours	68.84	23.58	22.62	115.06
Male gross annual income from employment and self-employment, €	0.37	0.04	0.29	0.45
Female gross annual income from employment and self-employment, €	0.32	0.04	0.25	0.40
Variables regarding other household members:				
Gross household annual income from sources other than head of household and partner's earned income, €	0.23	0.03	0.17	0.29
Number of adults	1709.61	624.44	485.73	2933.49
Number of children - age under 2	408.37	494.27	-560.38	1377.12
Number of children - aged 2 and under 5	2250.30	439.51	1388.88	3111.72
Number of children - aged 5 and under 18	1437.87	220.18	1006.33	1869.42
Other control variables:				
Male age, years	119.49	25.02	70.46	168.53
Male education level:				
(Reference value: no educational qualifications)				
Highest educational attainment: level 3	1692.90	800.47	124.01	3261.80
Highest educational attainment: level 4	3153.54	765.79	1652.62	4654.45
Highest educational attainment: level 5	6788.08	979.76	4867.78	8708.38
Highest educational attainment: level 6	8192.96	1376.92	5494.25	10891.67
Highest educational attainment: unknown	7154.63	2622.54	2014.55	12294.70
Household class:				
(Reference value: unemployed)				
Elementary	-6902.11	1443.58	-9731.47	-4072.75
Lower	-5456.16	1345.41	-8093.10	-2819.21
Middle	-6154.69	1377.18	-8853.91	-3455.46
Higher	-8332.50	1620.61	-11508.83	-5156.17
Academic	-10022.58	2310.88	-14551.82	-5493.34
Unknown	-9812.35	4699.51	-19023.22	-601.47

Table 5.7 Regression estimates for Household Emissions Intensity, for Dutch working age couple households

Adjusted $R^2 = 0.145$

Weighted, $n = 1,626$ (of which 17 cases excluded due to missing data)

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: 1.218 kg CO _{2e} per €	Unstandardised beta coefficients		95% confidence intervals	
	Unit: kg CO _{2e} per € per unit change in predictor variable			
	B	Std. Error		
(Constant)	1.183	0.037	1.110	1.255
Variables regarding head of household & partner:				
Male usual weekly hours	4.33E-04	3.59E-04	-2.70E-04	1.14E-03
Female usual weekly hours	-4.37E-04	3.81E-04	-1.18E-03	3.09E-04
Male gross annual income from employment and self-employment, €	-1.69E-06	2.94E-07	-2.27E-06	-1.11E-06
Female gross annual income from employment and self-employment, €	-1.95E-06	4.64E-07	-2.86E-06	-1.04E-06
Variables regarding other household members:				
Gross household annual income from sources other than head of household and partner's earned income, €	-1.58E-06	3.04E-07	-2.18E-06	-9.87E-07
Number of adults	0.025	9.18E-03	0.007	0.043
Number of children - age under 2	0.032	0.011	0.011	0.053
Number of children - aged 2 and under 5	0.017	8.66E-03	0.000	0.034
Number of children - aged 5 and under 18	0.024	3.92E-03	0.016	0.032
Other control variables:				
Male age, years	0.002	5.31E-04	0.001	0.003
Male education level: (Reference value: no educational qualifications)				
Highest educational attainment: level 3	-0.026	0.017	-0.059	0.006
Highest educational attainment: level 4	-0.037	0.016	-0.069	-0.006
Highest educational attainment: level 5	-0.072	0.018	-0.107	-0.036
Highest educational attainment: level 6	-0.077	0.023	-0.122	-0.033
Highest educational attainment: unknown	-0.084	0.035	-0.153	-0.016
Household class: (Reference value: unemployed)				
Elementary	0.060	0.026	0.009	0.111
Lower	0.014	0.020	-0.026	0.054
Middle	7.87E-03	0.019	-0.029	0.045
Higher	-0.011	0.020	-0.051	0.028
Academic	1.26E-03	0.026	-0.051	0.053
Unknown	0.013	0.038	-0.061	0.088

5.4 Discussion

This chapter provides an understanding of the significant relationship between the working patterns of household members and their household's greenhouse emissions. The hypothesis tested in this chapter is found to hold, namely that reductions in the working times of household members lead to reductions in the greenhouse gas emissions from that household's consumption. This is tested using cross-sectional data of nationally representative samples of UK and Dutch households. The regression models tested predict a high level of variance in household greenhouse gas emissions in both countries.

As expected based on the consumption behaviour literature reviewed in chapter 3, the principle effect of working time on emissions is not direct, but rather is mediated by earned income: reducing working hours reduces income, which in turn reduces emissions. Gross earned income is the main predictor of household emissions in both countries. Each extra pound earned in the UK by the analysed households adds 0.2kg to household greenhouse gas emissions, and each extra euro 0.32-0.34kg to Dutch household emissions. In both countries working hours are a big determinant of this earned income, so that working hours have a strong indirect effect on emissions.

Independently of their effect on income, male and female working hours only have statistically significant effects on emissions in the Netherlands: here, each extra hour worked per week correlates with increased annual household emissions of 106kg CO_{2e} for male working hours, and 64kg for female, even controlling for income. This is an interesting result, and the regression models for the Netherlands indicate that the reason is that total household expenditure is also significantly correlated to both male and female working hours, controlling for income. Changes in Household Emissions Intensity relating to working hours are not statistically significant. These results indicate that among Dutch households, those working shorter hours tend to spend less of their income, even controlling for earned income. This could be because they save more, perhaps because they consider their economic position to be

less secure. Further research, such as qualitative interviews, would be needed to uncover more about the reasons for this result.

Whilst male and female working hours have no significant effect on emissions in the UK, they do have a statistically significant correlation with Household Emissions Intensity, which falls with longer hours even controlling for income. With a larger dataset, this result might translate into a significant effect on emissions. Unlike with the Netherlands however, this means that households working longer hours tend to buy different kinds of goods and services than those working shorter hours. Again, without further research, outside the scope and aims of this thesis, what these changes might be, and the underlying reasons, cannot be identified. While these results are interesting in that they indicate that changes in household consumption patterns occur with changes in working hours that are not purely the result of effects on household income, the substantive size of these effects on emissions is small compared to the effects of working hours change on income, and hence expenditure.

Returning to the results for greenhouse gas emissions, the structure of the household also has a significant effect on emissions: as expected, the age of the head of household, and the number of household members of different age bands (other adults, and children of different ages), all generally affect emissions, with each extra household member corresponding with increased emissions of between 1,300kg and 3,100kg per year, and each year of age of the male head of household predicting an extra 180-190kg of annual CO_{2e}. The results are strikingly similar between the UK and the Netherlands, and indicate that the demographic group of the household is an important predictor of emissions. The implications of the results for the other sociodemographic variables included (education level, social class and, for the UK, geographic region) are harder to determine, but they again indicate that these factors can in many cases explain some degree of the household's emissions even controlling for the other variables discussed above.

The models show that there is little substantive difference between emissions arising per hour worked or per unit of income earned from either male or female work (what

differences that there are between beta values in the equivalent male and female variables are not statistically significant). This indicates that a household in which the combined income from the male and female is x and the combined working hours are y will have similar emissions levels regardless of the distribution of income and work between the male and female. The principle exception to this is with working hours in the Netherlands, where the direct effect of an hour worked is somewhat higher for the male than for the female. In this case, the difference between a male and female full time worker (40 hours per week) is around 1,700kg per year, controlling for income effects, roughly 6% of an average household's total emissions. The effect is thus substantively small and, again, is not statistically significant. In short, increasing gender equality in paid working patterns should, controlling for income effects, have no significant effects on household greenhouse gas emissions, signifying that there are no tensions between the policy goals of reduced emissions and increased gender equality in work and care.

The results for total expenditure and Household Emissions Intensity (HEI) provide some further understanding of the results for greenhouse gas emissions. Expenditure increases with income, but at a slower rate in all the models: a doubling of gross earned income correlates with an expenditure increase of 32-51%,⁵⁸ depending on who earns the money (the male or female) and country. This can be explained by increasing income tax and falling benefits with increasing earned income (effects which are not modelled), the underreporting of income at low income levels, and consumption smoothing by the household, i.e. increasing saving and reduced borrowing at higher earned incomes. HEI meanwhile falls with income. The combination of these factors explain why emissions do not increase as fast as income (a doubling of earned income less than doubles emissions), and is equivalent to the results of other research showing that emissions have an elasticity with income of below 1 (Biesiot and Noorman 1999:374; Moll et al. 2005:269).

Comparing the UK and the Netherlands, expenditure is predicted by a greater range of variables for the Netherlands than for the UK, where working hours, non-earned

⁵⁸ Based on the statistically significant results only.

income sources, age, education level and most class variables are not significant predictor variables. Dutch Household Emissions Intensity falls with income with the same order of magnitude as for the UK, and the correlation is similar regardless of the source of income, although the correlation with female earned income is the most strongly negative, as with the UK model. Interestingly for HEI, working time variables are only significant explanatory factors for the UK (although this does not translate into a significant effect in the models for total emissions).

The result that working time is a strong determinant of household greenhouse gas emissions is significant for the thesis. Reducing working time can thus be expected to reduce emissions, primarily because it leads to reduced income and hence reduced expenditure, an effect only slightly offset by the likely increase in Household Emissions Intensity.

From the policy perspective, policy instruments affecting working time can then be expected to affect greenhouse gas emissions, as argued by other authors (see chapter 2, section 2.1). The expenditure results are consistent with the work of other authors showing that savings rates increase with income, and with different demographic groups saving and borrowing to different degrees. This also needs consideration in policy design because of the differing levels of delayed effects on emissions that this implies, as discussed in chapter 3 (section 3.8.2).

Finally, the results are also useful for the scenario modelling in the subsequent two chapters. The generally high model fits for greenhouse gas emissions indicate that the effect of working time changes on emissions can be estimated with a substantial degree of certainty based on just a few readily available variables; it is not necessary to estimate the detailed changes in expenditure levels and Household Emissions Intensity of the household. This allows simpler modelling of emissions changes under different scenarios of working time changes in the following chapters. Results also show different demographic groups, such as those with or without children, and based on age band, also (in most cases) have significantly different emissions levels even controlling for working time and income. This is a further reason to consider

them separately in the scenario models in the following two chapters (in addition to the potential for them to respond differently to policy instruments).

5.5 Summary

This chapter tests the hypothesis that reducing the working time of household members reduces household greenhouse gas emissions, and finds it to hold in both the UK and the Netherlands for representative samples of the working age populations drawn from household expenditure surveys. Although consumption behaviour is complex and likely to be driven by a multitude of personal characteristics and situational factors exogenous to the models developed in this chapter, the regression models estimating household emissions nevertheless have high levels of fit. The results indicate that working patterns and income exert strong effects on household emissions in the UK and the Netherlands. Working hours affect emissions via their effect on income but, controlling for income, only directly affect emissions in the Netherlands, and then only to a small degree. Other sociodemographic variables (presence of children of different ages, age band, education level, class, and geographic location) also predict some level of emissions in most cases. Models of household expenditure and Household Emissions Intensity indicate that expenditure increases with income but with an elasticity of substantially less than 1 (i.e. a doubling of income less than doubles expenditure), whilst HEI decreases with income, helping to explain the result that emissions do not increase as rapidly as income.

The results indicate that working time changes are likely to affect greenhouse gas emissions. This has implications for working time policy design too, as such policies are thus also likely to have emissions effects. The model developed of household emissions is both parsimonious but also explains a high level of variance in household greenhouse gas emissions. The regression results in this chapter are thus quite suitable for use in the scenario modelling in the following two chapters, in which the effects on greenhouse gas emissions of different hypothetical changes in the working patterns of the UK and Dutch populations are estimated. These chapters examine the substantive size of greenhouse gas emissions changes under different

changes in working patterns, and from that, the implications of such effects for the design of working time policy are discussed.

Chapter 6 The greenhouse gas implications of UK and Dutch policies to increase labour market participation

The previous chapter provided empirical support for the argument that changes to levels of paid work in the household change the household's greenhouse gas emissions, primarily by affecting its total income, which then influences expenditure. However, the household model does not provide a clear understanding of the substantive size of these effects. What level of emissions changes could be expected under different scenarios of change in the working patterns of households and the population as a whole?

This chapter and the next address this question for two situations. The next chapter examines the potential of substantial working time *reduction* to contribute to greenhouse gas emissions reduction goals.

This chapter takes the opposite approach, and assesses the greenhouse gas implications of current government objectives relating to working time. There are diverse policy instruments in place to support periods of reduced working time over the working life course, for maternity leave, paternity leave (to a much more limited extent), sickness, disability and, in the Netherlands, more generally for any purpose. However, the only working time policies in the UK and the Netherlands for which there are clearly defined, measurable objectives are those relating to increasing labour market participation rates. As such, measurable objectives in the two countries are actually to *increase* total paid working time in the population, by moving more people who are currently not working into paid work. The ecological economics literature, and the household model tested in the last chapter, indicate that this will increase greenhouse gas emissions, but by how much? What are the implications for working time policy?

This chapter estimates the effect on emissions of attaining the UK and Dutch goals for increased labour market participation rates among the working age population. Formally, it tests the hypothesis that:

Current UK and Dutch policy goals relating to paid work will substantially increase national greenhouse gas emissions

Earlier chapters have reviewed in detail the route by which working patterns affect emissions so this is not recapped here. Instead, this chapter begins by giving details of the intended aims of working time policies in the UK and the Netherlands, both their social and economic goals, and particular objectives for labour market participation rates. The following section details the modelling approach by which the greenhouse gas effects of these participation rate objectives are estimated. Next, the results of the analysis are presented. These results are then discussed, critically looking at the modelling assumptions and at the implications for designing working time policy capable of reconciling environmental, social and economic goals. In particular, the modelling follows the official policy aims, in that it assumes people who move into paid work will achieve wage rates and employment opportunities equivalent to a similar individual who already has a job. There is a real risk however of the newly employed only obtaining marginal, low paid work, especially if they lack the skills required by employers or face multiple barriers to securing good jobs. The discussion therefore considers the implications for the modelling if this assumption is not met. A final section summarises the chapter.

6.1 Working time policy aims in the UK and the Netherlands

Working time policies in the UK and the Netherlands, as in other countries, are designed to meet social and economic goals, whilst their effects on environmental goals are not considered (see chapter 2). Key social goals relate to increasing the labour market participation of certain groups considered to be socially disadvantaged, to increase their material affluence, reduce poverty and social exclusion, and to increasing opportunities and capabilities to transition, temporarily, out of the labour market or reduce working hours for specific reasons, such as for

childcare (Knijn et al. 2007; Freud 2007; Esping-Andersen 2002). Economic goals include the reduction of state expenditure on benefits payments for disadvantaged groups and increased revenue from income taxes, increasing labour market supply to match predicted future demand, and increasing labour market skills and flexibility and hence wider economic competitiveness and growth (Knijn et al. 2007; Committee on Labour Market Participation 2008; European Commission 2010). Chapter 2 discussed these goals, and the underlying values and types of policy instrument used to achieve them, in detail (section 2.2).

Table 6.1 shows all demographic groups which are highlighted in UK, Dutch and EU policy documents with explicit, measurable working time policy objectives. These all relate to participation rates in paid employment, and include everything current up to early 2010.⁵⁹ In both countries, national objectives exceed EU-level objectives laid down in the Lisbon Strategy; in fact, latest participation rates already exceed EU objectives. Note that UK and EU objectives are expressed in terms of the Labour Force Survey (LFS) definition of employment (at least one hour of work in the week of survey⁶⁰), whilst Dutch objectives are expressed in terms of a more stringent national definition (at least 13 hours of work per week). UK objectives are sometimes expressed in terms of numbers employed rather than participation rates. The equivalent LFS-definition participation rates are estimated in the table for these objectives.

In many instances, whilst government documents identify that it would be beneficial to increase the labour market participation rates of particular demographic groups, and policy instruments have been set up to achieve this, no specific policy objective has been set. For example, UK policies explicitly target lone parents, the long-term unemployed, the sick and disabled, ethnic minorities, particularly women of Pakistani and Bangladeshi origin, young people, older people, and those in cities

⁵⁹ Policy changes following the changes in government in both the UK and the Netherlands after general elections in mid 2010, as well as revision of the Lisbon Strategy following the end of the period it covered in that year, are not considered in this chapter.

⁶⁰ “Employed persons are persons aged 15 and over who performed work, even for just one hour per week, for pay, profit or family gain during the reference week or were not at work but had a job or business from which they were temporarily absent because of, for instance, illness, holidays, industrial dispute, and education or training” (Eurostat 2009).

(where unemployment rates are higher) (Department for Work and Pensions 2007:8) to increase their labour market participation, but set no measurable participation rate objectives for most of these groups. In the Netherlands, the situation is similar: among women, for example, low average working hours is seen as a problem, but despite the notional aim to “increase labour participation among women in terms of hours worked” for the 1.5 million women working less than 25 hours per week, there is no measurable objective set out for what to increase it to (Ministry of Economic Affairs 2008:61; Committee on Labour Market Participation 2008:6).

Table 6.1 Policy objectives for participation rates in paid employment, by target demographic group, in the UK and the Netherlands

Target demographic group	Net participation rate objectives (in paid work, Labour Force Survey definition)		
	UK objectives	Dutch objectives	EU Lisbon Strategy objectives
All working age adults	80% employment	85%, LFS definition* (80%, by 2016, gross participation, including jobseekers, Dutch definition)	70% by 2010 (EU definition)
Older workers (age 50 to retirement age)	80%* (Extra 1 million employed by 2015)	67%, LFS definition* (45% of 55-64 year olds, by 2010, net participation actually in work, Dutch definition)	50% by 2010 (EU definition)
Lone parents	72.4%* (Extra 300,000 employed by 2015) ⁶¹	No specific objective, large municipality-level differences in decisions re. lone parent work obligations	No specific objective
Women	No specific objective	65% in 2010 (net participation, actually in work, Dutch definition)	60% by 2010

* LFS definition participation rates are author’s own calculations based on stated objectives expressed as numbers of people in UK and by Dutch definitions of employment in the Netherlands: see section 6.2.5 for details of their calculation.

Sources: HM Government (2008:28) for the UK
 Ministry of Economic Affairs (2008:11,57) for the Netherlands
 European Commission (2010:15) for EU Lisbon Strategy

⁶¹ Knijn et al. (2007:646) mention an objective of 70% lone parent employment by 2010, but no source reference is provided.

6.2 Research design

6.2.1 Data used

As throughout this thesis, the principle data sources used for calculating household level results in this chapter are household expenditure survey datasets and product emissions intensity data, as detailed in chapter 4 (section 4.2). For the UK, the 2004-5 Expenditure and Food Survey, and environmental data from the Stockholm Environment Institute-York, are used. For the Netherlands, the 2000 *budgetonderzoek* survey is used along with environmental data from Vringer et al (2010). Results from the expenditure survey samples are extrapolated to produce estimates at the national level using the approach described in section 4.3.3 of chapter 4, drawing on national greenhouse gas emissions estimates produced by the Carbon Footprint of Nations project (see section 4.2.4 for details of this dataset).

In addition, data on participation rates and population sizes used in this chapter are drawn from the Labour Force Survey (Eurostat 2010). Aggregate data from the LFS are available online for EU member states, presenting a range of population and labour market statistics by year. Data were accessed by demographic group and year for the participation rate and population size variables required in this chapter for the UK and the Netherlands.

6.2.2 Modelling the effects of meeting working time policy objectives

The UK and Dutch policy objectives described above lay out specific increases in participation rates in the populations which, with certain assumptions, can be precisely quantified as changes in paid working hours for particular demographic groups. How these aspired-to working patterns differ from a particular baseline situation such as that observed in the household expenditure survey datasets can also then be determined. As the data described above, and the regression model results in chapter 5, allow estimates household greenhouse gas emissions to be made based on given working patterns, then the change in emissions between the baseline and a scenario in which these objectives have been reached can also be estimated.

Changes in expenditure are also estimated to inform the discussion on the compatibility of greenhouse gas and social goals (in section 6.4). Given the comparatively low explanatory power of the regression models for the other independent variable used in this thesis, Household Emissions Intensity (as presented in chapter 5, section 5.3.2), the effects on it of the scenarios in this chapter are not estimated. Omitting this variable from the modelling does not impede on achieving the research aims. An indication of the change in Household Emissions Intensity can still be obtained from looking at the relative change in emissions and expenditure in this chapter as, by definition, it is equal to household greenhouse gas emissions divided by total expenditure.

In short, everything is available to estimate the greenhouse gas (and expenditure) effects of meeting these policy objectives. To increase comparability between the UK and Dutch results, the greenhouse gas effects of two scenarios are modelled. The scenarios modelled are:

Baseline: The characteristics of the UK and Dutch populations based on the representative samples in the 2004-5 UK Expenditure and Food Survey, and the 2000 Dutch *budgetonderzoek*.

Scenario 1: The 2008 situation. As the Dutch and UK baseline data are for different years, emissions and expenditure figures are estimated for 2008 to give a common comparator year. The emissions for 2008 are estimated based on the baseline data taking into account changes in participation rates and population sizes for different demographic groups revealed in the Labour Force Survey data, from Eurostat (2010). 2008 is the most recent year for which data were available at the time of analysis.

Scenario 2: Meeting of national participation rate objectives. Assuming no further change in population sizes after 2008, this is an estimate of the emissions arising when participation rate objectives are met, taken to be at some point in the near future (around 2015-2016, the times set by the UK and the Netherlands for achieving their objectives).

The changes in emissions between the baseline and scenario 1, and between scenarios 1 and 2, are calculated for different demographic groups corresponding with the different policy objectives being considered. As discussed above, measurable objectives relate to participation rates for older working age individuals, for lone parents (in the UK), for women (in the Netherlands), and for the working age population as a whole. For simpler modelling, the objective for women in the Netherlands is not modelled. Based on these objectives, demographic groups were defined based on the following criteria:

- the labour market status (working or not working⁶²) of the head of household and, if present, partner. NB. “working” is defined here following the Dutch national definition of being in paid labour for at least 13 hours per week;
- whether the head of household lives with a partner or not (here termed as “couple” or “single” households);
- the gender of the person(s) who are and are not working;
- the age band of the head of household or partner, divided into whether or not they are of older working age, from aged 50 to statutory retirement age. Statutory retirement age is 65 for men and 60 for women in the UK⁶³, and 65 for both men and women in the Netherlands;
- for single households, whether the head of household also has a child or children living with them.

For parsimony, not all possible combinations of these criteria are distinguished as separate demographic groups. The groups used for the analyses in this chapter are presented in Figure 6.1 below. They represent a set of 17 mutually exclusive groups such that any working age household will belong to one (and only one) group. As the groups are defined in part based on the working patterns of the household members (the head of household and partner, if present), then if the working patterns of one of

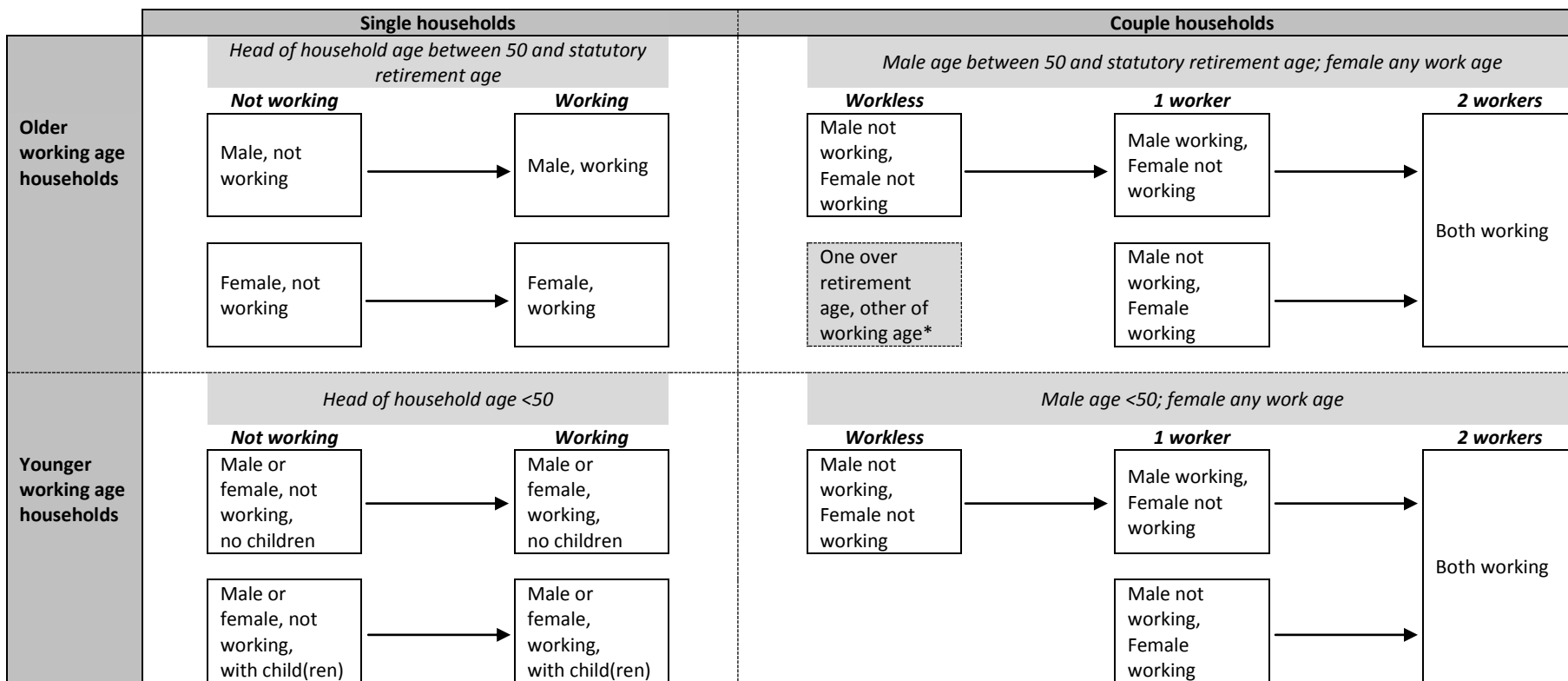
⁶² “Working” and “participating” are used interchangeably in this chapter to indicate someone who is in paid work.

⁶³ The gradual increase in women’s retirement age in the UK from 60 to 65 which began in April 2010 (UK Government 2011a), and the abolition of the employer’s right to end employment when an employee reaches retirement age in April 2011 (UK Government 2011b), are not considered in the modelling.

the household members changes, so too does the group to which the household belongs. The arrows in the diagram represent the transition pathways by which a household may move from one group to another if a household member enters paid work, if they are “activated” as a result of working time policy instruments, for example. For the sake of simplicity it is assumed that if a workless couple household (one in which neither the head of household nor partner are in paid work) is activated by policy, it will be the male, rather than the female or both, who is activated. Assuming that the male rather than the female will be activated is broadly consistent with existing working patterns in couple households: of one-worker couple households, it is the male that is working rather than the female in 81% of households in the UK, and 93% in the Netherlands (author’s own calculations, using the Expenditure and Food Survey 2004-5 and budgetonderzoek 2000).

The method for estimating changes in emissions and expenditure between scenarios involves two stages. Firstly, mean changes at the household level in expenditure and emissions as a result of a household member moving from non-participation to participation in paid labour (activation) are calculated for each of the ten 10 transition pathways presented in Figure 6.1 (i.e. for each of the arrows indicating a move from one demographic group to another). Secondly, at the national level, the numbers of households which change from one demographic group to another are calculated for each of these 10 transition pathways, so that the household level results can be extrapolated to estimate changes in greenhouse gas emissions at the national level. The next two sections provide further detail of the methods for these two stages.

Figure 6.1 Working age households by demographic group, categorised by work status of household members, age band, presence of children, and gender, showing originator and destination groups for activation into the labour market



* The definitions used in this thesis of working age couple households include households in which one partner is over retirement age but the other is still of working age. This group comprises those households where one member of the couple only is over retirement age. They are included for completeness, but it is assumed in the scenarios that they will not be influenced by working time policy objectives, i.e. the working age member will not be activated if he or she is not already in work.

NB. Households may contain any number of adults additional to the head of household and partner (if present). They may also contain any number of dependent children (aged 0 to 17 years), except where “no children” is explicitly stated. Older and younger working age households are defined based on the age of the head of household in single households, or the age of the male in couple households, as presented in the figure. There are a small number of same-sex couple households in both datasets; these are included in the categories above and not treated separately. Whether the household is classed as younger or older is defined for these cases based on the age of the Household Reference Person (for the UK data) or the main breadwinner (for the Dutch data).

6.2.3 Household level

Figure 6.1 above shows the transition pathways along which households move if a household member (the head of household or partner, if present) is activated (i.e. moves from not being in paid work to being in paid work). It is assumed that policy will, in the meeting of objectives, lead to a random sample of individuals within each demographic group being activated and thus their household moving from the group in which they are currently (the originator group) to the group to which they are matched (the destination group). For example, if a non-participating single older working age male is activated, he will move to the group for participating single older working age males. It is assumed that when an individual is activated, the greenhouse gas emissions and expenditure of their household will change, on average, from the mean of the originator group to the mean of the destination group (with a small correction described in the next paragraph). Drawing on the models of household greenhouse gas emissions developed and discussed in chapter 5, this assumes therefore that, when activated, the household members' working hours, wage rates and sources of non-earned income will, on average, change to equal the mean of the destination group, and hence too will their mean greenhouse emissions match the destination group mean. It is assumed that the design of the policies which result in their activation will, along with other factors, ensure this is an outcome. This assumption is returned to in the discussion later, as whilst official policy aims may be to achieve this, the newly activated are at greater risk, for a variety of reasons, of entering work that is substantially worse than the average in terms of wage rates and opportunities (Freud 2007:3–5).

In practice, chapter 5 demonstrated that there are socio-demographic characteristics of the household in addition to working hours, wage rate and non-earned income sources which have a statistically significant effect on household emissions and expenditure, namely: number of adults in the household, numbers of children aged 0 to <2, 2 to <5, and 5 to <18, age of the head of household, and education level of the head of household. There are statistically significant differences in the means of some of these characteristics between the pairs of originator and destination groups.

As these are factors which will not be altered by the activation of a household member, i.e. they are outside the influence of working time policy, the differences are controlled for to produce more accurate estimates of the changes in emissions and expenditure arising from activation. The estimated mean greenhouse gas emissions for the households being activated are thus adjusted by the difference in means between the originator and destination groups for these characteristics multiplied by the beta coefficient for these variables (as calculated and presented in chapter 5).

This provides the following output, presented in Appendix 4. For each of the 10 demographic groups in Figure 6.1 containing non-participating individuals, mean household emissions are presented. The mean household emissions are then calculated for when the non-participating individual is activated into paid labour. The estimate is based on the mean for the destination demographic group, correcting for any compositional differences in the two group populations relating to the numbers of adults and children, head of household/male age, and education level of head of household/male, as just described above. This allows the mean per household effect of activation on greenhouse gas emissions for the 10 different originator groups to be estimated.

The same method is followed to calculate the mean effects on expenditure for each of these 10 activation pathways, with the results also presented in Appendix 4.

6.2.4 National level

Total emissions are calculated for each of the 17 demographic groups in Figure 6.1 for each of the three scenarios (Baseline, Scenario 1 and Scenario 2) described earlier. The total emissions from the households in the samples are converted to produce national totals for all working households using conversion factors for both countries, calculated following the method described in chapter 4, section 4.3.3. For the baseline situation, this results in total national emissions equal to those calculated by the Carbon Footprint of Nations project (www.carbonfootprintofnations.com, and see Hertwich and Peters 2009), as described in section 4.2.4.

Changes in emissions from the baseline up to the year 2008 (Scenario 1) are estimated by taking into account changes in populations and participation rates between the baseline year and 2008 for older working age and younger working age adults, and lone parents, drawn from the Labour Force Survey (Eurostat 2010). Changes in emissions between the 2008 situation (Scenario 1) and final UK and Dutch objectives (Scenario 2) are estimated in a similar way based on further increases in participation rates based on the UK and Dutch objectives. It is assumed that there are no further changes in population sizes overall or for any demographic group between Scenario 1 and Scenario 2.

To calculate the changes in emissions between the baseline and Scenario 1, and between Scenario 1 and Scenarios 2, the numbers of households moving between demographic groups along each of the 10 transition pathways described above are calculated, assuming that each non-participating individual has an equal probability of being activated to meet the total changes in participation rates over the period. The resultant changes in total greenhouse gas emissions between scenarios is thus calculated by multiplying the number of households moving between demographic groups by the estimated mean change in their emissions that this results in. Changes in population sizes are also accounted for between the baseline and Scenario 1. The method allows the increase in national emissions arising from older working age households, younger working age households, lone parents, and overall, to be separately estimated.

6.2.5 Methodological issues

At the national level, both Dutch and UK objectives were subject to some interpretation in the modelling. In the UK, the older working age objective of an extra 1,000,000 in work gave no baseline date to compare to. Compared with 2008 Labour Force Survey (LFS) data, the objective implies a final participation rate of 82.8% for older working age individuals, higher than the overall working age population objective of 80%. It is unlikely that this is the actual intention of policy, so an objective of 80% participation for older working age adults was instead assumed. In the Netherlands meanwhile, objectives are expressed in terms of

national definitions of participation, and required conversion to LFS definitions. This was done based on multiplying objectives by the observed differences between the year 2000 LFS defined participation rate in the Labour Force Survey data and the Dutch definition participation rate observed in the budgetonderzoek for each of these demographic groups (older working age, younger working age, and lone parent). For example, the lone parent participation rate in the Netherlands in the year 2000 is 64% according to the Labour Force Survey, but is 65.4% based on the household expenditure survey, 2.2% higher (1.4 percentage points). A conversion factor of 2.2% is thus used for lone parents throughout the modelling to convert between LFS definition employment rates and the Dutch definition. Conversion factors for older working age and younger working age groups are calculated similarly.

To maintain simplicity of modelling, it was assumed that only the head of household and partner, if present, were subject to activation measures, and that participation rate objectives pertained only to these individuals. This omits some working age non-participating individuals from consideration where they live in households but are not the head of household or partner. In practice, this is likely to only be a small proportion of working age individuals, as working age adults predominantly live in their own property (or jointly with a partner). Nevertheless, this contributes to the differences in participation rates observed between the household expenditure survey datasets (calculated based only on data for head of household and partner, if present) and those derived from Labour Force Survey data for the same years.

The models assume the principles of the adult worker model as enshrined in Dutch, UK and EU working time policy approaches (see chapter 2, section 2.2.2), so that all adults are treated the same in the models, as potential labour market participants. Assuming this, each non-participating adult is assumed to have an equal probability of being activated to meet participation rate objectives. For example, if objectives require 10% of non-participating older working age adults to be activated, then each non-participating older working age adult out of the head of household and partner, if present, has a 10% chance of being activated in the model. In couple households in which neither the male nor the female are working, the household has double the

probability of one member being activated compared to households with only one non-participating working age adult, but it is always assumed to be the male that is activated. Also, for modelling simplicity, couple households in which one member of the household is over retirement age and the other is below, but not working, are not considered susceptible to activation.

6.3 Results

6.3.1 Patterns of labour market participation in the UK and the Netherlands

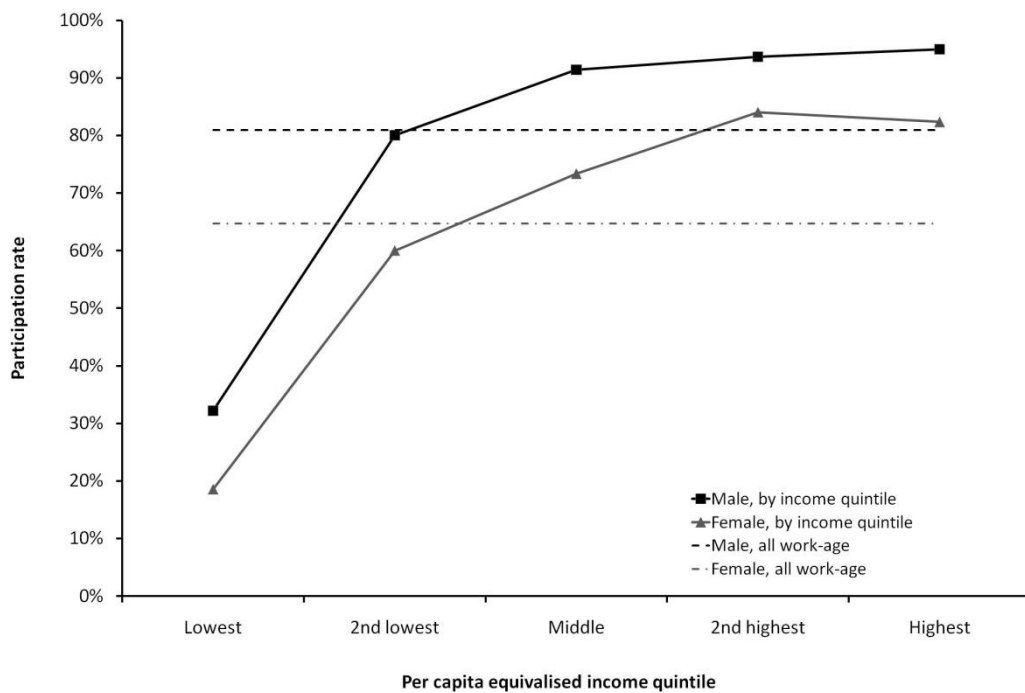
An initial look at participation rates shows marked differences between men and women and by income, as well as between the UK and the Netherlands. Figure 6.2 and Figure 6.3 present participation rates⁶⁴ by equivalised income quintile.⁶⁵ In the UK, very low participation rates among the lowest income band are observed, with rates increasing with income until the highest two bands. This is to be expected as benefit rates for those not in work will in most cases be substantially lower than the income received by those in work. Non-participation in paid work thus implies low income, and vice versa. Female rates are around 16% lower than for males, with some variation between income bands but no overall pattern.

In the Netherlands, whilst the trends are similar, participation among the lowest income band is somewhat higher than for the UK, especially for men. Female participation rates are markedly lower than male, some 25% points lower, although this converges slightly at the highest income band.

⁶⁴ Dutch definition, at least 13 hours paid work per week.

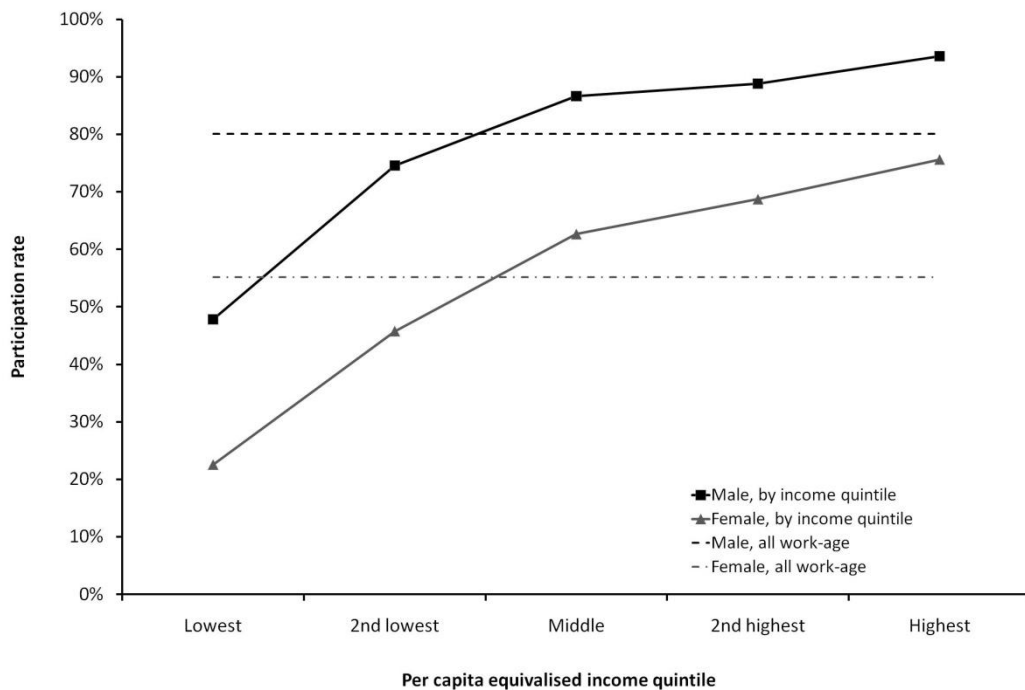
⁶⁵ Equivalised using the OECD method described in chapter 4, section 4.3.2.1.

Figure 6.2 Male and female participation rates by per capita equivalised income quintile of household, UK, 2004-5



Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 6.3 Male and female participation rates by per capita equivalised income quintile of household, Netherlands, 2000

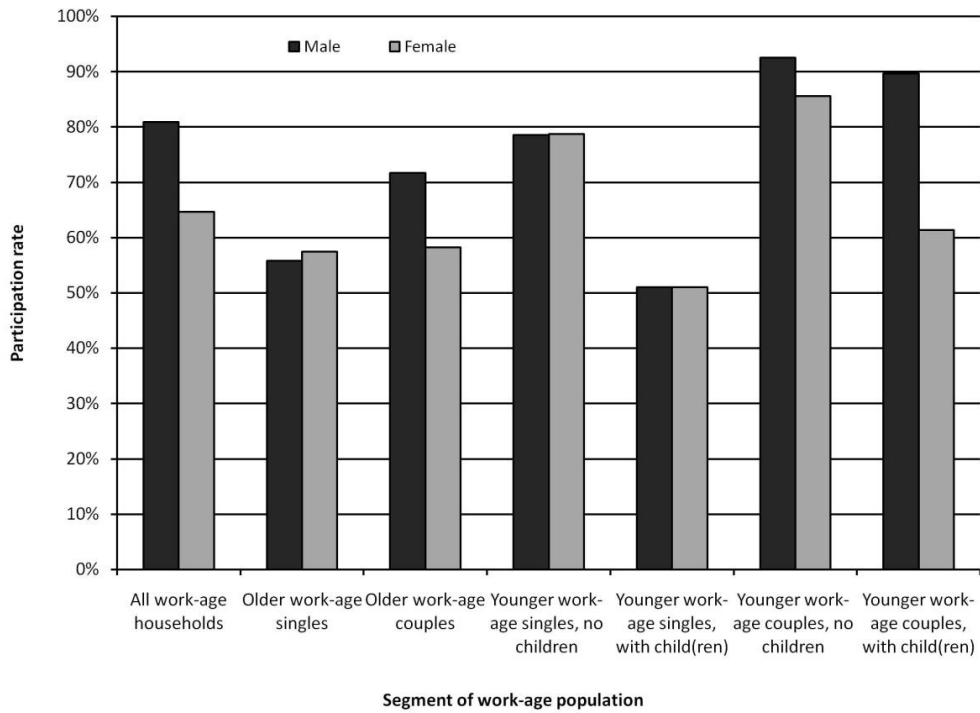


Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 6.4 and Figure 6.5 present participation rates by demographic group. In the UK, the overall 15% higher participation rate among men compared to women is seen to be exclusively the result of lower participation among women compared to men in couple households. The difference in participation in couple households is most marked among households with children, with a nearly 30 percentage point difference (90% of men in work, 61% of women). Among single households, there is little difference in participation rate between men and women. Being older, being single, and having children all correlate with substantially lower participation rates (although in couple households this latter effect is only substantial for women).

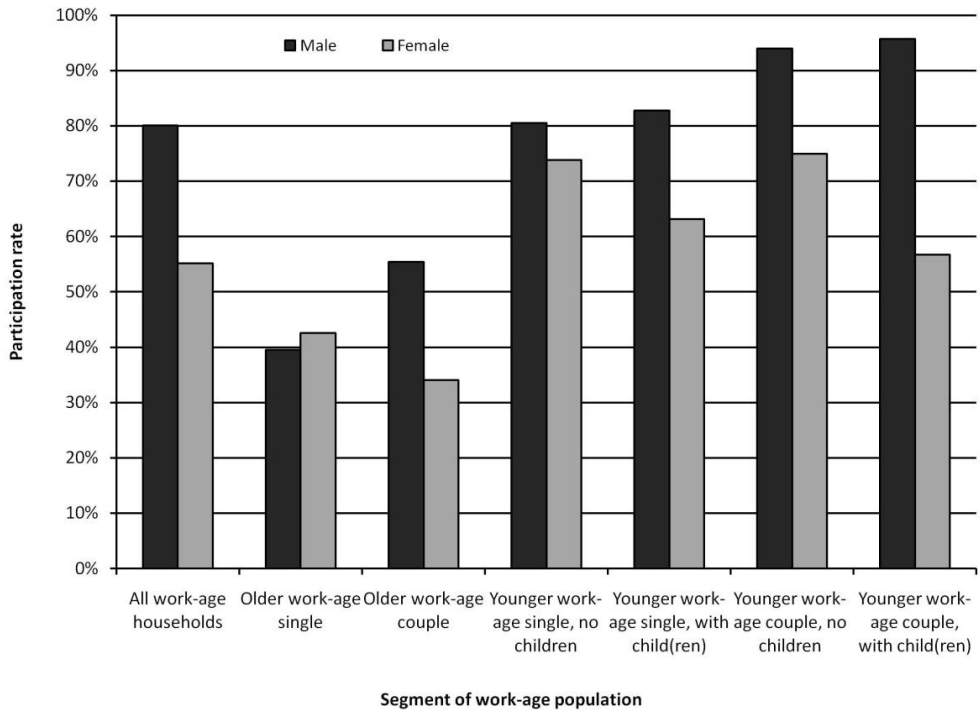
In the Netherlands, patterns are somewhat different to the UK. Across all household types, men are more likely to be in work than women, the exception being among older single households where the rates are similar. The greatest difference in participation rate is again in couples with children, with a 39 percentage point difference (96% for men, 57% for women). As with the UK, being older correlates with a lower participation rate. The presence of children reduces only women's participation rates however, and male rates are even marginally higher when children are present. The greatest difference between the UK and the Netherlands, aside from the greater gender differences, is among single households with children, which have much higher participation rates in the Netherlands, especially for men.

Figure 6.4 Male and female participation rates by demographic group, UK, 2004-5



Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 6.5 Male and female participation rates by demographic group, Netherlands, 2000



Source: Author's own calculations. See section 4.2 for details of datasets used.

These data indicate that UK and Dutch working time policy goals to increase participation rates should in principle affect mostly those on low income, raising their incomes. High income groups already exceed the participation rate objectives. Increases in participation rates will be greatest among older working age households and lone parents in the UK, but more evenly spread between demographic groups in the Netherlands.

Section 6.3.3 looks at the national changes in participation rates under the different scenarios in more detail, and their estimated social and greenhouse gas effects. The next section first estimates household level changes in emissions arising from activation, to inform these national level results.

6.3.2 Household level greenhouse gas and expenditure effects of increasing labour market participation

In almost all cases it is found that household greenhouse gas emissions increase as a result of the head of household or partner, if present, moving into paid employment where before they were not working. Figure 6.6 and Figure 6.7 below show the effect on household annual greenhouse gas emissions and expenditure of activation of one non-working household member (out of the head of household and partner, if present). Statistically significant increases are indicated by stars. Underlying data are presented in tables in Appendix 4, with further explanation of their calculation.

In the UK (presented in Figure 6.6) activating a member of a given demographic group in most situations increases both the household's expenditure and greenhouse gas emissions. In general, the proportional increase in greenhouse gas emissions is smaller than that for expenditure. This is consistent with the results in chapter 5, which indicate that wealthier households tend to have lower Household Emissions Intensities than lower income households, as they spend a greater share of their

income on relatively lower emissions intensity products, that is, products for which the emissions of greenhouse gases per pound spent on them is lower than average.⁶⁶

The greatest percentage increases in expenditure and emissions are for older single males (81% and 69% respectively), lone parents (81% and 64%) and workless younger couples (79% and 54%). These are all fairly small demographic groups, and increases are somewhat smaller for groups representing larger sections of the population.

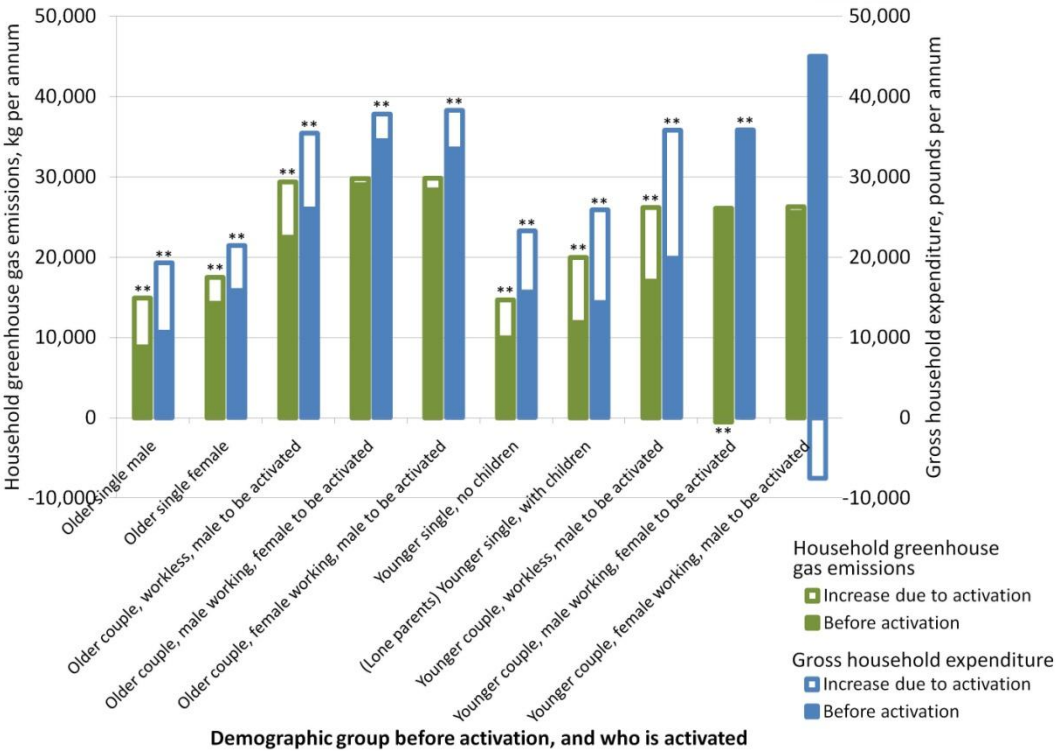
For all older working age households, the increase in expenditure is statistically significant at the 1% level. It is only significant for the first three groups of older working age household for greenhouse gas emissions however. Emissions do not rise significantly when an individual enters paid employment from an older working age couple household in which one of the head of household or partner is already in work.

Younger household expenditure and emissions increase substantially and statistically significantly on activation, at least for workless households. For households in which only the male is working, female activation makes only a small difference to expenditure and emissions (which even decrease marginally). The changes in expenditure and emissions for younger couple households in which only the female is working are not statistically significant, likely as there are very few cases of such households, so that the apparently anomalous results for this group cannot be considered reliable.

Overall, one can see that activation has a strong effect of equalising expenditure and, especially, emissions, between demographic groups, as poorer and lower-emitting households increase expenditure and emissions due to activation much more than do already higher spending households.

⁶⁶ Including items such as services, leisure activities, white goods, and so on, whilst items such as vehicle fuel, food (especially meats) and home energy use (heat and lighting) produce much higher emissions per pound or euro spent on them (see chapter 3, section 3.4, for details).

Figure 6.6 Mean household changes in greenhouse gas emissions and expenditure as a result of a household member being activated, for UK working age households, by demographic group

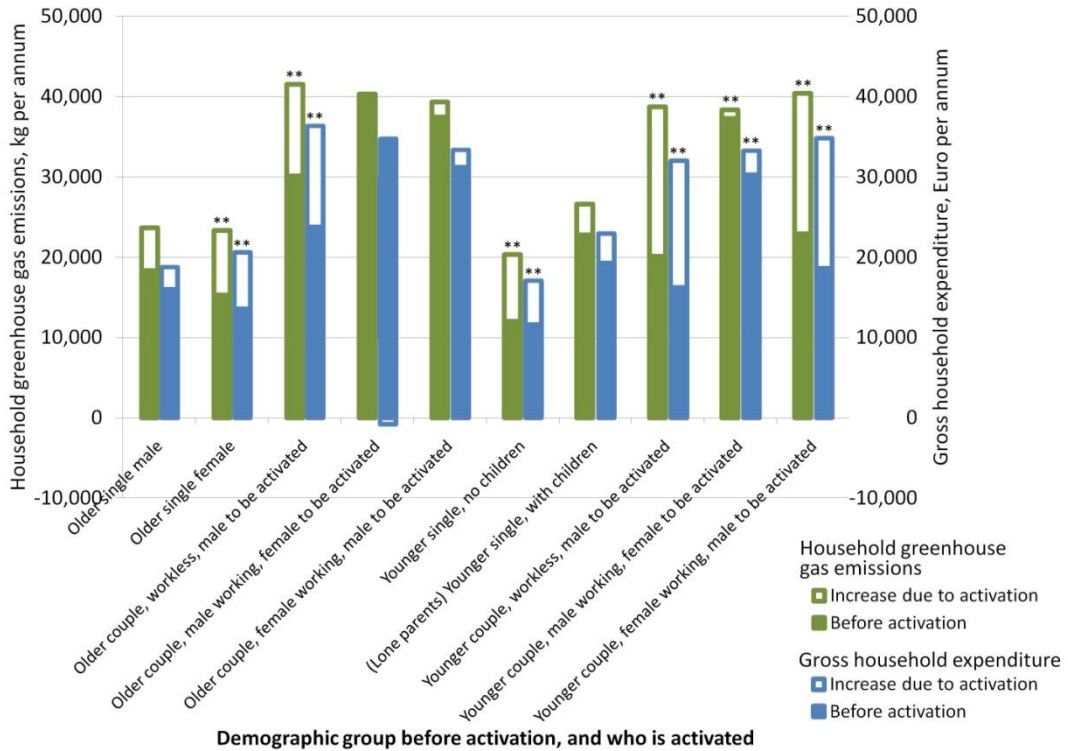


** Significant difference at the 1% level (2-tailed Wilcoxon Mann-Whitney test)
 Source: Author’s own calculations. See section 4.2 for details of datasets used.

Figure 6.7 presents equivalent results for the Netherlands. Largest increases in expenditure and emissions occur for activation of workless younger couple households (97% and 93% increases respectively), younger couple households in which the male is not working (87% and 77% increases), older single women (52% increases for both) and workless older couples (53% and 38% increases).

Among older single working age households, only females benefit significantly through increasing expenditure due to activation. Among older couple households, only the workless appear to benefit.

Figure 6.7 Mean household changes in greenhouse gas emissions and expenditure as a result of a household member being activated, for Dutch working age households, by demographic group



** Significant difference at the 1% level (2-tailed Wilcoxon Mann-Whitney test)
 Source: Author's own calculations. See section 4.2 for details of datasets used.

There appear to be substantial differences in the results between the UK and the Netherlands, with very different mean increases in expenditure and emissions resulting from activation for different demographic groups. This could be explainable by differences in the benefits entitlements of different groups in the two countries leading to different income effects of activation. Interestingly, activation appears to lead to a levelling of mean expenditure and emissions between household types in both countries, so that couple households all end up with similar mean levels, and single households too end up with similar, lower, mean levels. The differences between single and couple household emissions after activation appear to be higher in the Netherlands than in the UK.

Overall, household level data indicate that policies to increase participation rates will lead to increasing greenhouse gas emissions, as expenditure increases, assuming those activated obtain jobs of a similar standard to similar individuals already in paid work. In most cases these increases are substantially and statistically significant. The story is also one of decreasing inequality as a result of activation, as long as workless households (both single and couple) are activated. Perhaps due to differences in benefits entitlements, activating lone parent households only leads to a large and statistically significant increase in expenditure and emissions in the UK.

6.3.3 National level greenhouse gas effects of increasing labour market participation

The sections below present results for the UK and the Netherlands of the estimated increases in national greenhouse gas emissions arising from the increases in participation rates under the two scenarios described earlier. The effects of changes in participation rates between the survey year baseline (2004-5 for the UK and 2000 for the Netherlands) and Scenario 1 (the situation in 2008) are modelled, taking into account demographic and participation rate changes revealed in the Labour Force Survey data. The estimated changes between Scenario 1 and Scenario 2 (in which UK and Dutch labour market participation rate objectives have been met) are also presented. To inform the subsequent discussion on the effects of the objectives, the effects on rates of worklessness (households with neither the head of household nor partner, if present, in paid employment) and estimated effects on household income are also presented.

6.3.3.1 UK scenario results

Table 6.2 presents participation rate and population size data for the UK for the baseline situation (the year 2004-5), for Scenario 1 (the 2008 situation) and for Scenario 2 (when participation rate objectives have been met). The data show some small demographic changes between the baseline and Scenario 1, which are taken into account in the scenario modelling which follows. Participation rates overall increased over the period too, although among the largest section of the working age

population, younger working age households, the rate declined fractionally. UK objectives for labour market participation rates in Scenario 2 are as presented earlier (in Table 6.1). The largest increases being aimed for over Scenario 1 are for lone parents, followed by those of older working age.

Table 6.2 UK participation rates and demographics by demographic group

		Older working age	Younger working age (including lone parents)	Lone parents	All working age
Participation rate (LFS definition)	Baseline (2004-5)	69.9%	79.5%	54.8%	77.0%
	Scenario 1 (2008)	71.9%	79.5%	56.8%	77.4%
	% points change from Baseline to Scenario 1	1.9%	-0.1%	2.0%	0.5%
	Scenario 2 (participation rate objectives met)	80.0%	80.0%	72.4%	80.0%
	% points change from Scenario 1 to Scenario 2	8.1%	0.5%	15.7%	2.6%
Population size, 1000s, and as % of total population	Baseline (2004-5)	8,983 15.3%	24,522 41.7%	1,954 3.3%	33,505 57.0%
	Scenario 1 (2008)	9,170 15.2%	25,304 42.0%	1,916 3.2%	34,473 57.2%
	% points change from Baseline to Scenario 1	2.1%	3.2%	-1.9%	2.9%
	Scenario 2	Assumed no demographic changes from 2008 situation			

Source: EU Labour Force Survey (Eurostat 2010), HM Government (2008:28), and own calculations

Table 6.3 shows the estimated increases in national greenhouse gas emissions in the UK that arise from the changes in participation rates. While working age individuals account for just 57% of the population, the data indicate that the households in which they live account for 82% of greenhouse gas emissions from private consumption (household emissions). This is due to the fact that a substantial proportion of non-working age individuals also live in these households, both children and older adults; as a result, mean *per capita* emissions among working age households are actually somewhat lower than for households as a whole (8.4 tonnes per annum compared to 11.8).

Between the baseline (2004-5) and Scenario 1 (2008), the overall working age participation rate increased by a small 0.5 percentage points, driven primarily by an increase in older working age participation. This led to an estimated 0.2% increase in emissions from working age households. Meeting the UK objective of 80% participation (in Scenario 2), a further 2.9 percentage point increase in participation rates over the Scenario 1 situation, is estimated to increase emissions a further 1.0% from the 2008 level, over 6 million tonnes per annum assuming no demographic changes. This is a small increase compared to that between 2004-5 and 2008, but is driven by increasing participation rather than increases in the working age population.

Although both the participation rate and population of older working age individuals grew between 2004-5 and 2008, the relatively small household increases in emissions arising from activation in this group mean that the increases in emissions from this group are mostly due to increases in population rather than participation rates. However, the large 8.1% increase in the participation rate for this group that is required to meet UK government objectives will increase their total emissions by a further estimated 1.8%, 3.8 million tonnes per year, 64% of all the increases that would arise from meeting participation rate objectives for the working age population.

Lone parents meanwhile represent a much smaller, and shrinking, group in the population (5.5% of working age adults in 2008). Emissions from this group fell over the 2004-5 to 2008 period as a result of the fall in their population size, despite a comparable increase in participation rate. In line with the strong targeting of lone parents and children in workless households by government activation policy, UK objectives equate to a nearly 16 percentage points increase in lone parent participation from the 2008 situation. This will lead to an estimated 7.1% increase in emissions from this group of the population. Despite the small size of this group, this increase accounts for 37% of the total emissions increase between Scenario 1 and Scenario 2. It also represents the entirety of the increase in emissions and

participation from younger working age households. Given the precise nature of the UK's objectives, it appears the participation rate of younger people other than lone parents is actually expected to fall slightly up to the meeting of the objectives, perhaps due to increases in maternity and paternity leave take-up, participation in education, and so on. Hence the increase in emissions from younger households as a whole is in total slightly lower than for lone parents alone.

Table 6.3 UK data on annual national greenhouse gas emissions by demographic group, tonnes CO_{2e} per annum

	Older working age households	Younger working age households (including lone parents)	Lone parents households	All working age households
Baseline (2004-5)	213,737,781	352,904,828	31,893,601	566,642,609
<i>As a % of emissions from all households</i>	31%	51%	5%	82%
<i>As a % of emissions from all UK</i>	23%	39%	3%	62%
Scenario 1 (2008)	219,091,231	364,289,523	31,562,373	583,380,754
Increase from Baseline to Scenario 1	5,353,450	11,384,695	-331,229	16,738,145
(as a % of emissions from group)	2.5%	3.2%	-1.0%	3.0%
% increase due to demographic (population size) changes	2.1%	3.2%	-1.9%	2.9%
% increase due to participation rate changes	0.4%	0.0%	0.9%	0.2%
Scenario 2 (participation rate objectives met)	222,932,112	366,487,039	33,805,914	589,419,152
Increase from Scenario 1 to Scenario 2	3,840,882	2,197,516	2,243,541	6,038,398
(as a % of emissions from group)	1.8%	0.6%	7.1%	1.0%
% increase due to demographic (population size) changes	0.0%	0.0%	0.0%	0.0%
% increase due to participation rate changes	1.8%	0.6%	7.1%	1.0%

Source: Author's own calculations. See section 4.2 for details of datasets used.

What about the impact of these scenarios on social policy goals? The percentage of workless households falls in the scenarios, which take the assumption that all workless *individuals* within a demographic group (older working age, younger working age, or lone parents) are equally likely to be activated by policy. Hence couple households with two non-working individuals are twice as likely to have an

individual activated as other households where there is only one not working (single households, or couples with one member working). Based on this assumption, percentages of workless households are presented in Table 6.4. With the highest starting percentage of workless households, lone parents are also the most activated household type, followed by older working age households.

Table 6.4 Percentage of households which are workless, by demographic group, UK

	Older working age households	Younger working age households (including lone parents)	Lone parents households	All working age households
Baseline (2004-5)	18.4%	15.0%	49.0%	16.2%
Scenario 1 (2008)	16.9%	14.9%	47.1%	15.6%
<i>% points change from Baseline to Scenario 1</i>	1.5%	0.1%	1.9%	0.6%
Scenario 2 (participation rate objectives met)	10.4%	13.5%	32.5%	12.4%
<i>% points change from Scenario 1 to Scenario 2</i>	6.5%	1.4%	14.6%	3.2%

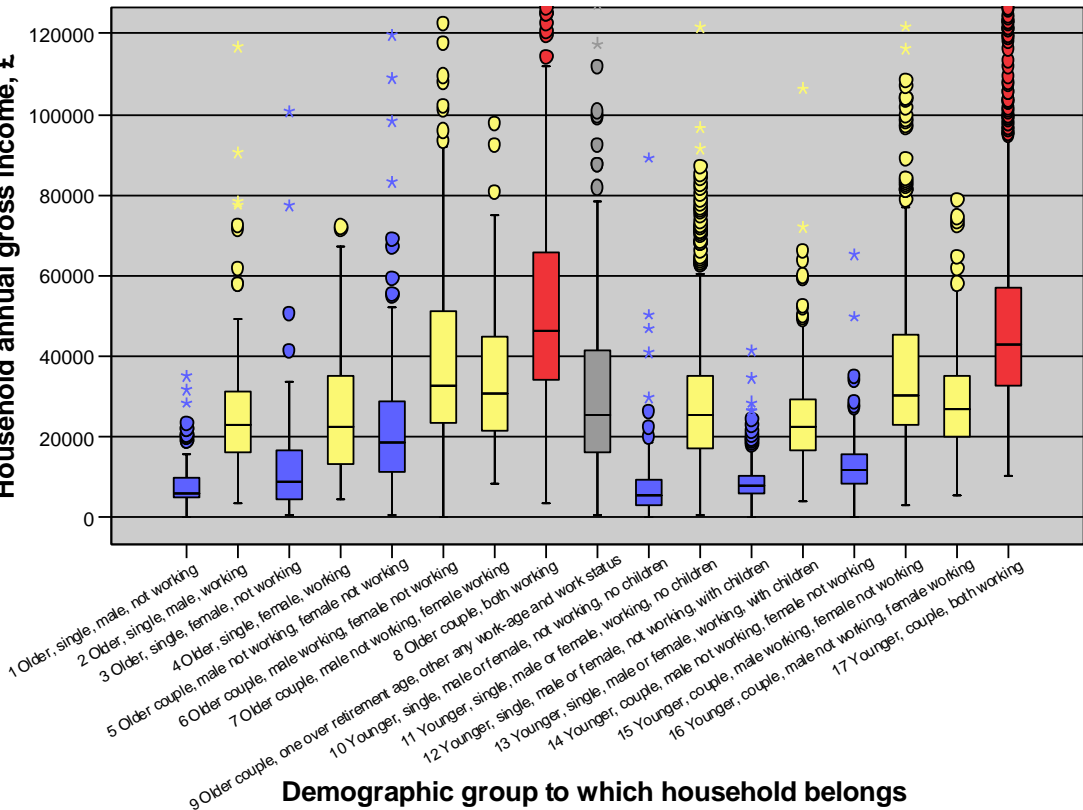
Source: Author’s own calculations. See section 4.2 for details of datasets used.

Figure 6.8 meanwhile presents a boxplot of household incomes for different groups of the population. It shows the distribution of earned income for each of the 17 demographic groups used in the modelling in this chapter, based on the household expenditure survey data. The figure can be used to give an indication of how household income will rise due to a household member being activated (either from the baseline to Scenario 1, or from Scenario 1 to Scenario 2), based on the assumptions in the modelling. To recap, it is assumed that activating a household member will move that household from one (originator) group to another (destination) group (as was described in section 6.2.2 and shown in Figure 6.1) and that, on average, this will lead to an increase in the household’s income equal to the difference in the means of the two groups (with minor differences due to differences in the demographic characteristics between the two groups). Hence, in the figure, blue (workless) households on activation can be expected to take on the income characteristics of the next yellow population group to the right, whilst yellow one-worker couple households can be expected to take on the income level of the next red

(two-worker couple) population group to the right. Group 9 in the figure, couples with one over retirement age and the other of any age, is marked grey as it is assumed for simplicity in the modelling that these households are not subject to activation. The figure indicates that the increases in emissions and expenditure described above arise as a result of increases in the incomes of lower income households: the majority of individuals activated come from workless households, which have lower than average incomes. In all cases, activation can be seen to lead to a substantial increase in the income of households (based on the modelling assumptions).

The data in the table and figure indicate that worklessness decreases substantially among all household types due to the participation rate increases, although remains high among lone parent households even if UK objectives are met for this group. The income figure, and expenditure data in the previous section, also indicate increasing affluence due to activation, and a reduction in income-poor households, due to households moving to higher levels of paid work (from no workers to one worker, or from one worker to two), with mean incomes, and so expenditure, increasing correspondingly. Increasing labour market participation rates could therefore be assumed to compress wage differentials in the population, whilst reducing the level of workless households should reduce benefit payments by the state, another aim of social policy.

Figure 6.8 Household annual gross incomes for different groups of the working age population, UK



Blue: workless households; Yellow: One-worker households; Red: Two-worker households
 Far outliers omitted from figure
 Source: Author’s own calculations. See section 4.2 for details of datasets used.

6.3.3.2 Dutch scenario results

Table 6.5 presents Dutch participation rate and demographic characteristics for the baseline year (2000), Scenario 1 (2008), and Scenario 2 (in which government labour market participation rate objectives are taken to have been achieved). Demographically, the Netherlands is in a similar situation to the UK, in that around 42% of the population are younger working age individuals, and 18% older working age (slightly higher than the UK, in part due to the higher female retirement age of 65 in the Netherlands). Overall, almost 62% of the population was of working age in the Netherlands in 2008, compared to 57% in the UK. The percentage of lone parents is somewhat lower (2.0% in 2008 compared to 3.2% in the UK), but showing

an upward trend rather than slightly decreasing as in the UK. There are some marked differences in participation rates however: despite large increases between 2000 and 2008, older working age participation is still, at 63%, nearly 9% lower in the Netherlands than in the UK, whilst the higher younger working age participation rates balance this, so that overall participation is higher than in the UK, at 79% in 2008. Participation among all demographic groups shows an upward trend.

Table 6.5 Dutch participation rates and demographics by demographic group

		Older working age	Younger working age (including lone parents)	Lone parents	All working age
Participation rate (LFS definition)	Baseline (2000)	52.0%	82.9%	64.0%	74.2%
	Scenario 1 (2008)	63.2%	86.4%	70.2%	78.9%
	% points change from Baseline to Scenario 1	11.2%	3.5%	6.2%	4.7%
	Scenario 2 (participation rate objectives met) (Dutch definition objective in brackets)	67.2% (45% 55-64 y.o.s)	92.9%	79.3%	84.6% (80% gross, including jobseekers)
	% points change from Scenario 1 to Scenario 2	4.0%	6.5%	9.1%	5.7%
Population size, 1000s, and as % of total population	Baseline (2000)	2,740	7,051	202	9,791
		17.5%	45.0%	1.3%	62.5%
	Scenario 1 (2008)	3,229	6,744	321	9,972
		19.9%	41.7%	2.0%	61.6%
	% points change from Baseline to Scenario 1	17.8%	-4.4%	59.0%	1.8%
	Scenario 2	Assumed no demographic changes from 2008 situation			

Source: EU Labour Force Survey (Eurostat 2010), Ministry of Economic Affairs (2008:11,57), and own calculations

Table 6.6 presents the estimated effects on greenhouse gas emissions from Dutch households due to changes in labour market participation rates between the baseline (year 2000) and Scenario 1 (2008), and from Scenario 1 to Scenario 2. In 2000, some 87% of emissions from households arose from working age households, around two-thirds of this coming from younger working age households. Around 72% of

working age households were of younger working age, so per household, their emissions are lower than for older households.

Between 2000 and 2008, emissions from working age households are estimated to rise 4.4%, by 6.8 million tonnes per annum. Increases in the size of the working age population and increases in the participation rate contribute to this increase by similar amounts, increasing emissions by 1.8% and 1.7% respectively. Meeting Dutch participation rate objectives will increase emissions by an estimated further 1%, or 1.6 million tonnes per annum, from the 2008 level.

Among older working age households, emissions increased 22% between 2000 and 2008, some 10.5 million tonnes. This is more than the total increase in emissions from all working age households (as the fall in the younger working age population led to an overall 3.7 million tonne drop in emissions from that group even considering their increasing participation rate). The 20% increase in population size of older working age individuals between 2000 and 2008 accounted for a large proportion of their increases in emissions, although the 11% increase in participation rate led to a 3.6% increase in their emissions. Meeting Dutch objectives, implying a further 4.0% increase in participation, will lead to an estimated further increase in this group's emissions of 1.2% over the 2008 level, or around 700,000 tonnes CO_{2e} per annum.

The other key risk group, lone parents, produced only 4% of household greenhouse gas emissions in 2000, reflecting their small share of the total population. However this increases by over 60% up to 2008, almost entirely due to increasing population size (which accounts for a 59% increase). The 6% increase in participation rate over this period increases emissions by 1%. Meeting Dutch participation rate objectives implies lone parent participation will increase by a further 9%, although this is not an explicit policy aim. If such an increase occurs, emissions are likely to increase from this group by a further 1.4% over 2008 levels, or 150,000 tonnes, some 10% of the total increase that would arise from all working age households.

Despite the large increase in emissions from lone parent households over the 2000-8 period, younger working age household emissions as a whole fall by 3.7 million tonnes per annum, 3.5%, due entirely to falling population size, which more than counters the 0.9% increase in emissions due to increasing participation. Meeting Dutch objectives would increase this group's emissions by 0.9% over 2008 levels, some 900,000 tonnes, over 50% of the total increase due to increasing working age participation.

Table 6.6 Dutch data on annual national greenhouse gas emissions by demographic group, tonnes CO_{2e} per annum

	Older working age households	Younger working age households (including lone parents)	Lone parents households	All working age households
Baseline (2000)	48,087,663	106,240,477	6,717,154	154,328,140
<i>As a % of emissions from all households</i>	27%	61%	4%	88%
<i>As a % of emissions from all Netherlands</i>	18%	40%	2%	58%
Scenario 1 (2008)	58,689,896	102,502,077	10,783,971	161,191,973
Increase from Baseline to Scenario 1	10,602,233	-3,738,400	4,066,817	6,863,833
(as a % of emissions from group)	22.0%	-3.5%	60.5%	4.4%
% increase due to demographic (population size) changes	17.8%	-4.4%	59.0%	1.8%
% increase due to participation rate changes	3.6%	0.9%	1.0%	1.7%
Scenario 2 (participation rate objectives met)	59,414,203	103,428,942	10,935,573	162,843,145
Increase from Scenario 1 to Scenario 2	724,307	926,865	151,602	1,651,172
(as a % of emissions from group)	1.2%	0.9%	1.4%	1.0%
% increase due to demographic (population size) changes	0.0%	0.0%	0.0%	0.0%
% increase due to participation rate changes	1.2%	0.9%	1.4%	1.0%

Source: Author's own calculations. See section 4.2 for details of datasets used.

Table 6.7 indicates the effect of these scenarios on levels of workless households. For the working age population, workless households fall from almost 15% of the total in 2000, to 13% in 2008, and to less than 10% on meeting Dutch objectives.

Bigger changes are seen in both older working age and lone parent households, with the level of worklessness nearly halving between 2000 and the objective in both cases. Worklessness among younger working age households also more than halves, but started from a much lower level in 2000.

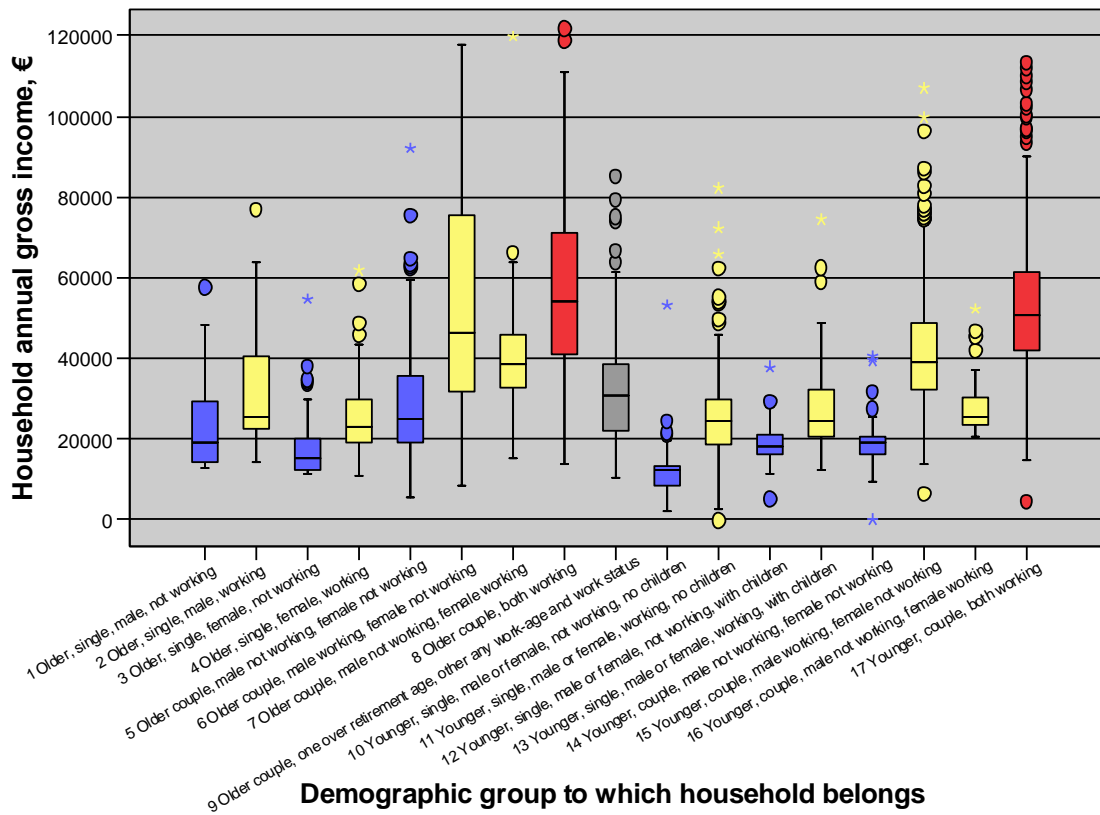
Table 6.7 Percentage of households which are workless, by demographic group, the Netherlands

	Older working age households	Younger working age households (including lone parents)	Lone parents households	All working age households
Baseline (2000)	33.7%	11.2%	34.6%	14.8%
Scenario 1 (2008)	22.6%	9.1%	28.3%	13.3%
% points change from Baseline to Scenario 1	11.1%	2.1%	6.3%	1.5%
Scenario 2 (participation rate objectives met)	18.7%	5.4%	18.9%	9.5%
% points change from Scenario 1 to Scenario 2	4.0%	3.7%	9.3%	3.8%

Source: Author’s own calculations. See section 4.2 for details of datasets used.

Figure 6.9 meanwhile gives an indication of the effect on household income of increasing participation rates. As with the equivalent figure for the UK above, this figure presents boxplots of household income distributions for different groups of the working age population, based on the Dutch household expenditure survey data. Blue bars are workless households, which on activation move to the next yellow household type to the right, with an average increase in income approximately equal to the differences in the mean incomes between the two groups. Yellow boxes meanwhile are one-worker households: those that are couples, on activation, move to the next red household type to the right. One can see that in almost all cases activation leads to substantively significant increases in income, such that one can say increasing participation rates, without other changes to the tax-benefit system, will tend to increase the incomes of lower income households (with less work), also reducing income inequality.

Figure 6.9 Household annual gross incomes for different groups of the working age population, the Netherlands



Blue: workless households; Yellow: One-worker households; Red: Two-worker households
 Far outliers omitted from figure
 Source: Author's own calculations. See section 4.2 for details of datasets used.

6.3.3.3 Comparison of UK and Dutch results

In both the UK and the Netherlands, meeting participation rate objectives (Scenario 2) are estimated to increase greenhouse gas emissions from working age households by about 1% over 2008 levels (Scenario 1). This equates to some 6.1 million tonnes CO_{2e} per annum in the UK, and 1.6 million tonnes per annum in the Netherlands. In terms of total national emissions from all sources, this is equivalent to an increase of about 0.66% in the UK and 0.62% in the Netherlands, independent of any other changes arising from increasing purchasing power, changes in product emissions intensities, and so on.

The similarity in national-level outcomes on emissions of meeting participation rate objectives masks substantial differences in the explanatory factors between the two countries however. Differences between the two countries in the following factors all influence how national emissions change between the scenarios, and are explained more below:

- The contribution of different demographic groups to total national emissions
- The distribution of households in the different demographic groups
- Increases in household expenditure and emissions that result from the activation of a household member in different demographic groups
- Participation rate objectives: percentage point increases for different demographic groups and overall
- Levels of per capita consumption and emissions.
- Methods of calculating underlying environmental data.

Table 6.8 presents some of these characteristics for the three main household groups analysed in this chapter: lone parents, younger working age (which includes lone parents), and older working age. Working age households contribute a slightly lower share of total national emissions in the Netherlands compared to the UK. Of the increases in household emissions in the two countries between Scenario 1 and Scenario 2, the majority comes from older households in the UK, while the main source is younger households in the Netherlands. In the UK too, the entirety of the increase from younger households is from lone parents, whilst in the Netherlands, which lacks a strong objective for lone parent participation, only 16% of the increase in younger working age household emissions comes from lone parents.

At the household level, mean Dutch emissions are substantially higher than UK, both per household and per capita, despite substantially lower per household and per capita expenditure. This reflects much higher product emissions intensities (levels of CO_{2e} emitted per unit of value for goods and services), although as discussed in chapter 4, whether this arises due to structural differences in the production and distribution efficiencies of the products and services bought in the two countries, or

to methodological differences in the calculation of these values, is not easy to tell, so that comparing these mean values between countries cannot be considered valid.

A one percentage point increase in participation rate increases emissions as a proportion of national totals more in the Netherlands than in the UK meanwhile. This is especially the case for increases in older working age participation, whilst lone parent participation rate increases have a much smaller effect on emissions in the Netherlands than in the UK. These results reflect the substantial differences between the countries in the household level increases in emissions and expenditure that arise due to activation.

In both countries, household expenditure increases with activation more than does emissions. This is because Household Emissions Intensity reduces on average as income and expenditure rise, as observed in chapter 5.⁶⁷ The exception is older working age households in the Netherlands, where a 0.30% rise in expenditure is estimated from a one percentage point increase in participation, leading to a 0.31% rise in emissions. This result arises because for the transition pathways in question, Household Emissions Intensity also in some cases increases, so that emissions increase by a higher percentage than does expenditure due to activation. This is the case for when non-participating single older working age males are activated, and for older couple households with a working male in which the female is activated. As these represent a large share of older working age households, then this leads to this exceptional result. The reason that the activated households have higher Household Emissions Intensities than the non-activated households is due to differences in the shares of money spent on different goods and services, but the precise details of these differences are outside of the scope of the thesis to investigate. The result does not affect the overall observation that Household Emissions Intensity falls with increasing income and expenditure, so that, overall, national emissions increase by less than does total expenditure as participation rates increase.

⁶⁷ See chapter 3 for a discussion of Household Emissions Intensity and how greenhouse gas emissions are affected both by how much a household spends in monetary terms and by the relative amounts the household spends on different goods and services.

There are also big differences in the participation rate objectives being aimed for, both overall and per demographic group. Dutch objectives are for a 5.7% overall increase in participation rate, compared to 2.6% in the UK, on 2008 levels. UK objectives target older working age adults and lone parents exclusively, to the extent that younger working age adult participation rates actually can be expected to decline slightly if lone parents are excluded from the figures. In the Netherlands meanwhile, the overall working age objective is seemingly spread more evenly between different demographic groups. The greenhouse gas increases arising from the particular targeting of older and lone parent individuals for activation in the UK is countered somewhat by the fact that these groups represent a smaller share of the population in the UK than in the Netherlands.

Table 6.8 Comparison of key characteristics of the UK and the Netherlands

		UK	Netherlands	Difference (NL value as a % of UK value)
Increase in national emissions, 2008 to objective	Tonnes per annum	6,038,398	1,651,172	27%
	As a percentage of total emissions from all households	0.9%	0.9%	108%
	As a percentage of total national emissions	0.7%	0.6%	93%
	From older working age households	3,840,882	724,307	19%
	From younger working age households	2,197,516	926,865	42%
	From lone parent households	2,243,541	151,602	7%
Share of national emissions from households	From all households	76%	66%	86%
	From working age households	62%	58%	93%
Mean emissions, kg CO_{2e} per annum, working age households, 2008 estimate	per household	22,612	31,643	140%
	per capita	8,375	12,830	153%
Mean expenditure, euro per annum*, working age households, 2008 estimate	per household	38,440	26,893	70%
	per capita	14,237	10,904	77%
Mean increase in emissions per household as a result of 1% point participation rate increase (based on 2008 population)	All working age	0.23%	0.27%	117%
	Older	0.22%	0.31%	143%
	Younger	0.24%	0.25%	106%
	Lone parents	0.45%	0.15%	34%
Mean increase in expenditure per household as a result of 1% point participation rate increase (based on 2008 population)	All working age	0.29%	0.33%	116%
	Older	0.37%	0.30%	83%
	Younger	0.28%	0.32%	116%
	Lone parents	0.54%	0.20%	37%
Percentage point increases in participation being aimed for from 2008 situation (LFS definition)	All working age	2.6%	5.7%	223%
	Older	8.1%	4.0%	49%
	Younger	0.5%	6.5%	1234%
	Lone parents	15.7%	9.1%**	58%
Distribution of older, younger and lone household types (percentages of working age households, 2008)	Older	26.6%	32.4%	122%
	Younger	73.4%	67.6%	92%
	Lone parents	5.6%	3.2%	58%

* UK figures based on approximate median exchange rate for year of 0.79 euro: 1 pound (source: European Central Bank 2010).

** No objective is specified, but assumed to have equal chance of being activated as other non-working younger people.

Source: Author's own calculations. See section 4.2 for details of datasets used.

6.4 Discussion of results and policy implications

Results at the household level indicate that activation leads to substantially increased income, expenditure and greenhouse gas emissions for nearly all demographic groups, assuming that the activated can be fully integrated into the labour market with good quality jobs, as policy at least intends to do (about which, see below for more). This suggests increasing the proportion of the population in paid work could have substantial impacts on national levels of greenhouse gases. In practice however, the case study countries of the UK and the Netherlands both have high participation rates, and objectives for increasing rates further are thus fairly modest. The 2.6 percentage point increase being aimed for over 2008 levels in the UK, and the 5.7% increase in the Netherlands, are likely to increase national emissions by 6.0 million and 1.7 million tonnes of CO_{2e} per annum respectively, some 0.66% and 0.62% of the total national emissions from the respective countries. The similarity in the final percentage emissions increases masks substantial differences in the reasons for them in the two countries, with differing participation rate objectives and per household emissions increases due to activation both overall and for different demographic groups.

These figures represent the emission arising from households only, and omit changes in state expenditure, which too leads to greenhouse gas emissions. As more people are moved into paid labour, one can expect that one of the policy goals for which this objective is set, to reduce welfare benefits expenditure, will also be met. Income tax receipts too should rise. This will increase state financial resources for expenditure elsewhere. Until recent times, this would likely have been spent in other areas of state activity, with the result that state emissions would also increase through increasing public sector consumption. This is outside the scope of this research to model. In practice, it is likely that today this money would instead be spent on debt repayments by the state, the effect being instead to reduce planned reductions in state expenditure slightly. In either case, the net effect is that the increases in emissions estimated here are likely to be lower than the actual effect, as government expenditure is omitted and would likely rise above what it would otherwise be.

Even omitting this effect, these increases in national greenhouse gas emissions are by no means insignificant, and shift UK and Dutch emissions in the wrong direction for the purposes of meeting greenhouse gas emissions reductions goals. How do social and economic goals fare with these policies?

In terms of economic goals, fiscal sustainability of the welfare state is a key issue, and increasing participation rates follows the employment-focused, adult worker model approach to modern welfare state reforms (chapter 2, section 2.2.1), in that the main source of income for individuals should be from paid labour, unless there is a specific reason why this is not possible, or desirable (e.g. when there is a dependent child or adult to be looked after). Increasing participation rates reduce benefits payments for both the unemployed and the inactive (such as incapacity benefits), and boost income taxes receipts, although strong activation policy instruments to increase participation rates and support people to obtain the skills to find good quality jobs themselves require substantial funding (Jørgensen 2009). Increasing labour supply should also increase production if there is demand enough for the extra labour, leading to economic growth.

A key social goal of increasing participation rates in both countries is to reduce the disadvantages faced by specific demographic groups (as discussed above in section 6.1). Both countries specifically target activation measures at particular “at risk” groups, particularly older workers, lone parents (primarily in the UK), the disabled, ethnic minorities, and workless households, especially those in which children are present. However, the only demographic groups with explicit participation rate objectives were older workers, lone parents (in the UK only), women (in the Netherlands only) and the working age population as a whole. Despite this, the results indicate that the already high participation rates of demographic groups not considered as “at risk” means that meeting these objectives effectively require at risk individuals to be activated. Achieving these goals *de facto* requires an increase in the low participation rates of at risk groups. Although outside the scope of this thesis to investigate in detail, the results presented in this chapter show a clear reduction in the numbers of workless households, and a corresponding, usually substantial, increase

in the income and expenditure (and emissions) of activated households. As these households are generally those at the bottom end of the income distribution, they are households where increasing income is likely to do most good, providing greater material comfort and security, and greater opportunities and capabilities to lead a happy, fulfilling life. Child poverty would also be reduced, as the number of children in workless households would fall (especially the case for the UK, where over 16% of children live in workless households, the highest rate in the EU-27, and 10% higher than the Dutch rate; EU Task-Force on Child Poverty and Child Well-Being 2008:28–29). Non-material wellbeing is also arguably improved, due to reduced dependence on the state and increased social inclusion. It also reduces income inequality. Increasing participation rates is not always unambiguously beneficial however, with the benefits for young children, particularly those of single parents (which account for more than half of the children in workless households in both the UK and the Netherlands; EU Task-Force on Child Poverty and Child Well-Being 2008:29), and for those with high levels of sickness or disability, being particularly contested (Lewis 2006:390; Hetzler 2009). Attempting to increase the working life of older working age adults also needs careful consideration as it extends the total work and income earned over the life course: this may meet economic goals, but for wellbeing and environmental sustainability, providing greater support to smooth income over the life course at a lower level to facilitate full or part time early retirement may be preferable, especially among higher income households.

There is however an important proviso regarding the outcomes of the increases in participation rates modelled in this chapter, which has implications for the policy instruments used to achieve these objectives. These results assume that all individuals not in paid work have an equal chance of moving into paid work⁶⁸, and that households in which an individual is activated takes on the working hours, wage rates and job security of an otherwise equivalent household in the datasets used, effectively becoming equivalent in terms of the employment opportunities open to

⁶⁸ Section 6.2.2 of the research design above discussed a particular exception to this where the probability of activation is considered at the household level for workless couple households, with the male of the couple being assumed in the modelling to be the activated household member.

them now and in the future. Whilst stated policy aims are to fully integrate the newly activated into the labour market as “insiders” in this way, there is a real risk of individuals, particularly those with low skills or multiple barriers to undertaking paid work, simply finding that they have to accept marginal, low paid and insecure work. In-work income poverty is already a serious issue, as the proportion of jobs which are low paid, limited hours, temporary or with poor conditions has expanded (Fraser, Gutiérrez, and Peña-Casas 2011:3), and a significant proportion of child poverty cases have parents in work, although in couple households there is only a small risk of child poverty if both parents are working, even part time (EU Task-Force on Child Poverty and Child Well-Being 2008:27,35). Low paid jobs and in-work poverty may particularly affect the newly activated, as those not already in paid work in many cases face multiple barriers to labour market entry, with a high proportion being incapacitated, long term unemployed and/or lone parents (Gregg, Harkness, and Macmillan 2006:52–57). This problem is heightened in the UK where there is a substantial share of the population without qualifications, who in turn make up a large share of the unemployed, and whose labour market position intensive policy efforts have so far done little to improve (Freud 2007). Whilst moving people into marginal jobs might mean the participation rate objectives are met, the social and wellbeing benefits might not be realised, and household income might rise only marginally. If this were the case, then the implications for the modelling in this chapter are that, on the one hand, the greenhouse gas impacts would not occur to the same degree as estimated but, on the other, neither would the positive increases in levels of income and expenditure among low income households. In short, there would be smaller negative environmental impacts, but also smaller positive, or even negative, social and wellbeing impacts. Alternatively, those furthest from the labour market, with “multiple disadvantages” might simply be sidelined, or “parked”, as the private sector employment services contracted to provide activation services in both the UK and the Netherlands “cream” the unemployed to find and focus on the most work ready, leaving those with multiple barriers to finding work un- or less supported (Finn 2010).

The implication of these results for policy design is that, in line with the adult worker model, substantial wellbeing benefits could be achieved through activating workless households, improving their material wellbeing, reducing income inequality and increasing social inclusion, for comparatively small, but by no means insignificant, environmental impacts in terms of increased greenhouse gas emissions. That said, policy instruments would need to focus on supporting people, through active labour market policies and lifelong learning, to find and secure fulfilling and adequately paid jobs, rather than simply low paid and marginal jobs. Whilst the Dutch approach focuses on this, and is heralded as a model of flexicurity along with Denmark (Viebrock and Clasen 2009b:306–307), in large part due to its active labour market policies, the UK would need to focus on providing more such support to its workforce to improve low skill levels, boosting the “security” element in flexicurity (European Commission 2008:113).

6.5 Summary

The results presented in this chapter are apparently the first time the greenhouse gas implications of working time policy objectives have been estimated in the UK and the Netherlands, or anywhere else. The hypothesis that current UK and Dutch policy objectives to increase participation rates will increase national greenhouse gas emissions is found to hold. Current objectives represent moderate increases in participation rates over the 2008 situation for the working age population overall, with objectives too specifically for older workers, lone parents (in the UK) and women (in the Netherlands). As such, greenhouse gas emissions increases are also estimated to be fairly small, at 0.62-0.67% of 2008 national emissions. Increases in per household emissions as a result of activation are estimated to be large meanwhile, especially when a member of a workless household is activated, as household income and expenditure increase by similarly high amounts. Given the distribution of current participation rates in the population, current objectives de facto mean that it is primarily the lower income and workless households where individuals would be activated. Increasing participation rates could therefore contribute, as intended, to the social policy goals of reducing poverty, flattening income distributions in the population, reducing labour market exclusion (which is

often equated with social exclusion), and reducing the fiscal burden on the government of the welfare state, whilst also remaining true to the ideological approach enshrined in the adult worker model and welfare to work principles. The relatively small increases in total national greenhouse gas emissions that arise as a result could even be considered an acceptable price to pay for improved conditions for socially disadvantaged groups, and for the resultant fiscal benefits to government, particularly in the current economic climate where tackling state budget deficits is high on the political agenda.

However, for these scenario outcomes to occur, policy instruments need to be well designed to help ensure the newly activated have the skills and opportunities necessary to obtain incomes, jobs and career prospects equivalent to those of similar demographic groups which are already in work, and are not simply moved into marginal low paid jobs which do little to improve their income or wellbeing (despite this also doing less to increase greenhouse gas emissions).

The results also emphasise the issue that working time policy, and its focus on increasing participation rates, makes no consideration of goals for reducing greenhouse gas emissions. Every source of increasing emissions increases the already large scale of the challenge of achieving substantial reductions in greenhouse gas emissions, and hence reducing the risk of dangerous climate change in the coming decades. Explicit modelling and consideration of the environmental impacts of working time policies could help ensure increases in emissions are considered.

In isolation, increasing participation rates among disadvantaged groups runs counter to environmental sustainability goals as greenhouse gas emissions increase. However, the ecological economics idea of using working time reduction as an environmental policy is that average working hours per person will reduce in the population, and work will become more evenly distributed, so that all who can meet their income needs through paid work do so (which is also in line with the principle of the adult worker model in social policy too: see chapter 2, section 2.3). Increasing participation rates is therefore in keeping with the principles of working time

reduction, so long as it is done in conjunction with a more generalised reduction in average working times per person large enough to offset the resultant environmental impacts. The next chapter considers this, looking at how working time policy could be used to reduce mean working hours per worker and increase the use of career breaks, to contribute to greenhouse gas reduction goals. At the same time, it looks at how this environmental goal can be balanced with social, wellbeing and economic goals too.

Chapter 7 A greener work-life balance? Working time reduction and its potential for reducing greenhouse gas emissions

Reduction of the average time individuals spend in paid work, with proportionally equivalent reductions in gross earned income, has been suggested by various authors as one way to reduce the environmental impacts of affluent societies, as income, expenditure and hence consumption of market goods (the main driver of these impacts) all concurrently fall (e.g. Coote et al. 2010; Hayden 1999; Robinson 2006; Schor 2005). This could be via shorter hours of work over the working week or longer periods outside the labour market via career breaks, be they for parental leave, skills training, early retirement or any other purpose. In addition, evidence from the psychology literature on the factors contributing to happiness have been cited to suggest that this reduction of working time is at least a helpful precondition for achieving higher levels of wellbeing, by giving individuals more time to spend on social, caring, creative, personal development and spiritual activities that seem to contribute more to wellbeing than material consumption, at least once a certain level of material comfort is securely met (e.g. Speth et al. 2007). Chapter 2, section 2.1, reviewed these arguments in detail.

Previous chapters of this thesis have provided evidence to support the argument that working patterns affect greenhouse gas emissions. Chapter 5 demonstrated that at the household level, the working patterns of a household's members do, primarily via effects on income, affect consumption, and hence greenhouse gas emissions, at least in the UK and the Netherlands. Chapter 6 estimated that this relationship would lead to measurable increases in national emissions in the UK and the Netherlands if current government objectives to increase labour market participation rates were met.

To date however, little work has been undertaken to estimate the effects of working time *reduction* on greenhouse gas emissions.⁶⁹ Details of the working time policy instruments that could be used to reconcile diverse environmental, social and economic goals are also generally specified in only quite general terms. This chapter addresses these two issues. Formally, it tests the hypothesis, developed in chapter 3 (section 3.1), that:

Reductions in average paid working time will substantially reduce national greenhouse gas emissions

In the next section, the form of existing working time policy instruments in the UK and the Netherlands are summarised to provide policy context. Belgian policy is also mentioned, as an example of innovative policy design in this area. The chapter goes on to present the method by which the hypothesis will be tested, and to present the scenarios of working time reduction for which the greenhouse gas effects are estimated. The reductions in working time modelled in these scenarios are intended to be of a comparable scale to the rights and opportunities provided by working time policies that already exist in different countries, particularly drawing on Dutch working time rights and the structure of the Belgian Time Credit Scheme, thus grounding the results in current policy best practice in this field. In the subsequent section, the results are presented of the estimated effects of these scenarios, firstly on greenhouse gas emissions at the national and household level, and then on the concurrent changes in paid working time, looking both at the working age population as a whole and also at different demographic groups. Following this, a discussion section summarises the results of the modelling undertaken and assesses the implications for the design of working time policy instruments which could achieve these diverse environmental, social and economic policy goals, drawing on the modified life course perspective developed in chapter 2 (section 2.3) to frame the discussion. The final section briefly summarises the chapter.

⁶⁹ Spangenberg et al. (2002) and Victor (2008, 2011), mentioned in chapter 2, section 2.1.2, are notable exceptions, although they consider working time only broadly, in terms of average hours per capita, as one of a set of macroeconomic variables, without looking at patterns of work in the population in detail as is done in this thesis.

7.1 Context: Existing policy instruments for working time reduction in the UK, the Netherlands and Belgium

This section presents some examples of more innovative policy design for working time reduction that already exist. There is an extensive range of working time reduction policies at national, sectoral and employer level around the world, and this section is in no way intended to be comprehensive, but rather to present those schemes in operation in the two case study countries, and also in Belgium, whose Time Credit Scheme rights inform the design of the scenarios, and the discussion, in this chapter.

Table 7.1 summarises basic working time reduction rights in the UK and the Netherlands, including retirement ages, maternity and paternity leave, rights to flexible working hours, and more. The Netherlands also has a range of working time policies for the wider population, both collectively and individually determined, discussed below. In the UK meanwhile, and in most other countries, rights and support for reduced working time are still primarily designed for specific life events in isolation (Delsen and Smits 2010), dealing with “old social risks” such as parenting, retirement, and incapacity.

Table 7.1 UK and Dutch working time reduction rights (in 2009)

Policy area	UK	Netherlands
Retirement age	65 (men), 60 (women)	65
Maximum working hours	48 (but employees may opt out of this limit)	48 (but typically less via collective agreement)
Maternity leave	52 weeks, which can start up to 11 weeks before due date. 2 week compulsory following birth. Pay: 13 weeks at 90% of previous earnings (or flat rate if child is adopted), 33 weeks at flat rate (£124.88 per week in 2010); 13 weeks unpaid. State financed. Around half of employers offer more leave; 16% offer higher pay	16 weeks (6 before, and 10 after birth). Leave is compulsory from 4 weeks before due date until 6 weeks after birth. Pay: 100% of earnings up to a ceiling of €186.65 per day (2010). State financed.
Paternity leave	2 weeks in the first 8 weeks after child's birth. Pay: flat rate (£124.88 per week in 2010) 18-19% of employers extend the minimum length and pay	2 days in the first 4 weeks after birth of child. Pay: 100% of earnings, no ceiling. Paid by employer.
Parental leave	13 weeks per parent per child 5 years or under; maximum of 4 weeks, in 1 week blocks, in any calendar year Parents of disabled children are entitled to 18 weeks per disabled child up to their 18 th birthday Unpaid	Hours equivalent to 26 weeks' work, per parent per child 7 years or under. Flexible usage, including use over a longer period of time, e.g. 52 weeks at half usual hours, or in 2-3 blocks, with employer agreement. Pay: tax deduction equivalent to half minimum wage (€4.07 per hour taken). Public sector workers are paid at 70-75% of wages including the tax deduction. 4 weeks parental leave entitlement for adopting parents, from 2 weeks before to 16 weeks after adoption; paid at maternity leave rates.
Flexible working	Parents of children under 16 (under 18 if child is disabled) and carers of adults may request reduced working time or flexible hours. Employer may only refuse if there is a "clear business ground for doing so"	All employees at organisations of 10 or more employees, who have worked for their employer for at least 1 year, may increase or decrease working hours. Employer may refuse if the organisation's interests "might be seriously harmed"
Care and emergency leave	"Reasonable" amount of time may be taken off work to deal with "unexpected or sudden emergencies". Unpaid.	Maximum 10 days leave per year for care of sick child, partner or parent. Employer paid at 70% of income. Palliative care leave of hours equivalent to six weeks' work. Unpaid. "Reasonable" amount of time for unexpected events. 100% pay from employer.
Developments	Various proposals are in consideration to extend paternity leave and increase transferability between men and women of childcare rights.	Various proposals are in consideration to simplify and extend leave entitlements to cover more purposes and merge into a common system, particularly to extend parental leave flexibility and eligibility (to new employers). Working hours flexibility is also to be increased by allowing employees to request specific fixed periods of working hours reductions or increases.

Sources: O'Brian and Moss (2010); Groenendijk and Keuzenkamp (2010)

In the UK, policy is relatively sparse, focusing primarily on parents only. In addition to parental leave, parents with children under 16 (or 18 if the child is disabled) have the right to request a reduction in paid working hours.

Dutch working time policy meanwhile is some of the most innovative in the world, in intent if not in implementation. Policy is increasingly informed by the life course perspective (which, as described in chapter 2, has its origins in the Netherlands), which considers people's contact with the labour market over the whole life course, offering a common framework for addressing people's varying preferences and needs to alter their work life balance at different stages of life, for varying reasons, and how to support these. As such, a full range of policies support individuals to alter their paid working patterns, with collective control of maximum weekly working hours, individual rights to alter these further, and support to take extended career breaks full or part time, lasting several years. Collective agreements between sectoral employers and unions allow national standard rights to be tailored and extended to meet the particular needs of different industries and types of employee.

Collective working time moderation was instituted with the 1982 Wassenaar Agreement, which moderated working time and wages in a bid to minimise unemployment by sharing paid work among the population (International Labour Organization 2011). The 2000 Adjustment of Working Hours Act meanwhile gives employees individualised, rather than collective, rights to reduce, or increase, their working hours. Part time employment is commonplace, and part time employees have the same employment rights (pro rata) as full time, including access to provisions in any collective labour agreements (Fouarge and Baaijens 2004). In 2006 the Life Course Savings Scheme was introduced. This provides employers the opportunity to take unpaid career breaks extending up to three years (Ministry of Social Affairs and Employment 2011). Employees making use of the scheme first save into a special savings account, then later use these savings to cover periods of unpaid leave taken under the scheme. In short, the scheme aims to meet the principle in the life course perspective of decoupling when an individual undertakes paid work

and when at least some of the resultant income is received, with the intention that transitions in and out of paid labour then become easier.

There are however various issues with Dutch working time policies. Childcare leave (i.e. maternity, paternity and parental leave) is limited in a comparative European perspective. Parental leave is focused on part time leave via the hourly nature of the framing of the rights, and the low level of wage compensation, which reflects its primary aim of allowing parents (particularly women) to maintain labour market contact, part time, rather than exiting the labour market entirely: it is focused on maintaining labour market supply more than facilitating strong parental childcare (Plantenga and Remery 2009:50–51). Furthermore, despite the provision of extensive individual rights to alter working hours and take career breaks, takeup has been rather low. Various barriers inhibit usage of these rights. Usage of the Adjustment of Working Hours Act rights seems to be restricted by fear of employer disapproval (although part time work is already prevalent and working time reduction requests that are made are commonly accepted) (Fouarge and Baaijens 2004:13). Meanwhile, various political compromises made in the design of the Life Course Savings Scheme limits its usefulness for one of its primary intended functions: supporting leave for childcare. A primary barrier to use of the rights is the requirement on the individual to save a share of their income into a special savings account in advance of a career break using the scheme. This money is intended to cover unpaid career breaks, and must be drawn during such breaks at between 70 and 100% of the individual's previous salary. However, the maximum one can save into the account whilst in paid work is 12% of the current salary⁷⁰ (Ministry of Social Affairs and Employment 2011), meaning that to save for a three year career break with 70% of the previous salary takes a minimum of 17.5 years (in practice, this would be even longer if the individual's salary increases over this period, as is likely). One can see immediately that this makes it virtually impossible to use the scheme to take an extended career break for childcare leave. Furthermore, it is unlikely individuals in their early 20s would already be in an employment and life situation to be planning financially with regard to their future children. There is, in short, a “sequential error” in the design of

⁷⁰ Employees born between 1949 and 1955 are allowed to save at a higher rate if they wish to, to be able to save for early retirement.

the scheme: the individual only realistically has the capability to save enough to use the scheme *after* the time they would want to use it (for childcare leave) (Plantenga 2005a:59–61). Despite the limitations for use to support childcare leave, the scheme has more potential to be used for early retirement (when introduced, the scheme replaced the pre-existing early retirement policy in the Netherlands): individuals can retire up to three years in advance of the statutory age (currently 65) if the full amount allowed of 210% has been saved and it is used at the rate of 70% of the employee's previous final salary (van der Meer and Leijnse 2005:17).

Other substantial barriers to the scheme's use also exist however. For one thing, no new rights to a career break are actually given by the scheme: an employer can refuse any request for a career break that is not based on existing statutory or collectively agreed entitlements (such as for maternity leave) (van der Meer and Leijnse 2005:17–18). The exception is for long term leave for care purposes, for which the employer can only refuse if they can make the case that it would cause their organisation "serious problems" (Ministry of Social Affairs and Employment 2011). There is thus a substantial risk to using the scheme: an employee may save for many years into the special savings account (for which there are, in addition, significant penalties if the money is withdrawn for any other purpose than a career break), only to find the employer refuses to grant a career break.

The scheme does have some incentives to encourage use, and these are partly tailored to the reasons for use. If it is used in conjunction with the statutory maternity leave entitlement then the state pays the woman approximately €650 per month as a tax discount (Ministry of Social Affairs and Employment 2011). However, aside from this, the otherwise modest tax breaks provided to incentivise the scheme's use (currently €195 income tax relief per year saved into the account; Ministry of Social Affairs and Employment 2011), together with the option for employers to contribute to an employee's life course savings, are too little an incentive to overcome its limitations, and use of the scheme (in terms of employees holding a life course savings account, and thus potentially able to use the scheme for an unpaid career break in future) is persistently low, languishing at about 3.5% of the

employed workforce since its introduction.⁷¹ Takeup rates are higher among higher income earners (and hence also among males, older workers and full time workers), and also among those with partners, suggesting potential equity issues with access to the scheme for those with lower incomes, despite they having an interest in using the scheme (Delsen and Smits 2010). Despite these issues, government commitment to the policy and to the life course approach is strong, and there are ongoing discussions on how to reform the policy: currently, it looks likely to be merged with a parallel savings scheme to make a new “Vitality scheme” (Molders and Broeder 2011).

Along with the Netherlands, the other EU country with particularly innovative individual working time reduction rights enshrined in policy is Belgium, and here the use of these rights is extensive. The Belgian Time Credit Scheme gives all private sector employees the right, at any point in their working career, to up to one year of career break, or part time equivalent (2 years at 50% of full time, or even 5 years at 80% of full time). Workers over the age of 50 who have had a working career of at least 20 years, and 3 years of “seniority” in the same firm, can take such working time reduction (at 50% or 80% of previous working hours) until their retirement. Public sector employees have access to a similar scheme. There are additional rights, introduced in the late 1990s, to three-month, one-off “thematic” career breaks for childcare, medical and palliative care purposes (Debacker et al. 2004:6,8–9). Unlike the Dutch Life Course Scheme, employers are generally obliged to accept career break requests from their employees, although there is a threshold of 5% of employees in an organisation who may be on TCS leave at any one time (further applicants are placed in a queue prioritised by the purpose of the break, e.g. care leave is prioritised). In addition, employers must give employees back their jobs on their return. Pay during the break varies, but is generally low, and up to a maximum €592 per month for full time breaks, with a supplement in Flanders (Merla and Deven 2010:61–62). Career breakers are otherwise left to manage their own finances during the career break, unlike the Dutch scheme, making the policy simpler to run and to implement. The scheme is well used, with 2.5% of the working population

⁷¹ Groenendijk and Keuzenkamp (2010) for 2007, and own calculations for 2010, based on: 270,000 life course accounts existing in 2010 (Molders and Broeder 2011), whilst the number of employees (Labour Force Survey definition, as described in chapter 6) was 7.87 million in 2008 (Eurostat 2009).

making use of it at any one time in 2008, and nearly 6% participating over the course of 2006, close to the theoretical maximum given the design of the policy. Among older workers over 50 years, 15% participated. Use is increasingly for part time rather than full time breaks (Merla and Deven 2010:64; Devisscher and Sanders 2007:123). However, usage has also been “limited to a rather privileged group of persons”: mostly relatively high income, two earner families (Devisscher and Sanders 2007:123) with more financial resources to be able to afford a career break. By gender, takeup is primarily by women among younger workers, but the balance is quite equal among older workers (Devisscher and Sanders 2007:123). Despite, or because of, the scheme’s popularity among employees, it faces some pressures. Government expenditure on the benefits it provides during breaks, and the administration of the scheme, is substantial, and growing (Debacker et al. 2004). Employer approval of the form of the policy meanwhile is rather low, particularly the limited ability to refuse use to employees, with employers reporting that the 80% of full time option in particular is problematic for them to accommodate.

7.2 Research design

7.2.1 Data used

As elsewhere in the thesis, and described in detail in chapter 4 (section 4.2) Dutch and UK household expenditure surveys (the 2000 *budgetonderzoek* and 2004 Expenditure and Food Survey) are combined with environmental data to estimate the mean greenhouse gas emissions from different demographic groups. These sample means can then be extrapolated to estimate national emissions using data from the Carbon Footprint of Nations project (www.carbonfootprintofnations.com, and Hertwich and Peters 2009) (see section 4.3.3 for details).

7.2.2 Approach and scenarios modelled

This chapter estimates the effect on the greenhouse gas emissions arising from household consumption of different scenarios of reduced working hours and career breaks in the UK and Dutch economies. When a household member reduces their

paid working hours, it is assumed that, on average, the household's total income, expenditure and emissions will also reduce in line with the regression models for UK and Dutch household greenhouse gas emissions and expenditure developed in chapter 5. Household Emissions Intensities should also increase slightly in line with the regression models in chapter 5. This partly offsets the fall in emissions that arise due to the fall in total expenditure in the scenarios, but only to a small extent, as Household Emissions Intensity varies with income far less than does expenditure. The regression models in chapter 5 enable estimates of household greenhouse gas emissions, expenditure and Household Emissions Intensity to be made based on the working patterns of the head of household and partner (if present), the wage rates of these individuals, income from other sources, the presence of other children (and their ages) and adults in the household, the head of household or male education level and age and, for the UK, the geographic region in which they live. This chapter focuses primarily on emissions however, as this is the key variable of interest (the changes in expenditure and Household Emissions Intensity can be largely inferred without detailed modelling). Based on the regression models, the changes in emissions can be estimated for any given household based on a reduction in working hours determined by the details of the scenario being modelled, by measuring the difference between the household's estimated emissions before and after the change in working patterns. These household level results can be used to calculate mean changes in emissions for different demographic groups, which in turn can be extrapolated to the national level to calculate the estimated reductions in national emissions from different demographic groups under the different scenarios.

The scenarios modelled in this chapter are described below. The size of changes in working patterns in the scenarios are substantial, but are still designed to keep within the boundaries of the model's assumptions (which were presented in chapter 3, section 3.8): in particular, the model is a linear one so cannot account for the systemic effects extreme levels of working time reduction would result in.

The levels of working time reduction are, at the same time, intended to be realistically achievable, in that they are designed to be within the range of

opportunities already found in existing best practice policy instruments. The career breaks modelled approximately follow the opportunities provided by, and levels of use of, the Belgian Time Credit Scheme and associated “thematic” leave rights described above, and also fall well within the options more weakly supported by the Dutch Life Course policy. The reductions in working hours modelled are also well within the rights provided by the Dutch Adjustment of Working Hours Act. Possible policy instruments to realise the outcomes modelled here are discussed in section 7.4.

The reductions in working hours and career breaks modelled are additional to those already present in the two countries. The scenarios modelled are presented below:

Baseline: Data as they appear based on the datasets, with no change in working patterns.

Scenario 0: estimates household greenhouse gas emissions based on the baseline data using the regression models in chapter 5. Changes in emissions arising in the scenarios below are calculated in comparison to these Scenario 0 estimates rather than the actual emissions observed from the households in the datasets, to obtain more realistic results (although the effect on the results of doing this is negligible).

Scenario 1: A 20% reduction in working hours of all full time workers (those working >35 hours per week). Equivalent to a reduction to a 4-day week, or 3.5 compressed-hours days, which would offer scope for factories to have two workers per job for a 7-day operating week.

Scenario 2: Specific increases in career breaks for particular demographic groups, similar to the Belgian Time Credit Scheme core and thematic leave rights:

2.a.: One year total career break over working career (for aged 20 to retirement age), modelled as 4 of 3 month career breaks over the career. Assuming a 40-year working life, this is modelled as 10% of workers in any one year taking a 3 month career break (this is approximately equivalent to 5% taking 6-month breaks, or 2.5% taking one-year breaks, in line with Belgian Time Credit Scheme takeup rates).

2.b.: 3 month increase in male and female parental leave rights for children under the age of 5. 100% takeup as a single, 3-month, block (equivalent to 25% of working males and females with children under 5 in any one year).

2.c.: 3 month increase in medical/palliative care leave for male and female older workers. It is assumed 1 in 15 older workers use this career break right in any one year. Over a theoretical 15 year working period from aged 50 to 64, a worker would therefore use it once on average. However, many workers retire earlier, and female retirement age in the UK was 60 in the period of study, not 65 as it is for males, so under the assumptions of this scenario a significant proportion of these individuals would retire without having made use of this right.

Scenario 3: All the above combined.

Three month career breaks are modelled as a 25% reduction in mean working hours for the year (this accurately estimates the income effects, and it is assumed that the household will smooth consumption over this period without difficulties, so that expenditure and greenhouse gas effects are also reliably estimated).

7.2.3 Household level

For each scenario, a specific change in the working hours of the head of household and partner, if present, is modelled for the households sampled in the household expenditure survey datasets. The changes in working hours are used to estimate the concurrent reduction in the individual's gross earned income, assuming wage rate is unaffected. These changes are then entered into the models developed in chapter 5 to produce estimates of the resultant reductions in household greenhouse gas emissions and expenditure.

For scenario 2, not every individual uses the career break rights at any one time. For any given household, there is the possibility that workers within it either do, or do not, take a career break in that year. For dual earner households, there are the possibilities of only one, either the male, or the female, or both, or neither, taking a

career break. The greenhouse gas and expenditure effects of each of these possibilities is calculated for each household. The total reduction in greenhouse gases, and expenditure, from a given household is then estimated to be the sum of the reduction for each possibility multiplied by the probability of a household being in that situation. Taking the example of scenario 2a for a dual earner household, there is a 10% chance of the male taking a career break in the year of the survey, and a 10% chance of the female taking a career break. There is thus a 1% chance of both taking a career break, a 9% chance of just the male taking one, a 9% chance of just the female taking one, and an 81% chance of neither taking one. The estimated reductions in greenhouse gases and expenditure for the household are based on the reduction that would arise if both were taking a career break multiplied by 0.1, the reduction if the male only took a career break multiplied by 0.09, and the reduction if the female only took a career break multiplied by 0.09 (the reduction if neither took a career break is zero).

7.2.4 National level

Mean reductions in working hours, income, expenditure and greenhouse gas emissions are calculated for each scenario for different demographic groups, excluding households for which required data are missing.⁷² Means are then extrapolated to the national level based on the distribution of the population observed in the datasets (including households for which required data were missing), so that neither household means nor national totals are affected by missing data.

Results are presented for six different demographic groups. These follow the groups used elsewhere in the thesis, determined on the basis that they have significantly different capabilities and preferences to use any working time opportunities open to them, and contribute, both per household and in total, substantially different amounts to the savings in greenhouse gas emissions modelled here.

⁷² There is 1 case out of 4,957 with missing data in the UK dataset, and 17 of 2,130 in the Dutch dataset.

Groups are:

- Older working age households (at least one of working age, and head of household/male aged 50 years or over):
 - Couples
 - Singles
- Younger working age households (head of household/male under 50):
 - Couples with children
 - Couples without children
 - Single with children
 - Single without children

Note that “couples” refers to households in which the head of household lives with a partner, plus possibly other household members (dependent children, and other adults). “Single” refers to households in which the head of household does not live with a partner, but other household members may live there.

Results are also split and presented in the chapter by income quintile (based on the baseline situation, before any reductions in working hours) equivalised using the OECD method described in chapter 4, section 4.3.2.1. This enables an analysis of the different contributions to emissions savings arising from different income groups. This is important to consider as the lowest income quintile is likely to have severely limited capabilities to reduce hours and take career breaks without reducing income unacceptably.

7.2.5 Methodological issues

It is assumed in the modelling that levels of state benefit, and other sources of income other than the paid labour of the head of household and, if present, partner, are unchanged as a result of changes in working time. Benefit payments are frequently means-tested, so that in theory the reductions in working hours and subsequent reductions in incomes modelled here could increase levels of benefits received by a household. The assumption that they do not change in the scenarios is partly due to the complexity of accurately modelling the benefits received by households in the two countries, particularly in the Netherlands where it is not simple to disaggregate household benefits received from other sources of non-earned income in the dataset. Equally however, benefits form but a minor source of income

for all but the poorest households, many of which are not in paid work. The assumption that benefits payments are unaltered by working time changes is therefore likely to substantially affect estimates of changes to greenhouse gas emissions only for the lowest income band of households, which as results in the chapter show, contribute only a very small proportion of the total estimated emissions reductions. As such, this assumption should have little effect on the estimates made here. Tax and benefits payments, the lowest income band, and their relation to achieving the emissions reductions modelled here, are nevertheless discussed in section 7.4.

7.3 Results

7.3.1 Effects of working time reduction scenarios on greenhouse gas emissions

Table 7.2 and Table 7.3 below show the greenhouse gas emissions reductions in the UK and the Netherlands arising from the different scenarios of reduced working hours and career breaks. Total emissions from working age households are presented for the different scenarios. The reduction in emissions under the different scenarios compared to the baseline are also presented as tonnages per year and as a percentage.

In both countries, by far the biggest reductions in emissions occur under Scenario 1, in which full time workers are assumed to reduce their working hours by 20%, equivalent to one day per week, or to shorter daily hours over five days or longer hours for 3.5 days per week. Emissions from working age households fall by some 4.2% in the UK under this scenario, 24 million tonnes per annum, and 6.4% in the Netherlands, 9.9 million tonnes CO_{2e} per annum. These represent a reduction in total national greenhouse gas emissions of 2.6% and 3.7% respectively (assuming that emissions from the state are unaffected: see the discussion, section 7.4, for more on this assumption).

Reductions due to scenario 2, in which certain individuals take 3 month career breaks over the year (equivalent to a 25% reduction in working hours for that year) are estimated to be somewhat lower. In the UK, scenario 2 reductions are estimated to be 5.6 million tonnes per annum in total, 0.6% of all national emissions, with approximately 60% of this resulting from the 10% takeup of career breaks across the whole working population, and 40% arising from higher takeup rates of specific career breaks for increased parental leave and for care responsibilities among older workers. In the Netherlands, scenario 2 reductions are somewhat higher at 1% of national emissions, or 2.6 million tonnes per annum, again split roughly 60-40 between the two career break types.

Combined as scenario 3, the two scenarios are estimated to lead to a reduction in UK emissions from working age households of some 5.1%, or 28.6 million tonnes CO_{2e} per annum. This is equivalent to a 3.1% fall in total national emissions. Reductions in the Netherlands are proportionally larger, the 12.1 million tonnes per annum being equivalent to 8.0% of emissions from working age households, 4.5% of total Dutch emissions. Note that the total savings in scenario 3 are less than the other two scenarios added together: this is because reductions in scenario 1 due to reduced working hours reduce the per household reductions achieved due to a subsequent career break in scenario 2, as household incomes, and so expenditure and emissions, are already lower than in the baseline.

Table 7.2 Greenhouse gas emissions reductions arising from different scenarios of working time reduction in the UK

		Scenario					
		Scenario 0: no change in working patterns	Scenario 1: 20% reduction in full time working hours	Scenario 2: three month career breaks			Scenario 3: work hours reduction + career breaks (Scenarios 1 and 2 combined)
				a: 10% takeup per year by all working adults	b & c: 25% takeup per year by working parents with children <5, and; 1 in 15 take up per year among older workers	Scenario 2 total (a-c combined)	
Total emissions from all working age households	Tonnes CO_{2e} per year	566,194,487	542,287,071	562,680,386	564,071,566	560,557,465	537,602,861
	As a percentage of baseline emissions from all working age households	100%	96%	99%	100%	99%	95%
	As a percentage of baseline emissions from all households	82%	78%	81%	81%	81%	77%
	As a percentage of baseline emissions from country	62%	59%	62%	62%	61%	59%
Reductions over Scenario 0	Tonnes CO_{2e} per year	-	23,907,417	3,514,101	2,122,921	5,637,022	28,591,626
	As a percentage of baseline emissions from all working age households	-	4.2%	0.6%	0.4%	1.0%	5.1%
	As a percentage of baseline emissions from all households	-	3.4%	0.5%	0.3%	0.8%	4.1%
	As a percentage of baseline emissions from country	-	2.6%	0.4%	0.2%	0.6%	3.1%

Source: Author's own calculations. See section 4.2 for details of datasets used.

Table 7.3 Greenhouse gas emissions reductions arising from different scenarios of working time reduction in the Netherlands

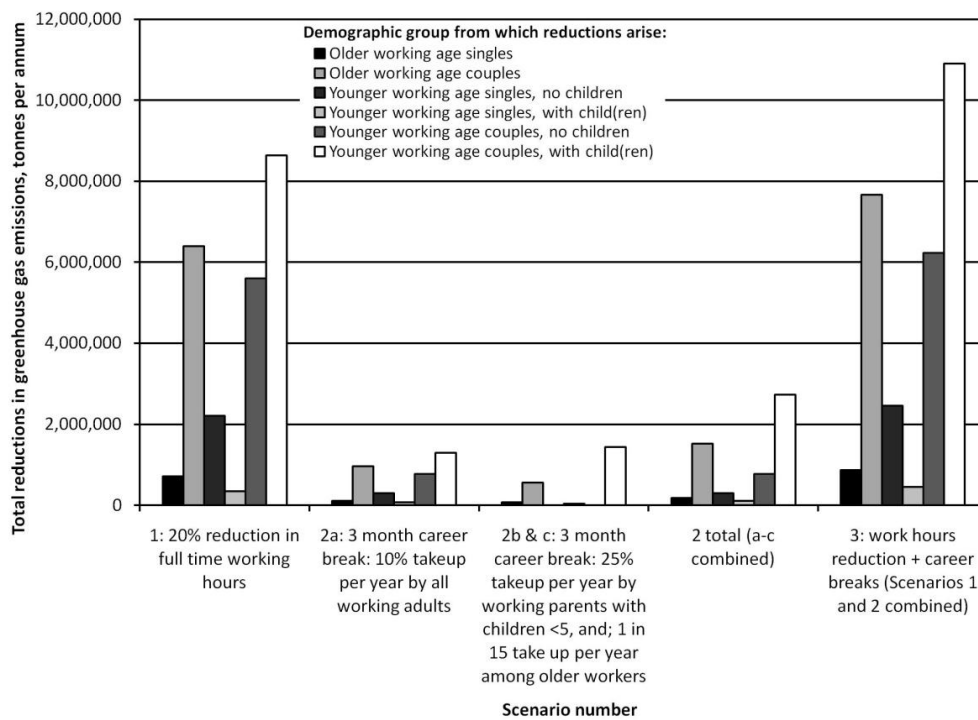
		Scenario					
		Scenario 0: no change in working patterns	Scenario 1: 20% reduction in full time working hours	Scenario 2: three month career breaks			Scenario 3: work hours reduction + career breaks (Scenarios 1 and 2 combined)
				a: 10% takeup per year by all working adults	b & c: 25% takeup per year by working parents with children <5, and; 1 in 15 take up per year among older workers	Scenario 2 total (a-c combined)	
Total emissions from all working age households	Tonnes CO_{2e} per year	154,332,700	144,476,497	152,774,815	153,244,984	151,687,099	142,241,400
	As a percentage of baseline emissions from all working age households	100%	94%	99%	99%	98%	92%
	As a percentage of baseline emissions from all households	88%	83%	87%	88%	87%	81%
	As a percentage of baseline emissions from country	58%	54%	57%	57%	57%	53%
Reductions over Scenario 0	Tonnes CO_{2e} per year	-	9,856,203	1,557,885	1,087,716	2,645,602	12,091,301
	As a percentage of baseline emissions from all working age households	-	6.4%	1.1%	0.7%	1.7%	8.0%
	As a percentage of baseline emissions from all households	-	5.6%	0.9%	0.6%	1.5%	6.9%
	As a percentage of baseline emissions from country	-	3.7%	0.6%	0.4%	1.0%	4.5%

Source: Author's own calculations. See section 4.2 for details of datasets used.

These reductions are substantial. Where in the population do they arise from? The next paragraphs present the sources of emissions reductions disaggregated by key demographic groups and then by income. Households with children, and older households, are key groups targeted by working time policies relating to work family balance and (early) retirement, and here too have special leave arrangements in scenario 2. Income is also a key factor to consider: it affects both the emissions of households, and also their capabilities to use career break and reduced working hours opportunities that are presented to them.

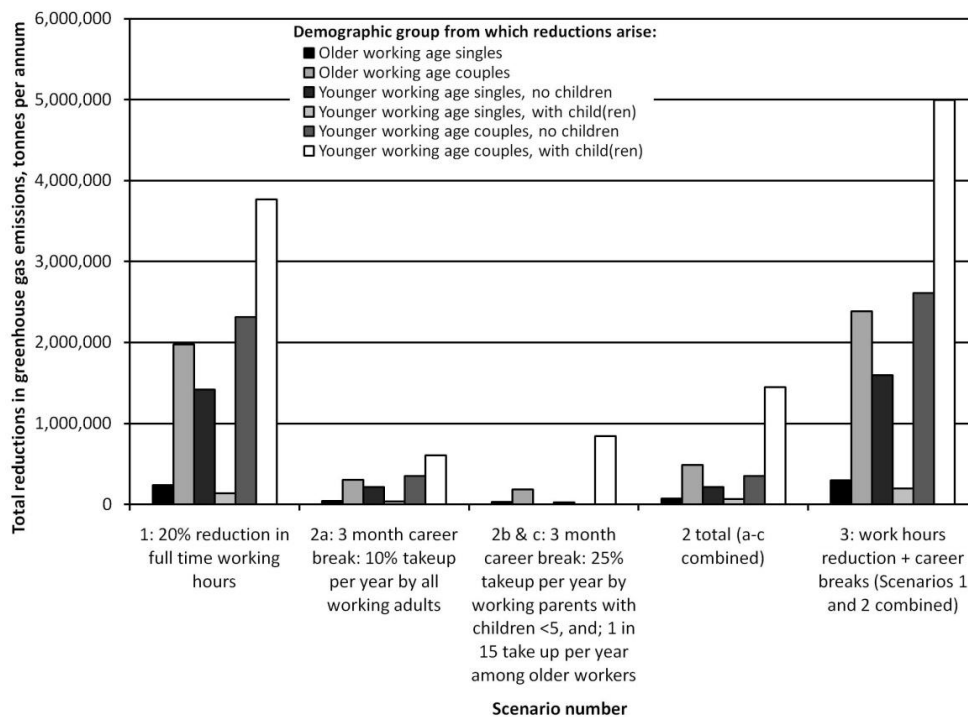
Figure 7.1 and Figure 7.2 break the reductions in emissions down by demographic group for each of the scenarios. For all the scenarios in both countries, the largest reductions in emissions come from younger working age couple households with children. 36-38% of emissions reductions come from this group in scenario 1, 48-55% in scenario 2, and 38-41% in scenario 3. In the UK, the next largest reductions come from older working age couple households, representing approximately 27% of total reductions in all scenarios. After that, younger working age couple households without children are the next largest contributor to reductions in the UK, with other groups representing small shares. In the Netherlands, the contributions of these two groups varies more between scenarios in relative importance, but are of similar magnitude to each other and slightly smaller than UK contributions from these groups.

Figure 7.1 Total national reductions in UK greenhouse gas emissions for different scenarios of reduced working time, by demographic group



Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 7.2 Total national reductions in Dutch greenhouse gas emissions for different scenarios of reduced working time, by demographic group



Source: Author's own calculations. See section 4.2 for details of datasets used.

The results above indicate that older couple households and younger couple households, especially those with children, represent the major source of savings in greenhouse gas emissions under the scenarios. The share of total reductions coming from different demographic groups depends on the relative sizes of the groups (in terms of the proportion of households they represent) and the mean reductions in emissions per household in the group (in turn dependent on various factors such as mean income, working patterns and participation rates, and hence levels of working time reduction in the scenarios). As presented in Table 7.4 and Table 7.5 below, those demographic groups contributing the largest share of greenhouse gas reductions are those representing the highest proportion of households. Couple households also have higher mean reductions in emissions per household under the scenarios than do single households. Whilst couple households with children have lower mean reductions in emissions than do younger couples without children, they still contribute the largest share of total greenhouse gas reductions thanks to being the largest demographic group. The larger share of reductions coming from younger working age single households without children in the Netherlands compared to the UK can also be attributed to the comparatively larger share of households that they represent in the Netherlands.

Table 7.4 Mean emissions reductions by scenario for each demographic group, and percentage of working age population each group represents, UK

	Demographic group	Scenario				
		1	2a	2b & c	2 - total	3 - total
Mean reduction in per household greenhouse gas emissions: kg CO_{2e} per annum and percentage reduction for group compared to baseline	All working age households	952 4.2%	140 0.6%	85 0.4%	225 1.0%	1,139 5.1%
	Older working age single	307 2.2%	48 0.3%	32 0.2%	80 0.6%	375 2.7%
	Older working age couple	997 3.5%	150 0.5%	88 0.3%	238 0.8%	1,196 4.2%
	Younger working age single, no children	575 4.2%	79 0.6%	- 0.0%	79 0.6%	639 4.7%
	Younger working age single, with child(ren)	172 1.1%	36 0.2%	20 0.1%	56 0.4%	222 1.4%
	Younger working age couple, no children	1,552 6.6%	213 0.9%	- 0.0%	213 0.9%	1,727 7.4%
	Younger working age couple, with child(ren)	1,260 4.7%	189 0.7%	210 0.8%	399 1.5%	1,592 5.9%
Proportion of working age households (this is unchanged by the scenarios)	All working age households	100.0%				
	Older working age single	9.3%				
	Older working age couple	25.5%				
	Younger working age single, no children	15.4%				
	Younger working age single, with child(ren)	8.2%				
	Younger working age couple, no children	14.4%				
	Younger working age couple, with child(ren)	27.3%				

Source: Author's own calculations. See section 4.2 for details of datasets used.

Table 7.5 Mean emissions reductions by scenario for each demographic group, and percentage of working age population each group represents, Netherlands

	Demographic group	Scenario				
		1	2a	2b & c	2 - total	3 - total
Mean reduction in per household greenhouse gas emissions: kg CO _{2e} per annum and percentage reduction for group compared to baseline	All working age households	1,990 6.4%	314 1.1%	220 0.7%	534 1.7%	2,441 8.0%
	Older working age single	531 2.8%	97 0.5%	65 0.3%	162 0.9%	671 3.5%
	Older working age couple	1,843 5.0%	281 0.8%	175 0.5%	456 1.2%	2,223 6.1%
	Younger working age single, no children	1,427 8.1%	215 1.2%	- 0.0%	215 1.2%	1,606 9.2%
	Younger working age single, with child(ren)	520 2.1%	148 0.6%	106 0.4%	254 1.0%	754 3.0%
	Younger working age couple, no children	3,054 8.8%	466 1.3%	- 0.0%	466 1.3%	3,443 10.0%
	Younger working age couple, with child(ren)	2,658 6.7%	428 1.1%	595 1.5%	1,023 2.6%	3,526 8.9%
	Proportion of working age households (this is unchanged by the scenarios)	All working age households	100.0%			
Older working age single		9.0%				
Older working age couple		21.7%				
Younger working age single, no children		20.1%				
Younger working age single, with child(ren)		5.3%				
Younger working age couple, no children		15.3%				
Younger working age couple, with child(ren)		28.6%				

Source: Author's own calculations. See section 4.2 for details of datasets used.

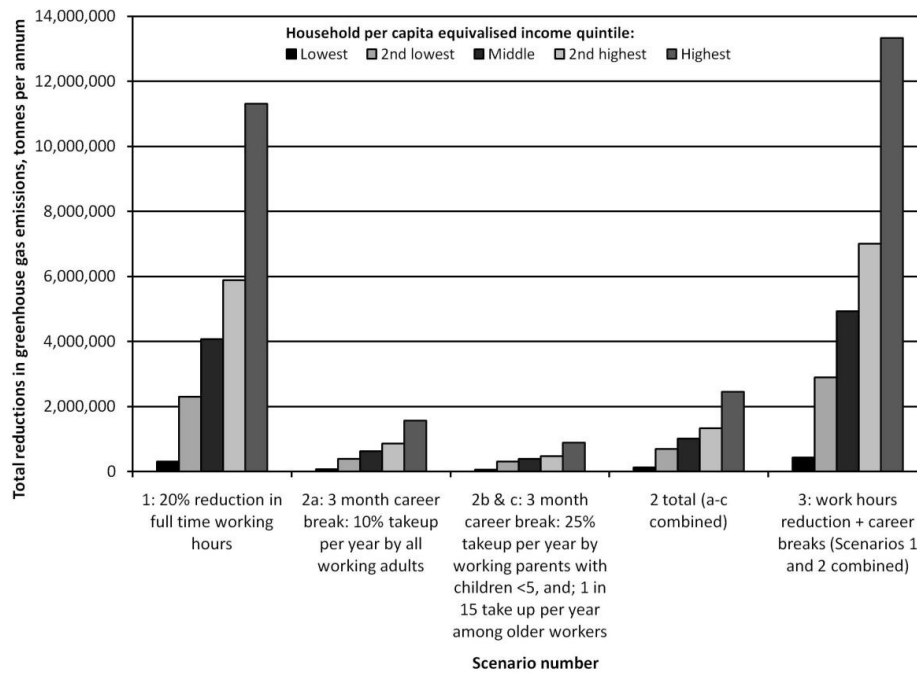
The effect of the household's income band on its emissions reductions is also, as would be expected, very important. Figure 7.3 and Figure 7.4 present total emissions reductions from working age households split into quintiles based on their OECD equivalised per capita income.

The disparity between income bands is marked, particularly in the UK. In the UK, the lowest income quintile accounts for just 1-3% of emissions reductions in the

different scenarios, whilst the highest income quintile accounts for 42-47% of total reductions. In the Netherlands, the results are slightly less divergent, but still highly unequal: the lowest income band contributes 5-8% of total reductions, and the highest 25-37%.

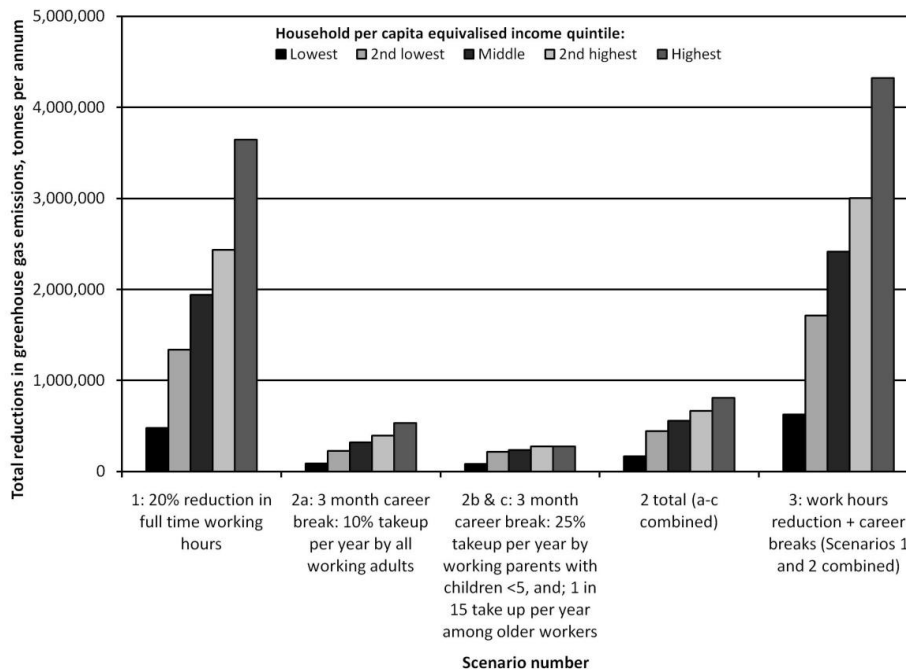
The results are as would be expected. Under the scenarios, both the probability of using working time reduction opportunities, and the fall in income, and hence expenditure and emissions, which result, increase with household income band. This effect is only slightly offset by the fact that Household Emissions Intensities are lower in higher income households: the difference in the size of changes in expenditure between the income quintiles is far larger than the difference in Household Emissions Intensity, so that emissions still fall the most in higher income bands. The lowest income households are much less likely to be in (full time) paid work (as seen in chapter 6), so that a much smaller share of these households will reduce hours or take career breaks in the scenarios. At the same time, those individuals in lower income bands which do reduce working time will typically have much lower wage rates, so that their reductions in income, and hence expenditure and emissions, will also be much lower. Hence, both the proportionate and absolute fall in income from this lower income band will be much smaller than for the highest band.

Figure 7.3 Total national reductions in UK greenhouse gas emissions for different scenarios of reduced working time, by per capita equivalised income quintile of household



Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 7.4 Total national reductions in Dutch greenhouse gas emissions for different scenarios of reduced working time, by per capita equivalised income quintile of household



Source: Author's own calculations. See section 4.2 for details of datasets used.

7.3.2 Effects of working time reduction scenarios on working patterns and income

Table 7.6 and Table 7.7 present summary statistics of the size of the reductions in total working hours in the two economies for the different scenarios, and their subsequent effects on income, expenditure and so emissions.

One can see that in both countries, the effects of the scenarios on the total working hours in the two economies is similar, with scenario 1 being the predominant contributor to the total reduction in working hours in the scenario 3 total, and the career breaks of scenario 2 contributing a relatively minor amount. The policies, especially for scenario 1, affect a large proportion of the population in both countries, the lower figures in the Netherlands for scenario 1 reflecting the already higher prevalence of part time work there compared to the UK. With similar demographics and participation rates, scenario 2 has similar effects in both countries in terms of the proportions of the workforce affected by it.

Greater differences are apparent in the tables for the effects on income and expenditure. In the UK, the reduction in total gross income in the working age population is 15.9% for all the working time policies combined (scenario 3). This then results in a 6.3% drop in expenditure, in turn leading to a 5.1% drop in emissions from these households. In the Netherlands meanwhile, total gross income drops by a smaller 12.5%, but the effect on expenditure is much greater, as it drops 8.8%, which in turn means total emissions from working age households drops by 8.0%, nearly 3% more than in the UK.

Table 7.6 Effects of scenarios on working patterns, incomes, expenditure and greenhouse gas emissions, for UK working age households

	Scenario				
	1	2a	2b & c	2 – total of 2a-c	3 – total of 1 & 2
Reduction in total work hours in economy (as a percentage of baseline, from working age households)	17%	2%	1%	4%	20%
Percentage of workforce using policy (reducing hours among full time workers by 20% in scenario 1, or taking 3-month career break in scenarios 2a to 2c), or at least one in scenario 3*	74%	10%	6%	16%	79%
Reduction in total gross income (as a percentage of baseline from working age households)	13.3%	2.0%	1.2%	3.1%	15.9%
Reduction in total gross expenditure (as a percentage of baseline from working age households)	5.2%	0.7%	0.4%	1.2%	6.3%
Reduction in total national emissions (as a percentage of baseline emissions from working age households)	4.2%	0.6%	0.4%	1.0%	5.1%

*This counts the proportion of working heads of household and partners, if present, who have reduced working hours or taken career breaks under the given scenario.

Source: Author's own calculations. See section 4.2 for details of datasets used.

Table 7.7 Effects of scenarios on working patterns, incomes, expenditure and greenhouse gas emissions, for Dutch working age households

	Scenario				
	1	2a	2b & c	2 – total of 2a-c	3 – total of 1 & 2
Reduction in total work hours in economy (as a percentage of baseline, from working age households)	15%	2%	2%	4%	19%
Percentage of workforce using policy (reducing hours among full time workers by 20% in scenario 1, or taking 3-month career break in scenarios 2a to 2c), or at least one in scenario 3*	65%	10%	7%	17%	71%
Reduction in total gross income (as a percentage of baseline from working age households)	10.2%	1.6%	1.1%	2.8%	12.5%
Reduction in total gross expenditure (as a percentage of baseline from working age households)	7.2%	1.2%	0.9%	2.0%	8.8%
Reduction in total national emissions (as a percentage of baseline emissions from working age households)	6.4%	1.1%	0.7%	1.7%	8.0%

*This counts the proportion of working heads of household and partners, if present, who have reduced working hours or taken career breaks under the given scenario.

Source: Author's own calculations. See section 4.2 for details of datasets used.

The working hours reductions in scenario 1 clearly represent a larger change in working patterns than the career breaks of scenario 2, and so it is worth presenting more details of the effects it has on working patterns. Scenario 1 assumes substantial changes in the paid working hours of the population, with all individuals working over 35 hours per week reducing their working hours by 20%. The effect of this can be seen in Figure 7.5 and Figure 7.6 below. These show the working patterns of men and women who live together (i.e. couple households), which represent the majority of individuals. The baseline figures show the distribution of working patterns as found in the UK (2004-5) and Dutch (2000) datasets, to allow the changes under the scenario to be better seen. The scenario 1 figures show the effect of the scenario in which full time workers reduce their hours by 20%.

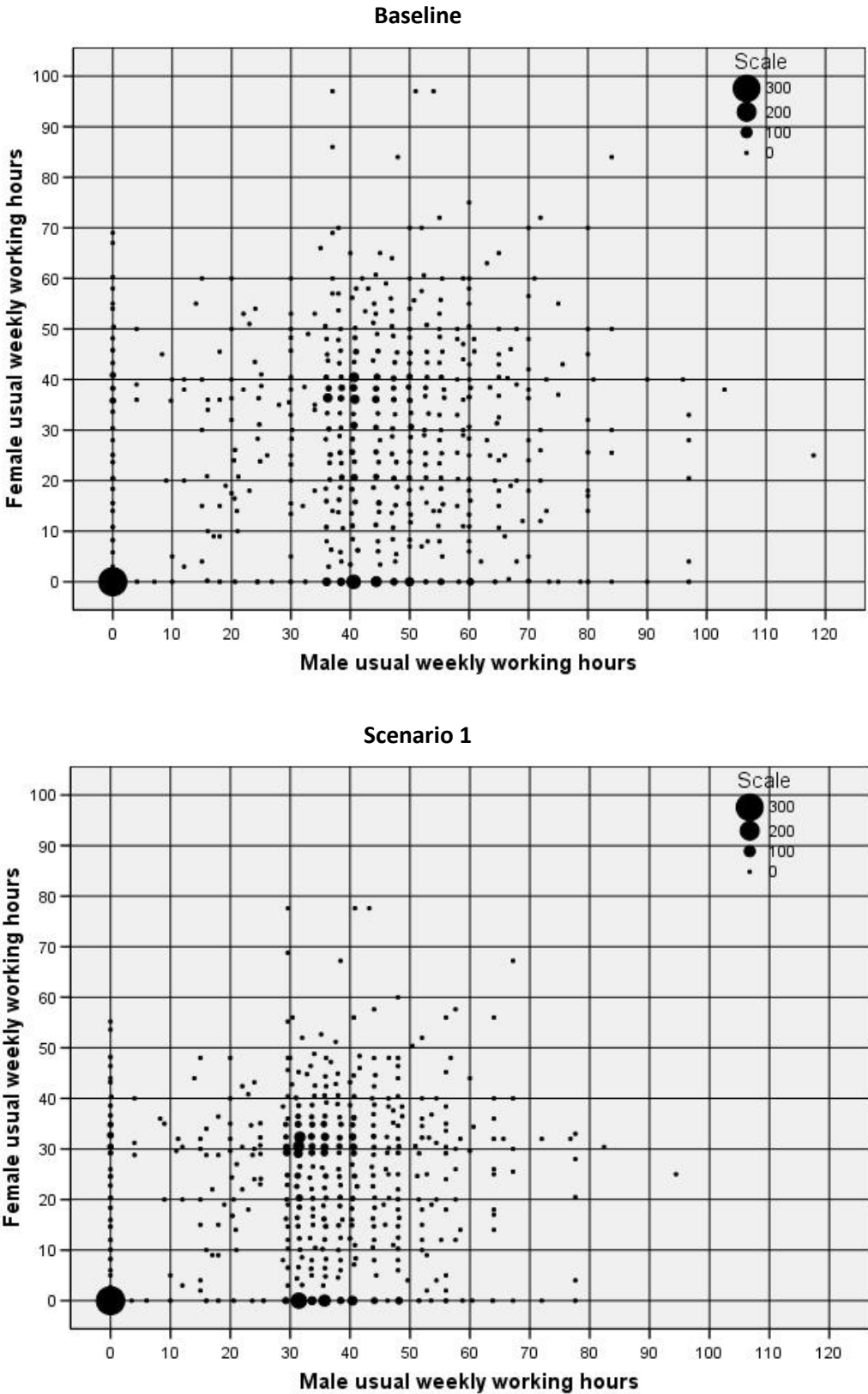
In the UK, apart from no worker households, the pattern that is seen in the baseline data is most commonly of a woman either not working or working full time, but with significant numbers spread across the spectrum of working hours. The male generally is working full time, with a much higher predominance of long hours of work (>40 per week) than for the woman. There are few cases where the woman in a household works longer hours than the man. The effect of scenario 1 is that there is a compression of working patterns, with a much larger share of households now following a “2 x ¾” working pattern, in which both male and female work around ¾ of full time hours. Extremely long hours of work are much less common than in the baseline. There is much greater equality in working hours between the male and female in households as a result of the scenario.

In the Netherlands meanwhile, female working patterns in the baseline situation are much more evenly spread between no work and full time, but with substantially more than the UK not working at all. Male working hours, like the UK, are mostly full time, but with more men tending to work shorter hours (down to 30 per week) and far fewer working long hours (over 40 per week), a marked contrast to the UK situation. As a result of this different starting point, scenario 1 in the Netherlands results in far more households working 2 x ¾ or less (with the female generally being the one working less than ¾ of full time). Full time work is fairly uncommon in

scenario 1 in the Netherlands: the Dutch part time society alluded to by Visser (2002) really does become reality.

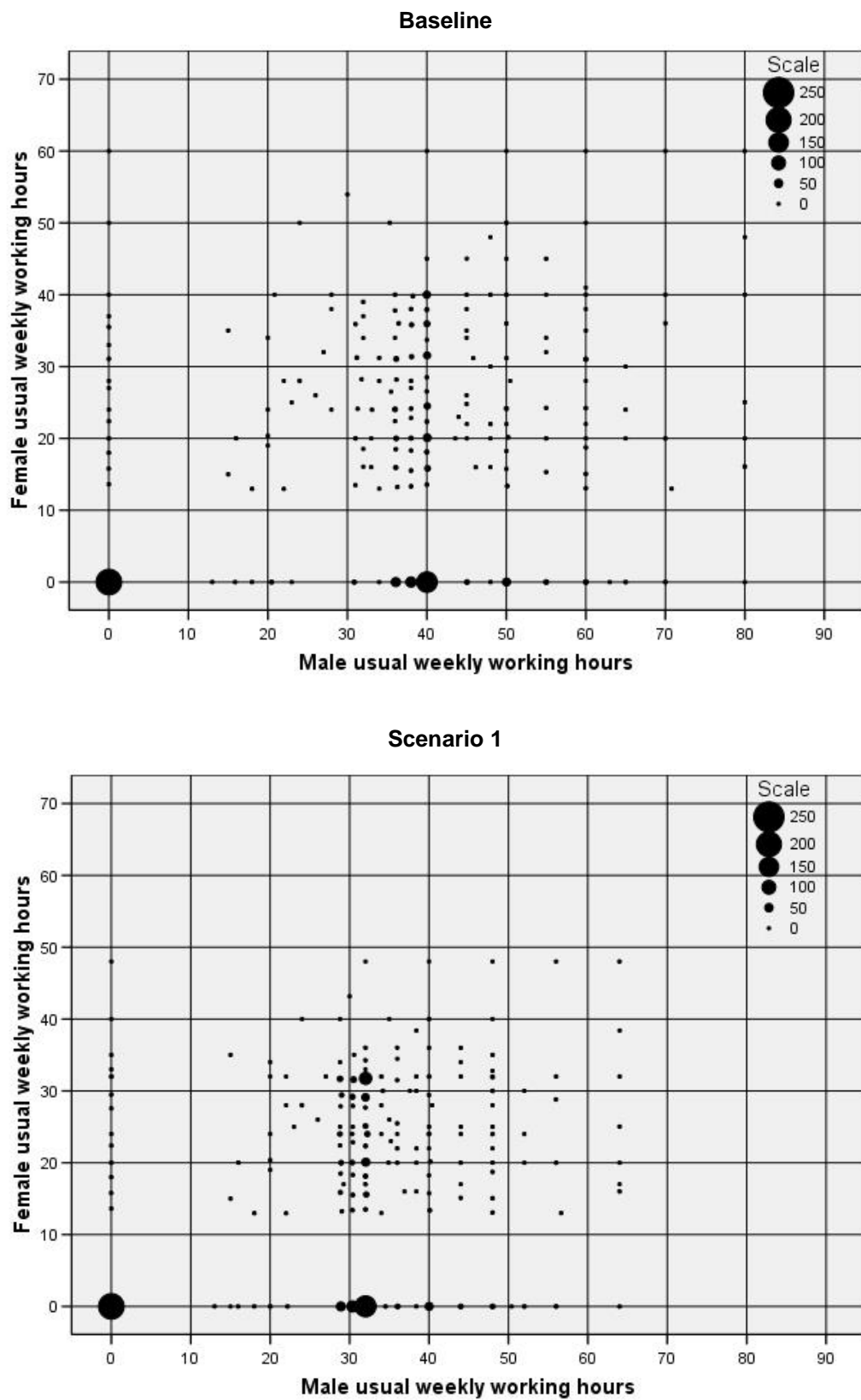
Due to the currently longer typical working hours of men compared to women in both countries, the effect of scenario 1 is a shift to more gender equal working patterns within couple households.

Figure 7.5 Change in couple household working patterns between baseline situation and scenario 1, UK



Source: Author’s own calculations. See section 4.2 for details of datasets used.

Figure 7.6 Change in couple household working patterns between baseline situation and scenario 1, Netherlands

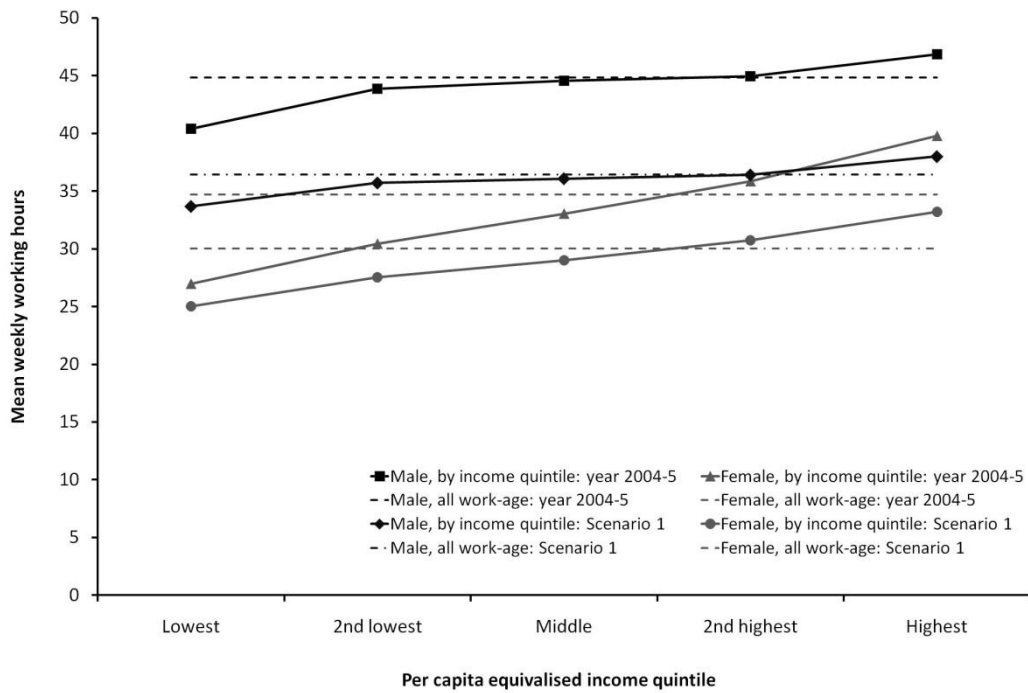


Source: Author's own calculations. See section 4.2 for details of datasets used.

Across income bands, Figure 7.7 and Figure 7.8 show mean male and female working hours of those in paid work for all working age households, single and couple. Mean working hours in the baseline situation increase with household income, particularly for women. Working hours are on average substantially longer for men than women, over 10 hours per week difference in both countries, although the difference is smaller at higher incomes. Dutch working hours for both genders, but particularly for women, are also substantially shorter than their British counterparts.

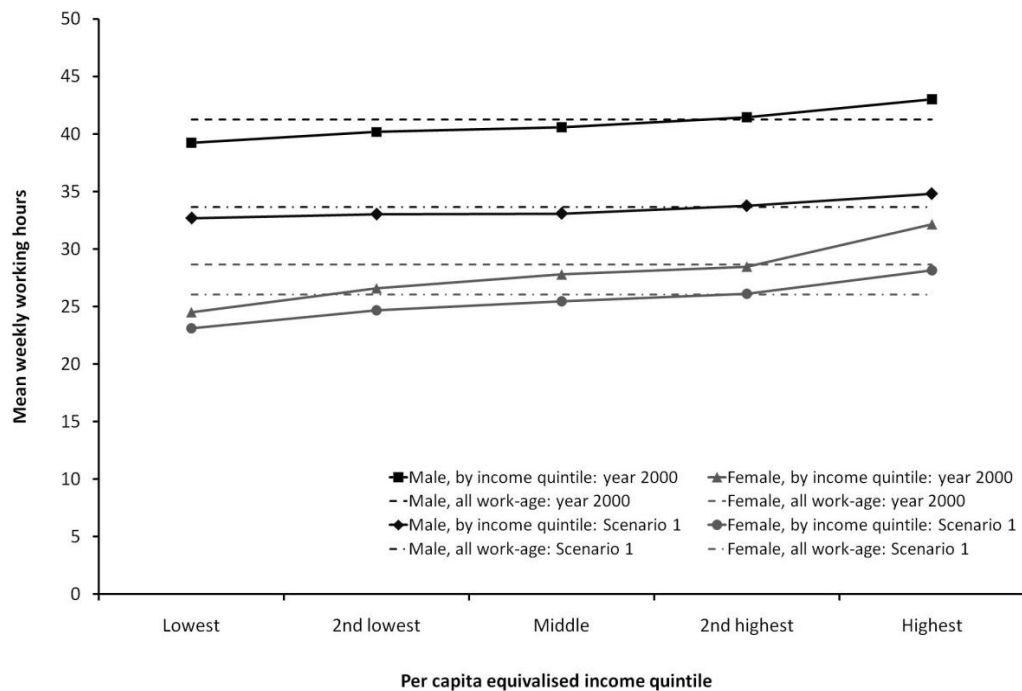
As a result, the effect of scenario 1 is that male hours on average fall far more than do female, by almost 10 hours per week for men, and around 3-4 for women. There is thus greater equality in working patterns between men and women in general, following the pattern found above for couple households. Working hours differences across income bands also reduce, particularly for women, although there remain greater differences for women than for men across income bands.

Figure 7.7 Male and female mean working hours by per capita equivalised income quintile of household, UK, for baseline and scenario 1



Source: Author's own calculations. See section 4.2 for details of datasets used.

Figure 7.8 Male and female mean working hours by per capita equivalised income quintile of household, Netherlands, for baseline and scenario 1



Source: Author's own calculations. See section 4.2 for details of datasets used.

7.4 Discussion

7.4.1 *Summary of results*

This chapter has modelled the estimated effects on greenhouse gas emissions from household consumption arising from different scenarios of reduced working hours. The hypothesis tested in this chapter is found to hold: working time reduction does lead to reductions in emissions, under the assumptions in the model. The scenarios modelled here are by no means an exhaustive set of options for reductions in working time. To fit with the assumptions in the modelling, there was a need to focus on smaller changes in working patterns than some authors propose (e.g. Coote et al. 2010). Hence it was not, for example, considered possible to model cuts in weekly hours of 50% or so, or of long periods of career break spanning several years, as is in principle possible under the Dutch Life Course Savings Scheme. Chapter 3 (section 3.8) discussed the modelling assumptions in detail. In brief, the bigger the change in working patterns modelled, the more likely the model assumptions are to not hold. Household decisions around working and spending patterns under large working time reductions might differ substantially from those found in the datasets upon which the scenario results are based: they might, for example, smooth their income differently, have different opportunities to borrow, or draw down savings, or have different expected lifetime incomes, compared to the households in the datasets used. Systemic effects would also become increasingly large with larger working time reductions: changes in product prices and wage rates, as both consumer demand and labour supply reduced substantially, would have increasing effects on consumption patterns (not just in the UK and the Netherlands but globally) (Alcott 2008) that are not considered in the model. For these reasons, smaller but still substantial working time reductions were modelled in this chapter for which household behaviour, and the resultant effects on greenhouse gas emissions, are more likely to follow that observed in the data.

Scenario 1 represents a general reduction in the mean weekly hours of full time workers of 20%. Scenario 2 meanwhile models a substantial career break scheme, along the lines of the rights and patterns of use of the Belgian Time Credit Scheme.

Scenario 2's components simulate a realistic scenario in which individuals, alongside usage of such rights at a background rate of one three-month career break per decade in paid work, also take up one extra three-month break for childcare per child under 5, with many also taking another in the later stage of the working life, primarily for medical or palliative care purposes. Scenario 3 combines Scenarios 1 and 2.

The results above indicate that Scenario 1 especially, a general reduction in full time working hours, would have a substantial effect in reducing greenhouse gas emissions, reducing emissions from working age households by 4.2% in the UK, and 6.4% in the Netherlands. A career break scheme with similar rights and levels of use as the Belgian Time Credit Scheme meanwhile leads to a more modest but still significant reduction of 1.0% of working age household emissions in the UK, and 1.7% in the Netherlands. Combined, the two policies would lead to an estimated 5.1% reduction in emissions from these households in the UK, and 8.0% in the Netherlands. As emissions from these households represent just a proportion of both countries' total emissions, these total reductions are equivalent to 3.1% and 4.5% respectively of total national emissions. The annual tonnage reductions, 28.6 million tonnes CO_{2e} in the UK, 12.1 million in the Netherlands, are approximately equivalent to the total annual greenhouse gas emissions from consumption of Croatia and Cyprus respectively⁷³.

The marked differences between the two countries in the percentage reductions in emissions reflect numerous differences in socio-economic conditions and household behaviour between the two countries. These differences are reflected both in the regression models of household behaviour developed in chapter 5 and used in this chapter for estimating the effects of the scenarios, and in the household expenditure and environmental data used. For one thing, the relationship between gross income and expenditure varies between the countries, which may be due to differences in tax systems, benefits received, the household members' own estimation of their likely lifetime income (a predictor of expenditure), availability and propensity to use credit facilities or to save, all in turn affected by cultural attitudes relating to debt,

⁷³ Source: www.carbonfootprintofnations.com

consumption behaviour, impacts of working patterns and career breaks on future income and career prospects, perceived economic security, etc. The relationship between income and Household Emissions Intensity also varies, reflecting both differences in the share of total expenditure that goes on different types of good and service between the two countries, and also differences in the calculated product emissions intensities of like products between the two countries. The result is that the change in household greenhouse gas emissions for a given level of working time change differs between the two countries. At the same time, the markedly longer working hours of full time workers in the UK compared to the Netherlands means that Scenario 1's working hours reductions are proportionally larger in the UK than in the Netherlands. Without this latter consideration, the emissions reductions in the Netherlands would, proportionally to the UK's, be even larger than they already are.

It should be noted that the results reflect only near-term emissions reductions arising from reductions in private consumption by those households reducing working hours and/or taking career breaks. Two factors, discussed in section 3.8, mean that these are likely to underestimate the total reductions in greenhouse gas emissions occurring. Firstly, future expenditure may be reduced in the households which reduce working hours or take career breaks as, on the one hand, lower income households on average save a smaller proportion of their income, so they will have fewer savings to spend in future and, on the other hand, future working time and wage rates may be reduced due to accustomisation to having less paid work and due to reduced opportunities on the labour market, i.e. negative career impacts. As discussed in chapter 3, and more below, this latter effect on future labour market contact can to a large extent be addressed by policy, whilst normalisation of working time reduction through popular use precludes employees facing discrimination arising from it. The former effect of reduced savings means that there are emissions reductions what would arise later in time which are excluded from the model.

Secondly, there is a systemic effect which also means that the model results are likely to be underestimates. The scenarios would reduce tax revenue from income taxes and from VAT. Either this is reflected in reduced public sector consumption,

or through increased taxes elsewhere, ultimately reducing income and household consumption by other households. Either way, this means that further greenhouse gas emissions reductions not measured in this research would likely occur, so that the reductions estimated here are lower estimates of what might actually occur in practice.

7.4.2 Policy implications

The results presented in this chapter allow a discussion of the potential to meet social, economic and environmental goals through the use of substantial reductions in working hours. This section looks at this and the potential compatibilities and tensions between goals, on the assumption that the outcomes modelled in this chapter have been achieved; the next section focuses on how they might be achieved and issues in doing so.

The results indicate that working time reduction could indeed contribute to greenhouse gas reduction goals. The large size of effect lends weight to the argument that environmental impacts should be explicitly considered in the design of working time policy.

If policy targeted higher income households in particular, this would bring the highest environmental benefits, as the total income and hence expenditure reduction for a given level of working time reduction would be higher in this group, assuming policy ensured their hourly wage rate were unchanged. The social outcomes need careful policy consideration too however. In principle the result would be a lowering of income inequality in the population, with higher earners giving up more income than lower earners. However, there is a risk of increasing inequality in non-paid time instead, even as income inequality falls. The lowest income workers would likely need financial support to be able to reduce their working time: such support would likely mean that greenhouse gas reductions from this group would be smaller than those modelled, as their incomes would reduce less, but they anyway contribute only a small amount to the total reductions modelled in chapter 7, and it would reduce the inequality in non-paid time. Meanwhile, if policies focused on reducing the working

hours of those who work the longest hours, and in encouraging increased use of career breaks among those who take them least (e.g. for care purposes) then there would be increased gender equality in paid working patterns, as it is men who tend to work longer and take less time out for care. This would also be at least a helpful precondition for increasing gender equality in childcare and other non-paid activities too, paving the way for the completion of the revolution in gender roles, towards a genuine gender equality, that has been in process for several decades (Esping-Andersen 2009).

The results focus on the environmental, and social, implications of particular working time patterns, without specific modelling of how these would be achieved. Nevertheless, the modified life course perspective allowed some discussion of the policy instruments that could potentially help achieve these outcomes. Policy instruments would need to be well designed to achieve these concurrent benefits, and reconcile diverse environmental, social and economic goals whilst being tailored to respond to the needs, preferences and capabilities of both different demographic groups and different employment sectors. In the social policy literature, working time policy focuses primarily on instruments designed to influence people's working time behaviour through a mixture of time rights and financial (dis)incentives, so that people are either individually or collectively influenced to adopt particular working patterns at particular stages of the life course. In this respect, the Netherlands is somewhat ahead of the UK, and policy there provides an insight into how substantial working time reduction could be achieved. In the Netherlands, the life course perspective underpins the approach taken to working time policy. Time rights are approaching an ideal state, as summarised earlier in section 7.1. Weekly working hours (and wage rates) are moderated collectively, with tailoring to sectoral requirements. Individuals have the right to request further reductions in their weekly working hours for any reason, which the employer can only refuse under exceptional circumstances. In terms of career break rights, employees can use the Life Course Savings Scheme to request a career break of up to three years. However, this right is rather limited as the employer can refuse any requests, except where they involve statutory rights to a break (such as for maternity leave) or exit from the labour market

in the form of pre-retirement. These rights need to be extended, to make them stronger so that employers have less opportunity to refuse requests. The UK meanwhile provides rights to request reductions in weekly hours for parents of children under 16 (or 18 if they are disabled), but in general there is little else available during the working age life course beyond the traditional rights to maternity leave and incapacity leave. Policy needs substantial expansion to facilitate further working time reduction therefore.

Financial support would also likely need to be extended in both countries to achieve equitable working time reduction. In the Netherlands, the requirement on individuals to save in advance of taking a career break would need to be abolished as it inhibits use of the Life Course Scheme, and a borrowing provision should be introduced for those who need it to enable them to take career breaks early in the life course (such as for parental leave) before there has been sufficient opportunity to save enough to cover such a break. Similar provisions would need to be introduced in the UK as well.

Financial incentives to reduce working time may also be necessary. These would need to be set to encourage generally lower levels of paid work but, in keeping with the modified life course perspective, be tailored to specific uses on non-paid time. Higher incentives should be provided for socially and environmentally beneficial non-paid activities (such as lifelong learning, child and elderly care, or volunteer work in environmental projects), for social risk events (such as redundancy or incapacity), and for activities which promote higher wellbeing (such as attending mindfulness training or creative activities in which “flow” can be experienced). For equity reasons, financial incentives would need to be targeted to particular demographic groups too, to enable them to have the real capacity to take up working time reduction rights, notably low income households and those with children, demographic groups in which income is already more likely to be spread thinly and capabilities to reduce it further are more limited. Whilst this would mean the income, and hence expenditure and greenhouse gas emissions effects, of working time reduction would be smaller than modelled for these households, the financial

resources used would have to be drawn from elsewhere in the economy, so that reductions would nevertheless take place in areas of the economy not modelled in this research. Whilst these reductions would not be identical to what would have occurred in these households, they are likely to be of a similar magnitude. Whilst both countries go some way towards having such financial incentives already, much more tailoring of incentives is needed, and restructuring of income tax rates and benefits for working time reduction is needed to reduce the financial benefits of working long hours and to reduce the income lost from working time reduction for lower income groups.

The modified life course perspective also indicates that working time reduction should be supported and encouraged by diverse mechanisms, not just financial. Offering financial incentives to the employed population as a whole to reduce working time could be expensive, and may not even be particularly effective. Multiple avenues of influence on behaviour need to be used, including use of diverse media channels to highlight the wellbeing effects of certain activities outside of paid work and the limited effects on wellbeing of increasing income once a certain level is reached, addressing employer objections to working time reduction, and providing increased levels of support for doing some of the beneficial non-work activities, including the provision of more courses and voluntary activities.

Regulation would also likely be needed to protect people's wage rates under reduced working hours: an assumption in the modelling here is that people's wage rates are unaffected by time changes, and hence that gross incomes fall proportionately to the reductions in working hours. This is in contrast to various other working time moderation policies which have sought to maintain incomes even as working hours fall, i.e. to increase wage rates, and in contrast too to the effect of career breaks and working hours reductions reducing future income earning potential. Although those taking career breaks often face impacts on future job opportunities and wage rates as a result, widespread working time reduction would also reduce labour supply, creating a relatively higher demand than at present, which would tend to encourage wage rate increases. A gradual transition to the shorter average working hours

modelled in this chapter could in part ameliorate the resulting reduction in income households face, as wage rate increases over time at least in part counter the wage effects of reducing working hours (Coote et al. 2010:28). Policy instruments may be needed to incentivise increased savings rates meanwhile, which are likely to decline under the scenarios modelled. Savings rates tend to correlate with income, so that reducing work and income is likely to reduce savings rates too, all else being equal. On the one hand, this represents another source of greenhouse gas emissions reductions that are not measured in the modelling: if policy ensures that over a person's life course, total work performed is reduced, then this implies further reductions in emissions in the future as a result of working time reductions now. On the other hand, reduced savings rates, or greater debt accumulation, can mean greater pressures in future to increase work again, so that, for example, the effective retirement age might creep up to counter increased use of career breaks, effectively negating the greenhouse gas savings as lifetime work, and income earned, work out being unchanged. Hence concurrent policy instruments might be needed to encourage greater savings, to counter the tendency under working time reduction to save less and borrow more (a tendency which could be enhanced by people trying to maintain their accustomed levels of consumption despite reduced income). Maintaining state finances would, as already mentioned, also need careful consideration. Sectoral agreements could also be necessary to support, for example, sectors subject to more intense international competition, which are important export sectors, or which provide key services to society, to ensure that their costs and competitiveness are maintained, and that the country's trade balance and public service levels can be maintained even as private consumption levels fall. A range of wider effects on the economy therefore need to be considered beyond just the immediate life course policies needed to effect working time reductions.

7.5 Summary

This chapter has sought to estimate the reductions in UK and Dutch greenhouse gas emissions that would arise under different scenarios of paid working time reduction in the working age population. The scenarios modelled in this chapter indicate that a substantial level of emissions reductions could be expected as a result of ambitious

levels of working time reductions. The emissions reductions are however small in comparison to the levels required to reach sustainable levels and aimed for by governments. This suggests that further reductions are needed via other policy measures, probably relating to consumption patterns and in particular to ensuring technology and process changes occur to reduce the levels of emissions arising from energy generation and manufacturing. The scenarios are interesting in that they also have outcomes that could result in, or are conducive to, reduced income inequality, greater gender equality in paid work and non-paid care, and increased wellbeing via non-consumption activities. The discussion above has highlighted too however that the levels of working time reduction modelled here could be taken far further. Key barriers to doing so relate to impacts on the productive efficiency of the economy, the maintenance of public sector revenue and international competitiveness and trade balances, and the dominant consumption-oriented norm with respect to lifestyles and routes to wellbeing. It is clear the link between working time reduction and greenhouse gas emissions reductions would continue to hold with greater levels of working time reduction. The extent to which wellbeing would continue to rise as working time fell is less clear, and likely dependent on the exact policy instruments used, and the degree of value change regarding routes to wellbeing that could be achieved in society.

The direct reduction in greenhouse gas emissions might seem small for a given level of working time reduction, but the estimates are likely to be low, as there are sources of further reductions of emissions not modelled here. These relate to reduced tax revenue needing to be matched by reduced expenditure elsewhere in the economy, and to reduced household savings rates which imply further curtailment of consumption in the future. Although not examined in this research, there should also be similarly important reductions in the use of natural resources and the production of other pollutants, benefiting ecosystems, habitats, and the people and species which rely on them.

Policy instruments already exist that provide the opportunities to reduce working time modelled in this chapter. Dutch policy, although still needing significant

changes, is significantly closer to what is needed than British policy. Policy needs to provide workers the opportunities and capabilities to reduce hours, and to influence preferences and norms surrounding working patterns: extending rights to employees to reduce working hours and take career breaks; providing financial support to reduce working hours, particularly for certain demographic groups (the low income and parents) whose options are likely to be more constrained; reducing the relative income benefits of working longer; protecting the employment and career progression of part time workers and career breakers; altering the tax structure to reduce costs to businesses of employing more people rather than making use of overtime and longer hours, to reduce impacts on their competitiveness and political opposition to measures; implementing surrounding policy instruments to encourage greener work and consumption patterns; and awareness-raising, facilitating and providing options for activities that involve less consumption and greater use of time for non-work activities demonstrated to support increased wellbeing.

In short, policy instruments can also strongly influence behaviour not just to meet current preferred levels of working time, but to go beyond them to achieve further reductions in work, by altering opportunities and capabilities, and influencing preferences through incentivising and promoting different work life balance strategies over the working life course.

In the case study countries of the UK and the Netherlands, policy support for working time reduction would need to be extended to achieve these greenhouse gas emissions and working time reductions. In the Netherlands, the career break rights in the Life Course Savings Scheme need to be strengthened, with the right of employees to request a career break turned into a right to actually *have* the career break, as in the Belgian Time Credit Scheme. The savings requirement should also be abolished, whilst optional borrowing facilities for career breaks early in the career (particularly for parental leave) should be introduced. In the UK, time rights would need to be extended with a career break scheme along the same lines, and extension of existing rights for parents to reduce working hours to the rest of the population. In both countries, support needs to be improved to make such rights really functional

freedoms, in which people have the genuine capability to use them, protected from adverse career impacts, across income and demographic groups. Incentives to work less also need to be improved, including restructuring financial incentives to work less, but also covering wider initiatives to support values and activities relating to non-consumption routes to wellbeing such as increased time with family, in the community, volunteering and in personal and spiritual development.

This chapter has contributed to the academic debate regarding the potential of working time reduction to reduce environmental impacts by producing estimates of the size of these effects for the case of greenhouse gas emissions in the UK and the Netherlands. It has demonstrated that working time reduction has large environmental effects that warrant consideration alongside social and economic goals when working time policy instruments are developed and evaluated. It has indicated that social and greenhouse gas reduction goals need not be incompatible, although reconciling them with GDP growth is more likely to be problematic. By selecting scenarios that are within the level of rights provided by existing working time policy instruments, and by drawing on a modified life course perspective, it has also contributed to an understanding of how policy might contribute, through diverse instruments, to achieving such working time reduction.

Chapter 8 Conclusion

This thesis took as its starting point the argument that reductions in paid working time, be it the time spent working per week or in total over the life course, could, via corresponding reductions in earned income, substantially reduce environmental impacts, as households spend and consume less. Following this, policy instruments designed to regulate working time, through influencing, for example, participation rates, working hours, parental leave, and rights to career breaks, could also have significant environmental effects. Whether these effects are intentional or not, the argument is that they warrant consideration in the design of working time policy, and that such policy could even be used as an instrument for sustainable development through reducing average paid working time and increasing the use of career breaks.

The thesis has contributed to the literature through considering two related research questions. Firstly, what size of environmental effects could arise from changes in paid working time? And secondly, if environmental goals are added to the heady mix of social and economic goals already addressed by working time policy, what are the implications for the design of such policy: how could policy instruments be designed to reconcile these diverse environmental, social and economic goals? The first of these questions was addressed empirically, whilst the second was addressed through discussion of the empirical results and existing literature. The sections below recap the main points from the previous chapters and how they have contributed to answering these research questions.

8.1 Literature synthesis

A review of the literature on working time revealed two distinct perspectives, presented in chapter 2. Among some ecological economics researchers, concerned with environmental sustainability, reduction in paid working time offers the potential to achieve environmental benefits as people concurrently earn less, and so consume less, leading to fewer environmental impacts from the production, distribution, use and disposal of products. At the same time, they draw on the happiness literature to

argue that working time reduction could also bring substantial wellbeing benefits alongside the environmental benefits, at least for those who can still securely meet their basic material needs. The greater time available for individuals to spend outside of paid work in community activities, volunteering, with their families, in personal and spiritual development, and so on, is argued to be more important, at least in high income countries, to people's wellbeing than more paid work, income and consumption (e.g. Speth et al. 2007, and see chapter 2, section 2.1.1.2). The evidence in the happiness literature demonstrates that happiness comes to a substantial degree from the individual's own mindset, but lends weight to the arguments that more time outside paid work is at least a helpful contributor to high levels of happiness. Theories of behaviour meanwhile give an insight into why individual preferences surrounding levels of paid work and income are suboptimal for individual wellbeing and for society and the environment as a whole, as they are influenced among other things by consumerist and work-oriented values and norms embedded in culture and promoted by marketing.

The study of existing working time policies meanwhile is embedded in an entirely different discipline, social policy, and has a perspective that focuses primarily on existing social and economic goals, rarely with any reference to or consideration of the environmental effects of such policies. In this social policy literature, the focus on the study and evaluation of existing working time policy goals and instruments has led to a more nuanced approach to policy design and analysis, in the shape of the life course perspective. This aims to address and reconcile diverse government goals, demographic and economic situations, the capabilities and preferences of different demographic groups, and the needs of different economic sectors, so that working time limits and rights, and financial support for different working patterns, are tailored to employees based on an assessment of how beneficial to wider society a particular use of time outside of paid work is, and how much a period outside of the labour market is outside the individual's control, e.g. due to incapacity from sickness or disability, or redundancy.

The two literatures differ but contribute valuably to one another, and chapter 2 ended by synthesising the two to produce a modified life course perspective, one in which environmental goals are considered alongside the social and economic, leading to a greater overall level of support for paid working time *reduction* across the life course for environmental and wellbeing ends. The wider understanding of the drivers of individual behaviours around work and consumption found in the ecological economics literature also expands the range of policy instruments that can be considered, beyond just time rights and financial instruments, to wider factors to influence values, attitudes and habits around work and consumption, and incentives to encourage routes to wellbeing that use more time and less money. This modified perspective helped inform the policy discussions in later chapters.

8.2 Methodological approach

The empirical work in the thesis took the approach of studying the greenhouse gas emissions of working patterns at the scale of the household, and looked at the greenhouse gas emissions arising from the household's consumption. Drawing on the consumer behaviour literature, a model of the household was developed in chapter 3 linking the working patterns of its principle members (the head of household and, if present, his or her partner), primarily via the effect on earned income, to household expenditure and so emissions, controlling for various socio-demographic variables (including the numbers and age bands of resident children and other adults, and the social class, education level, and age band of the head of household, or male in couple households). The use of household expenditure survey and product emissions intensity data, as described in chapter 4, allowed this model to be tested using regression analysis (in chapter 5) to see how household emissions vary with working patterns for representative samples of the UK and Dutch populations. These regression results were used in chapters 6 and 7 to see how greenhouse gas emissions would alter for the working age population as a whole and for different demographic groups under different hypothetical scenarios of change in their working patterns, allowing estimates to be made of the effects of the scenarios on total national emissions. Such scenario modelling is a relatively uncommon methodological approach for social policy research, but more common in

environmental fields in which the aim is often to estimate the environmental effect of policy instruments that have not (yet) been implemented in practice. There were numerous assumptions made to produce a parsimonious model. The assumptions, and their implications for the research and for policy advice, were discussed in chapter 3 and in the discussion sections of the subsequent results chapters, and are recapped later below. The approach was also challenging. Data preparation for the UK dataset in particular required substantial amounts of coding, to integrate the expenditure survey data with the product emissions intensity data, and to combine the individual level variables with the household level variables, which in the UK dataset came in separate files not immediately amenable to combining. An approach had to be developed to simulate, with justifiable assumptions, how household emissions would change under two different conditions – moving from inactive to employed work statuses, and reducing working hours. These methods were developed from first principles without drawing on the approaches of other authors. Inevitably, this required a high level of attention to detail and care with what was being done to ensure the results were accurate based on the data and modelling assumptions. Keeping a detailed diary of activities was one way in which the author achieved this. Inevitably, there were avenues which were tried but not followed for various reasons, as discussed in the introduction (chapter 1), and what is presented in this thesis reflects only the final product, and little of the interim stages that preceded it.

8.3 Empirical results

A first look at the data, in chapter 4, revealed that the demographic groups contributing most to total national emissions were couple households, in particular those with children and those of older working age (between aged 50 and retirement), primarily because these groups represent a large proportion of the national population. Per household too, these households were the highest emitters, but taken per capita there was found to be little difference in emissions between demographic groups, except for those with children which had substantially lower emissions per capita: despite the higher number of “mouths to feed” the number of potential workers in, for example, a couple household compared to one without

children remains unchanged, and hence the income earning potential prevents expenditure rising with the number of children. In short, even if the need to consume increases, the ability to do so does not much, and hence per capita expenditure and emissions fall. Meanwhile, looking at the population by income band, it is clear that emissions increase with the household's per capita income, as expenditure also rises.

Chapter 5 used these data and the model of the household to test the first of the thesis' three interrelated hypotheses that, at the household level, reductions in the paid working hours of household members will reduce the greenhouse gas emissions arising from that household's consumption. The hypothesis was found to hold in both countries, with the paid working hours of the head of household and partner (if present) both affecting household greenhouse gas emissions. This was primarily through the effect of working hours on gross earned income, which, multiplied by hourly gross wage rate, it determines. Only in the Netherlands did emissions also vary directly with changes in working time controlling for income effects. In couple households, it made little difference to emissions whether the household's income was earned by the male or by the female in the couple. A doubling of household income less than doubles emissions. This is due to how both expenditure and Household Emissions Intensity⁷⁴ vary with income (recall that household expenditure x Household Emissions Intensity = household greenhouse gas emissions). Expenditure also less than doubles with a doubling of income, whilst Household Emissions Intensity falls as income increases, so that how emissions vary with income is found to be affected by changes both in expenditure and in the types of goods and services bought. In the case of greenhouse gas emissions and expenditure, the model of the household explained a large proportion of the variation in the dependent variable (with adjusted R² values of between 0.313 and 0.499).

In chapter 6, the first of the two scenarios modelled in the thesis was presented, testing the hypothesis that, as current UK and Dutch policy goals relating to paid

⁷⁴ Household Emissions Intensity was developed in chapter 3 as a measure of the household's greenhouse gas emissions per unit expenditure, i.e. per pound in the UK, and per euro in the Netherlands. Its value is determined by the share of total expenditure spent on different types of products, as these result in different levels of emissions per pound or euro spent on them.

work centre on increasing labour market participation rates (and hence increasing the total working time in the population as a whole), they will increase national greenhouse gas emissions. Again, this was found to be the case, although in line with the relatively small increases in participation rates being aimed for, the increases in total national emissions that result were also fairly small: 0.66% in the UK and 0.62% in the Netherlands. That said, at the household level, labour market activation of a household member could lead to large increases in emissions, as income and so expenditure increase. Given that most income bands and demographic groups already have participation rates in excess of the national objectives, it was de facto workless and low income households that were activated in the models, so that the objectives also in principle lead to reduced income poverty and worklessness, potentially increasing wellbeing and social inclusion in the population. Given that women also are less likely to be in work than men in couple households with children, there is potential too for increased gender equality in paid work in this group in particular. The social and economic benefits of increased participation rates – reduced worklessness and income poverty, lower child poverty, lower social exclusion, greater gender equality, reduced welfare state expenditure and a higher skilled, more competitive labour market – if they could be achieved, could arguably make the comparatively small greenhouse gas increases a worthwhile price, particularly if working time reduction among the already in work compensated for this. However, these results are provisional on the newly activated having employment of a similar quality to equivalent already-working households, as opposed instead to obtaining only marginal and low paid jobs. The feasibility of achieving this in the UK and the Netherlands is questionable given that those still not in paid work are often the least skilled, those with disabilities or long term sickness, and the long term unemployed, facing either strong barriers to entering the labour market or only poor prospects for the types of work obtained. There is a real risk that people will simply be moved into marginal low paid jobs, doing little to alleviate material/income poverty, although this would also increase greenhouse gas emissions by less than modelled here.

Next, chapter 7 took up the theme of working time *reduction*, looking at the hypothesis that reductions in average paid working time will substantially reduce national greenhouse gas emissions. The chapter looked at the potential for reducing emissions, and hence contributing to greenhouse gas emissions goals, of substantial working time reduction, using a combination of collective reduction in the average weekly working hours of full time workers of 20%, combined with increased use of career breaks: over the working life, a total of one year of extra career break, modelled as four lots of three months; plus two extra three month career breaks for childcare and in pre-retirement taken by the majority of the relevant demographic groups (those with children, and older working age households). Around three quarters of households have at least one member reducing hours or taking a career break in the scenarios, leading to mean income reductions of 12.5-15.9%, mostly occurring from reduced weekly working hours. These reductions were estimated to reduce emissions from working age households by 5.1% in the UK and 8.0% in the Netherlands, equivalent to a reduction of 3.1% and 4.5% respectively of national emissions from all sources (all household, state and investment expenditure). The majority of these reductions arise from the reductions in weekly working hours for full time workers, and come from couple households, particularly those with children and those of older working age. The reductions arising due to the career breaks are comparatively small. Looking by income band, the lowest income quintile accounts for just 1-8% of these emissions reductions, whilst the highest accounts for between 25 and 47% of them. At the same time, as women tend to be working shorter hours than men in the population, particularly when they have dependent children, then it is the men in the scenarios who reduce their weekly working hours most, leading to convergence between the genders in paid working time, and a pattern closer to a dual-earner, part time society.

The results summarised above answer the first research question of the thesis, demonstrating that working time does indeed affect household greenhouse gas emissions. Furthermore, changes in working time, both increases in the form of increased participation rates, and decreases in the form of reductions in mean weekly paid working hours and increased use of career breaks, are estimated to lead to

substantial changes in greenhouse gas emissions, not just for the households concerned, but for the UK and the Netherlands as a whole.

8.4 Implications for working time policy

The policy relevance of these results is that they indicate that environmental goals, at least relating to greenhouse gas emissions, warrant consideration in the design of working time policy, as the impacts of changes in working patterns are large enough to have an effect on the meeting of emissions reduction goals. Including consideration of them will likely lead to better policy design. The next two sections therefore discuss the implications of the results in this thesis for working time policy, which was the second of the research questions. Given the centrality of the arguments regarding the potential environmental and wellbeing benefits of working time *reduction*, the implications of the results in chapter 7 for different working time reduction scenarios are the main focus, and the discussion below elaborates on that in chapter 7. Section 8.4.1 below first looks at the potential to reconcile diverse environmental, social and economic goals through the use of working time policy. Section 8.4.2 then goes on to discuss the design of policy instruments to support and incentivise working time reduction, drawing on the thesis results and the modified life course perspective.

8.4.1 Goal compatibility and tensions

The results also show that the reconciliation of diverse environmental, social and economic goals requires careful consideration. On the one hand, increasing participation rates may lead to increased greenhouse gas emissions, an undesirable outcome looked at in isolation. However, if those moved into work were those currently further from the labour market, the low income and other social risk groups, and they were able to obtain good jobs in terms of their wage rates and prospects, then worklessness and income poverty should fall, with arguably corresponding reductions in social exclusion and the negative wellbeing impacts of not having paid work. These could be seen as benefits that outweigh the environmental costs, if they could be achieved. As discussed in chapter 6, achieving

these goals would require strong support for active labour market policies and skills upgrading, particularly in the UK where these factors are weaker than in the Netherlands. Without this there is the real risk that the currently out of work, many of whom face multiple barriers to work, simply swell the numbers in in-work poverty (Gregg et al. 2006:52–57), adding to the group who find themselves lacking both sufficient time and income to stay out of poverty and meet basic needs (Burchardt 2008). Moving these groups into paid work is not out of keeping with the principle of reducing average paid working time in the population as a whole: the idea is that everybody works and earns his or her income where there are not good reasons not to, but that everyone in paid work spends, on average, a reducing amount of time doing their jobs, i.e. high participation rates but lower working hours and more career breaks.

Indeed, the environmental costs of increased labour market participation rates would be more than compensated for if substantial working time reduction, along the lines of that looked at in chapter 7, were achieved for the population as a whole. The scenarios modelled in chapter 7 led to substantial emissions reductions, well in excess of the increases due to increasing participation rates, as summarised in the previous section above. However, even considering that the results represent a low estimate of the likely effect on emissions of specific working time reductions (as they omit potential future reductions in emissions from households, and reductions in public sector emissions, as discussed in chapter 7, section 7.4.1) they indicate that working time reduction is likely to only be able to contribute a small proportion of the total emissions reductions apparently needed to avert dangerous levels of climate change, in keeping with the arguments in the literature presented in section 2.1.2. This implies that substantial changes in production methods (notably a decarbonisation of energy generation and manufacturing) and in consumption patterns are almost certainly necessary too. It is important to note too that such decarbonising of production methods would mean that product emissions intensities would fall, so that the tonnes of emissions averted by reducing working time would also fall: as production gets greener, reductions in consumption bring smaller environmental benefits. Nevertheless, the production of goods and services, and

hence private consumption, will undoubtedly continue to result in greenhouse gas emissions for some decades to come, and also have multiple other impacts on the environment, so the environmental benefits of working time reduction will continue to be substantial and worth considering.

In addition, there are non-material social and wellbeing benefits to consider too. Social goals appear to be well met by the working time reduction scenarios. Data suggests that there is a substantial unmet preference to reduce working hours (see chapter 2, section 2.1.3.1). As discussed in the same section, such survey data may underreport actual preferences for reduced hours, whilst individual working time preferences may be higher than is optimal for wellbeing due to a range of wider societal pressures such as to work longer hours. The happiness literature suggests that widespread reduction of full time work could lead to great wellbeing benefits through more time with ones family, for community and volunteering, for personal and spiritual development, and so on (Speth et al. 2007), assuming material needs are still securely met. At the same time, increased use of career breaks and reduced working hours would help take some of the pressure off the “rush hour of life” between the ages of around 30 to 50, when people are juggling childcare with career progression and mounting financial responsibilities, by providing increased flexibility to do this.

The working time reduction scenarios all also lead to increased gender equality in paid working hours. This increasing gender equality is mostly through a levelling of mean weekly working hours between men and women in work. The career breaks modelled for households with younger children and older workers also increase gender equality as men, more likely to be in work during these periods than women, are more likely to take a break under the assumptions of the model. This effect could be further enhanced if policy deliberately targeted men more than women to take these career breaks, rather than being “gender-blind”. The other effect of this levelling in paid working hours is greater gender equality in hours outside of paid work. This is at least a helpful precondition for an increase in gender equality in care work too: whilst existing “father-friendly” working time reduction policy does not

unambiguously increase paternal time spent with children (Smith Koslowski 2008:184–5), it should at least help those fathers who wish to spend more time with their children to do so. Turning to the later stages of the working life, such policies should also help address gender inequalities in early retirement rates.

There is increasing income equality in the scenarios too, as income drops more among higher income groups, which are more likely to be working long hours in the baseline situation, and so reduce their hours under the scenarios, and also have a higher wage rate, so reduce income more per hour's working time reduction. Arguably this could result in greater time inequality between households, with higher income bands having more time outside paid work, whilst the lowest income bands are less likely to be in paid work (see chapter 6, section 6.3.1) and so instead have free time in the form of involuntary unemployment which can be damaging to happiness (Glyptis 1989:71–91). The issue at low income bands is rather the unequal distribution of labour, with some working full time (in sometimes marginal jobs) and others being unemployed. Working time reduction, with concurrent income reductions, could potentially allow redistribution of this work, as was one of the original aims of both the Dutch Wassenaar Agreement and the Belgian Time Credit Scheme (discussed in chapter 7, section 7.1). However, even for those working full time, some find themselves in a situation of being unable to reduce working time without facing income poverty, or are already in income poverty as well as having insufficient time outside of paid work, with women and young adults, single households and those with, particularly younger, children, and/or low education, being most at risk of being in this latter situation (Burchardt 2008:88–89). The policy implications of this are discussed more in the next section.

It is relevant from the environmental perspective that emissions reductions arising from the lowest income band are not a major share of total reductions in any of the scenarios: it is likely that such households would not in reality be able to make use of opportunities to reduce hours and take career breaks due to income restrictions, at least not without some kind of financial support, so that the emissions savings from this group may well not occur under current tax-benefit regimes. The contribution of

households in the bottom income quintile is only 1-8% of saved greenhouse gas emissions in the scenarios in chapter 7 (depending on country and scenario), so total emissions savings would not be substantially affected if they were not able to reduce working time as modelled.

The macro, economic, results of these scenarios are potentially more problematic. At the national level, there are major drops in domestic production (in terms of work hours), gross income, and expenditure, as chapter 7, section 7.3.2 presented. This would reduce government income tax revenues, either meaning cuts in public services or increased taxes elsewhere in the economy or, although this is less viable in the current global economic climate, and ultimately unsustainable, increased borrowing. There are also implications for the national trade balance and competitiveness. Possible ways to address these tensions are discussed in the next section, which looks at the specific policy instruments which could deliver the outcomes modelled.

A final issue is that with falling total work done in the countries, GDPs are likely to fall too, as total production drops. This is likely to be only partly offset, if at all, by increased hourly productivity rates that have been observed to occur when people work less (Schor 1999:154–157). The increases in participation rates modelled in the scenarios in chapter 6 would also offset this effect to some degree. Whilst Neoclassical economics would tend to interpret such GDP reductions as inherently negative, the ecological economics literature takes a more critical perspective on GDP, as already highlighted in chapter 2 (section 2.1), noting the scale of negative impacts of consumer capitalist economic models on the environment and, in high income countries, on the wellbeing of certain groups. From the ecological economics perspective, reductions in GDP can therefore be an appropriate solution to environmental problems and the disbenefits of consumerist lifestyles, at least until the scale of the global economy is within what is considered sustainable, given current technology.

8.4.2 Implications for policy instruments

The scenarios modelled in chapter 7 are, on the one hand, designed to look at the potential role that working time reduction could play in reducing national greenhouse gas emissions in the UK and the Netherlands. At the same time however, they are designed to be realistic goals for which there are precedents for policy instruments which have been implemented in practice in different EU nations, which could potentially be applied in both countries to realise these outcomes. Whilst instruments exist, are the *goals* for working time reduction as modelled in chapter 7 realistic? Certainly under current conditions they appear to be what the UK's Committee on Climate Change classifies as a "stretch ambition": that is, a scenario "for which at the moment no policy commitment is in place, including more radical new technology deployment and more significant lifestyle adjustments" (Committee on Climate Change 2008:117). However, the recent financial crisis and recession shows how external shocks to the economic system can suddenly change the situation and allow such changes. The number of full-time workers dropped by over 1 million in the UK since the start of the recession up to August 2010, whilst part time jobs increased by 330,000, marking a rapid shift to a truly mixed hours labour market, with "as many people in the UK working between 16 and 30 hours per week as were working 45 hours or more per week" in spring 2010, moving the UK down the EU rankings of working time to be the country with the fifth shortest hours (Inman 2010). This is without the intervention of national policy, which could in principle have further encouraged this trend and avoided some of the increase in unemployment of 580,000 people that also occurred (*ibid.*). Working time reduction can therefore happen spontaneously (at least in a relatively "free" labour market such as the UK's) when external conditions force reductions in the total work in an economy.

Leaving aside such external shocks, how could policy instruments achieve such working time reduction? Policy can help ensure that working time changes occur in a way that is controlled and benefits the wellbeing of different demographic groups as well as the environment. To analyse this, this section draws on the modified life course perspective developed in chapter 2 (section 2.3), which combines the insights of the ecological economics and social policy literatures on this subject. Policy

instruments in this perspective need to provide not just the opportunities to reduce working hours, in terms of rights to alter ones working time via shorter weekly hours and career breaks, but also need to make sure these rights are functional freedoms, such that people are protected from career impacts from making use of these rights, and have the support to manage financially. On top of this, given the misalignment between the socially and environmentally optimal level of work and actual working patterns, diverse policy instruments need to incentivise working time reduction, via financial incentives and efforts to influence cultural, and individual, values, norms, habits and behaviours surrounding paid work, consumption and non-material routes to wellbeing. These need finally to be tailored to different demographic groups and different industrial sectors, and be backed up by instruments to address the perspective of employers and to garner their acceptance.

In terms of *opportunities* provided by policy, the right to reduce working hours is already present in the Netherlands for nearly all employees, as discussed in chapter 7, section 7.1. In the UK, similar rights are reserved only for parents of children aged under 16 (or 18 if the child has a disability), so they would need extension to the rest of the working population. With regards to career break rights, those modelled in chapter 7 draw on the Belgian Time Credit Scheme and surrounding rights for child, medical and palliative care leaves. However, all the rights required to be able to take such career breaks already exist in principle in the Netherlands, in the form of the Life Course Savings Scheme, which offers the opportunity to take career breaks even far in excess of what is modelled in chapter 7. The rights in the Life Course Scheme are rather weak however, and would be improved by making it possible for employers to refuse a request for a career break only under exceptional circumstances, when they could make the case that it would seriously impact on their business, as in the Belgian scheme. In the UK, no similar policy exists, and so a substantial extension of rights would be required, and something along the lines of the Dutch or Belgian policies would suffice.

Financial facilities, available to those that need and want to use them, may also be needed to help people to save and borrow for a period of shorter working hours or

career break. The Dutch Life Course Savings Scheme is not ideal in this respect: as discussed in chapter 7, section 7.1, the requirement to save before a career break within the restricted terms of the scheme acts to inhibit its use, not facilitate it, whilst the absence of a borrowing facility makes its use for parental leave very difficult due to the “sequential error”: the (desired) career break comes before the period of a person’s career when they could more realistically afford to save enough for it (Plantenga 2005a:59–61). The Dutch scheme would require changes in these areas to be made more functional. The UK meanwhile generally lacks policy in this area (although, the Student Loan Scheme could be argued to be along the same lines, providing a loan to be paid back later for a particular group at the beginning of their career, for the particular purpose of University study).

Time rights and standards can also be set collectively as well as individually, such as the working time and wage moderation collectively negotiated in the Netherlands in the Wassenaar Agreement in 1982, or the French 35 hours maximum working week law. The details of collective instruments are, as with individualised ones, also important: as mentioned in chapter 2 (section 2.2.2.2), the French 35 hours week rules can lead to negative wellbeing effects where employers require irregular or unsociable working times of their employees (Fagnani and Letablier 2004). Employee control of their paid working *patterns* as well as their total working time is important too.

There are hence collective and individualised, voluntary and mandatory, policy instruments that have been used in practice to achieve working time reduction.

In some respects, the choice of patterns of reduction in weekly working hours modelled in chapter 7 (Scenario 1, a 20% reduction in weekly hours for all workers working over 35 hours per week) is not the easiest for which to envisage appropriate policy instruments. It has some of the characteristics of both an individualised change (in that the number of hours per week reduction varies by employee), and a collective one (in that all full time workers change their hours). A maximum working week of 35, or even fewer, hours, would have translated more easily into

policy instruments, i.e. collectively mandated change similar to the French scheme. However, as this would also mean pro-rata reductions in gross income, it is hard to see such a mandated working time reduction being acceptable to the public as a whole. Indeed, the modified life course perspective favours the individualised approach, so that individuals are free to choose their working patterns over the life course and their choices are merely influenced, not determined for them.

The modified life course perspective suggests that such incentives are needed to encourage generalised working time reduction as modelled in chapter 7.⁷⁵ In terms of financial incentives, these could include both benefits paid for shorter hours of work and during career breaks (LaJeunesse 2009:235–242; Koopmans and Plantenga 2008), as well as a higher rate of income tax applied to longer hours of work (Hayden 1999:108). These would alter the relative costs and benefits of different work life balance patterns for households, to incentivise lower levels of paid work and income, and with careful design could even end up fiscally neutral for government (LaJeunesse 2009:235–242). The level of benefits paid can also be tailored to the purpose to which the extra time outside of paid work is put: the social policy literature suggests higher benefits for non-paid activities which are considered socially beneficial or acceptable (such as skills training or care work), or which are due to risks outside the individual’s control (such as redundancy or incapacity) (Koopmans and Plantenga 2008:5; Schippers 2004:197). Activities with environmental benefits (such as volunteering on conservation projects) or which the evidence shows contribute to increasing wellbeing through non-consumption routes (such as mindfulness training, creative activities in which “flow” can be experienced, and community activities) could also receive greater support to encourage behaviour change. This tailoring of support and incentives exists in both the UK and the Netherlands, but only in a few specific areas (notably for maternity leave and for redundancy and incapacity), so would need substantial further development.

⁷⁵ Although there appears to be unmet demand for working time reduction, incentives would still be needed to overcome barriers to realising this demand, and to encourage even further reductions in working time in line with individual optima for wellbeing, and social and environmental optima. See chapter 2, section 2.1.3, for a discussion on this.

The modified life course perspective also discusses the need to target rights and incentives to different demographic groups, recognising that they have different preferences, needs, capabilities and opportunities to alter their working patterns. The working time reduction scenarios in chapter 7 would likely need such policy targeting to achieve. Certain demographic groups in particular may need financial support to be able to reduce working time. Low income households particularly may not be able to take up the opportunities open to them, even in cases where the household members are in (full time) paid work, as low income limits their capabilities to reduce hours and income further (Burchardt 2008). In addition, households with children, both singles and couples, may be facing the “combination pressure” (Plantenga 2005a:54) of simultaneous high demands on their time and income, and hence be similarly constrained. LaJeunesse (2009:235–242) suggests ensuring those households on less than median income (equivalised per capita) can reduce their working hours without income loss, via receiving compensatory benefits. The self-employed meanwhile face particular barriers to taking career breaks and reducing hours, as they are their own employers, and their livelihoods depend directly on maintaining the business which they own. Chapter 7 assumed no difference in the behaviour of the self-employed compared to other employees in the scenarios, but it is likely that they would also need specific policy instruments and support to enable them to make use of such rights, including similar financial benefits, at least in cases where they have no or very few employees. Whilst such financial transfers to incentivise and facilitate working time reduction would affect the greenhouse gas results modelled, as the eligible households would see their incomes reduce less than they would otherwise, hence they would probably spend more and so have higher emissions than otherwise, this would be countered by reductions elsewhere in the economy of a similar scale.

It is not just financial transfers and restructuring of the tax system that could incentivise working time reduction, and the modified life course perspective includes a host of other, broader, determinants of behaviour that could be considered. Perceived (and actual) threats to future career progression and job security from reducing working time inhibit use of many existing schemes (Groot and Breedveld

2004:294). Where these barriers rest with employer attitudes, measures can be taken to adjust incentives for them. Anti-discrimination laws could help with this, such as requirements for the equal treatment of part and full time workers in the Netherlands. Incentives for employers are also likely needed to reduce the costs they face from, and hence their resistance to, working time reduction. In skilled jobs particularly, working time reduction, and filling the vacancies that arise as a result, would be harder and more costly for employers (Coote et al. 2010:29), as a result of which some employers feel that working time reduction is incompatible with senior jobs, for example in management (European Commission et al. 2005). There would be an extra cost of working time reduction to employers, which suggests either such rights would need to be negotiated at the sector level and be more restricted in some areas where they would lead to insufficient skilled labour supply, or that other approaches would be needed to address this, such as increasing funding for skills training in particular careers, or encouraging immigration of people with particular skills sets. This is not purely a cost however: employing two skilled part time workers instead of one full time worker reduces risks to businesses too, as they become less vulnerable to impacts from staff falling ill, retiring, leaving to a new job, or taking a career break. Restructuring taxes and benefits on employers could help with costs, to make it better to employ more people for shorter hours than to employ fewer people for longer hours.

Social norms around gender roles can also have a large effect on the use of paternity and maternity leave. Whilst high takeup rates for paternal leave would negate the possibility of discrimination by employers, and normalise more gender equal work and care patterns, achieving the transition from low to high takeup can be effected by policy design, as has been seen in Scandinavian countries, in which a share of parental leave is lost if it is not taken by the father (Smith and Williams 2007:189). How transferable these policies would be to other countries is debateable however: to what extent do they merely lend support to, and rely on for their success, existing cultural values for greater gender equality? The UK for example has relatively high levels of paternal time in EU comparison despite the absence of supportive policy (Smith and Williams 2007:188).

Policy can also attempt to influence values and attitudes towards work-and-spend consumerist lifestyles themselves. Policy could promote the, seemingly genuine, wellbeing benefits of working and consuming less, using diverse channels of communication to raise awareness of the value of particular non-paid activities in supporting wellbeing, and the comparatively limited wellbeing benefits of high levels of paid work and consumption. There is also scope to greatly increase the ease of access to such activities, by providing courses in mindfulness training, for example, greater access to creative, voluntary and community activities, and so on. There could even be moves to restrict marketing which actively promotes material consumption as a route to increased happiness. Unfortunately, based on the empirical research in this thesis, little can be said about how to design such policies so that they are effective, but it seems that achieving effective policy intervention in such areas of value and attitudinal change is likely to be just as hard as it could be important. They represent policy areas which, again, are largely unexplored in practice in the UK and the Netherlands.

8.5 Modelling assumptions and the wider policy context

Many of the modelling assumptions included in this research could be addressed by specific policy instruments to ensure they occurred as modelled. One key assumption in the research is that wage rates are unaffected by working time change. Currently there is a clear relationship between working hours and wage rates, with higher wage rate jobs frequently being only full time. However, if substantial working time reduction were achieved in the population, such effects would be minimised, because there would be no relative disadvantage to a particular employee from reducing their working time as there is now (in that it shows less commitment to the employer and impacts on promotion prospects, for example).

Other key assumptions relate to the macroeconomic context. The research considered the effects of changes in working patterns on emissions driven by private household consumption in the immediate term. Excluded were public sector emissions and delayed effects on private consumption due to changes in savings

rates, and impacts on future wage rates and working pattern choices. The key point for the research results is that, under the modelling assumptions, public sector revenue, savings rates and, potentially, future wage rates are likely to fall from what they would otherwise be, hence further expenditure and emissions reductions would arise in other parts of the economy and in future due to working time reduction in the present. The greenhouse gas emissions reductions calculated in this thesis are likely to be underestimates rather than overestimates therefore. Again, some of these factors can be controlled by policy. It could be considered undesirable that savings rates fall (especially where these relate to private pensions savings) or that tax revenue fell (as this affects public sector fiscal sustainability). However, policy instruments can be used to encourage higher savings rates, most crudely (but also perhaps not very effectively; Harris et al. 2002:221) by raising interest rates, whilst tax and benefits restructuring can help maintain the fiscal balance of the state and the absolute size of state expenditure even as private household expenditure fell. The complexity of such dynamic interactions between private households and the state, as well as effects on the macro-economy and the global economic system including prices changes due to falling demand, and changes in international competitiveness and the balance of trade, were all factors that had to be excluded from this modelling for parsimony, which is why the scenarios modelled do not involve such substantial working time reduction as some authors suggest (e.g. Coote et al. 2010). These issues highlight the complexities of modelling large scale changes in a complex interacting system such as the economy. They also demonstrate the wide range of policy implications that need to be considered when acting to change working patterns: the life course perspective needs to include a wide range of surrounding policy areas aside from those directly involved in altering working patterns.

Aside from these assumptions, other policy considerations are needed. Employers will have genuine impacts on their businesses, with some increased costs and also potentially increased benefits, but government may need to intervene to reduce the costs to encourage employer support, and ultimately then the feasibility of effecting substantial working time reduction. Phasing in such reductions gradually to mitigate costs has been suggested as an option, but the effectiveness of this strategy is

untested. The cultural attitudes of employers to working time reduction and flexibility also need consideration.

Finally, the politics of working time reduction also demands more attention than could be given in this thesis. For government, there are issues regarding the benefits of encouraging working time reduction. A significant share of greenhouse gas emissions reductions that result will occur in other countries, the producers of the goods and services that consumers buy, and thus not contribute to the meeting of domestic emissions goals. This increases the effective cost of such a method of abating domestic emissions. Then there are wider issues arising from the impacts on GDP growth, on government fiscal sustainability, on balance of trade, on international influence: these more fundamentally relate to how the economy can transition from an unsustainable growth-oriented path to one in which material throughput is at a sustainable level, particularly if it is one nation state making this transition in a sea of growth-oriented states. These issues were outside the scope of this work to consider.

8.6 Comparison and generalisability of results

The results demonstrated a substantial level of similarity between the UK and the Netherlands. This is perhaps unsurprising given the similarity of the countries in a number of key respects, such as income levels and participation rates, economic systems and demographic distributions, and household living patterns focused on single or couple occupancy and nuclear families. In both countries, a high level of household emissions can be predicted using just a small set of variables, including income and working hours, although the relationship between them needed first to be established using household expenditure survey data and product emissions intensity data to determine the detailed consumption patterns and resultant emissions of representative samples of the population. For a given level of change in working patterns, the scale of emissions changes that result is similar in both countries. Differences in the outcomes of the scenarios nevertheless arise from multiple factors. There are differences in the starting points of the two countries in terms of labour market participation rates and typical working hours, and different policy objectives

for increasing participation rates. This means that the modelled increases in participation rates in chapter 6, and the decreases in working hours and increasing use of career breaks in chapter 7, represent different levels of change from the baseline situations, and hence different total changes in emissions. In addition, differing underlying datasets and correlations between the independent and dependent variables in the household models between the two countries also affect the size of changes predicted to occur in the scenarios. Nonetheless, and considering that the results are inevitably only estimates of the changes likely to occur, they show a high level of similarity and lead broadly to the same conclusions regarding the potential role of working time reduction as a tool for reducing emissions. The study of two countries with similar socioeconomic situations has helped confirm the robustness of the research results, whilst their substantially differing policy support for working time flexibility and reduction has allowed the policy implications of these results to be considered for different contexts. It has also given an indication of the generalisability of the research here: it seems reasonable to expect that for other high income nations with employment focused welfare systems, changes in emissions of similar magnitude and direction could be expected from working time changes of a similar size. What is likely to differ more substantially would be the levels of change in working patterns different countries are aiming to, or would aim to, achieve, a result of both different starting points and different labour market objectives. Additionally, substantial differences in existing working time policies between countries mean policy recommendations would need to be tailored to their particular situations. Results and policy advice here are more likely to adapt easily to a similar northern European country (such as Germany) or welfare state model (Esping-Andersen 1990) than to, for example, a southern European welfare state (such as Spain or Italy) where there are substantially different levels and patterns of labour market participation and current policy objectives and instruments.

8.7 Possibilities for future research

There are many possible scenarios of change in the working patterns of the populations that could have been considered in this research. Whilst the participation rate increases modelled in chapter 6 were based on existing UK and Dutch policy

objectives, for the reductions in working time modelled in chapter 7 there were no such objectives, and the choice of scenarios was much more open. Various other scenarios of change could have been modelled instead in this research, including a mandated maximum working week of 35 hours similar to that in France, and, given the relatively small emissions reductions arising from the career breaks modelled, much longer career breaks totalling several years of the working life, and perhaps including a reduced retirement age. Future research could therefore include the modelling of such alternative scenarios.

Repeating this research using data for more countries would be another avenue of future research. Data limitations to some extent restrict the possibility of replicating this research design in most other countries, as the required product emissions intensity data are not available for many. This situation is likely to improve with time however as research in this area progresses.

However, given this thesis has established the validity of the arguments surrounding the environmental effects of changes in working patterns, and the scale of changes that could be expected for a given level of change in working time, more relevant and important to policy goals would perhaps be further research into how to achieve greater working time reduction. On the one hand, this would relate to the experienced barriers of employees to reducing working time. One avenue of research here would be to conduct a qualitative study of the experiences of those who have, despite the barriers, “voluntarily simplified” (McDonald et al. 2006) their lives – working, earning and consuming less – to uncover the labour market, social, cultural, attitudinal and other barriers they faced, still face, and overcame, and how their values and attitudes around paid work and consumption differ from others. Another approach would be to study grassroots, community-building projects such as the Transition movement (Hopkins 2008) or the Slow movement (Parkins 2004), which combine explicit consideration of the potential environmental and wellbeing benefits of life outside the work and spend consumer culture. These were all interesting related issues that were included as research questions in the early stages of this PhD research, but which ultimately had to be omitted to maintain a

manageable scope to the thesis: initially, contacting participants in the Dutch Life Course Scheme had been considered for this research, to investigate their use and experience of the scheme, but it was too soon after its introduction for there to be anyone actually using it for career breaks. This could also be an area of future study.

On the other hand, the design of policy instruments to support and incentivise working time reduction would also be of interest to research further. One avenue of research could therefore attempt to establish more rigorously the effects on household consumption and emissions of existing working time reduction policies. The Belgian Time Credit Scheme or French 35 working week could be ideal case studies, as they have been in force for substantial periods of time and have measurable working time effects. Company-level working time reduction and career break schemes could also be ideal test cases as they enable the inclusion of a control group (e.g. employees in another similar firm in the same country who do not have access to such schemes) to compare against. However, it would also be of interest to go beyond studying the working time outcomes of traditional policies that focus on time rights, financial incentives and benefits in kind, as these have already been extensively researched in the social policy literature. Whilst this thesis drew on the modified life course perspective to argue that a wider range of policy instruments are needed to address cultural and employer values and beliefs around work and consumption, and to boost the provision of non-consumption activities that support happiness, it was not possible given the empirical work undertaken to say how these might be effectively designed. Qualitative research on voluntary simplifiers and community projects as suggested above might shed light on how to motivate such behaviour changes.

A final area of possible future research relates to the political and structural barriers to introducing strong and widely used working time reduction policy. What are the attitudes of different policy actors to working time reduction, and the underlying conditions which shape, influence, and could potentially change, these? How and why do these attitudes vary between countries, sectors, and employers?

8.8 Final thoughts

The modified life course approach developed in chapter 2 offers a novel contribution to the study of working time policy in the social policy discipline. It introduces explicit consideration of environmental issues that are increasingly likely to impact on, and be impacted by, social policy in the coming decades (Gough et al. 2008). By considering the happiness literature too, it also introduces the possibility to evaluate and critique existing working time policy goals more generally than is currently the case in the social policy literature: at present, critical assessment of working time policy goals, as opposed to instruments, is largely restricted to the areas of gender equality and child wellbeing. At the same time, the modified life course perspective introduces a more varied understanding of human behaviour, to consider policy instruments to influence working time behaviour that go beyond time rights, financial incentives and services in kind such as childcare, offering the potential to address in new ways the often paltry take-up rates of existing working time reduction opportunities enshrined in parental leave, career break and other work life balance policies. As it stands however, further research is needed to detail how such value and behaviour change can be encouraged effectively. Also, the modified perspective offers no easy answers to the central tension between economic growth goals on the one hand, and environmental sustainability and increased wellbeing on the other.

The scenarios of working time change modelled here contribute to the ecological economics literature by giving an indication of the scale of contribution to sustainability goals that can be expected from working time reduction. Despite the difficulties and assumptions inherent in such modelling, and encountered in this research, the results lend weight to the argument that these environmental effects of working time change are large enough to warrant explicit consideration in working time policy design, but highlight too that it can probably play only a limited role in achieving environmental sustainability. It seems that changes to production methods and patterns of consumption, to make them less environmentally damaging, are inescapably needed too to achieve environmental sustainability.

That said, there seems to be substantial benefit to be had from working time reduction, not just environmental, but also for wellbeing, social equity, gender equality and childcare. The scenarios modelled here represent just the beginning of what might be achievable with time and concerted effort to motivate value and behaviour change around time use and consumption. Integrating environmental considerations, a fuller understanding of the conditions that lead to happiness, and a more nuanced understanding of how to support and incentivise more sustainable work and consumption patterns and values, could be key to achieving an equitable, environmentally sustainable future, and working time policy in this respect seems one appropriate place to start, by giving people more opportunity and support to break the cycle of work and spend. Some countries, including the Netherlands, already have many of the policies in place to achieve substantial working time reduction, albeit in nascent form, lacking as they do any environmental goals or strong and diverse support and incentives for people to make substantial reductions in their working time.

Reducing the role of material consumption, and the commodification of human time and interactions through paid labour, could leave people the time to cultivate the ideas and activities that improve the wellbeing and happiness of themselves and their children, families and communities, increase time for contact with and appreciation of nature, and provide people and society as a whole more time for personal and spiritual development and a more sustainable pursuit of the “Art of Living”.

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Appendices

Appendix 1: Methods of product environmental impact calculation

This appendix provides a brief description of the methods and data used to calculate the environmental impact intensity data used in this research. The specific datasets used were calculated by Vringer et al for the Netherlands and Stockholm Environment Institute-York for the UK, as discussed in chapter 4, section 4.2.3. They provide a measure of the environmental impact per unit of final market price involved in the production of the same categories of goods and services as used in the corresponding household expenditure surveys. For greenhouse gas emissions, the environmental impact considered in this thesis, this is measured in terms of the kg of CO_{2e} per pound or euro of sale price of the product.

The data are calculated by drawing on an approach that dates back to the oil crises of the 1970s. These early studies analysed household energy use (as opposed to environmental impacts), to attempt to provide advice on where best to direct policy to achieve the largest reductions in fuel use (Hertwich 2005b:4680). This started with work by, among others, Hannon, Bullard, Herendeen and Tanaka (for example, Hannon 1974; Bullard and Herendeen 1975; Herendeen and Tanaka 1976). Studies were performed for many developed countries, and were based on economic input-output tables, which give financial data on resource movements between sectors of the economy and imports and exports, to chart the flow (in monetary terms) of resources.

More recent studies generally attempt to measure environmental impacts rather than just energy use, such as the use of specific resources and the emissions of specific pollutants, notably carbon dioxide and other greenhouse gases, reflecting the change in emphasis of the studies towards environmental issues. Three approaches exist. One, input-output analysis, combines the input-output financial data with environmental accounts, which provide measures of the physical flows of materials: this provides a relatively quick analysis based on widely available data, but can only

be disaggregated into about 30-60 different product categories, so is relatively coarse. Second, process analysis uses Life Cycle Assessments to assess the impacts of specific products from cradle to grave: these are more data and research intensive, but can provide accurate results disaggregated by far more product categories (several hundred). A third approach, a “hybrid” analysis, attempts to combine the benefits of the two, using Life Cycle Analysis for what are considered to be the highest impact stages of a product’s production, distribution and disposal, and using the coarser IO analysis for the rest. The approach has been found in practice to be rapid enough to be useable and still provide substantial detail and disaggregation by product category (Vringer and Blok 1995; Vringer et al. 2010:2511–2512). Furthermore, the most advanced methods incorporate “multi-region input-output analysis” (MRIO analysis), which uses environmental and input-output data for several different regions of the planet, so that the different production efficiencies of different regions, and hence the variations in environmental impact intensities of different products depending on where in the world they are produced, are taken into account (Vringer et al. 2010:2510–2511). In a study by Vringer et al. (2010) applying the different methods to the same raw data for the Netherlands, substantial differences in results are found, with the hybrid MRIO approach theoretically being the most accurate.

Studies in this field vary in which of the methods above are used, and in the precise details in which they are applied. Kok, Benders and Moll (2006), Hertwich (2005b) and Wiedmann (2009) provide detailed reviews of different studies and the methods they use. The Dutch dataset used in this thesis from Vringer et al uses a hybrid approach combining MRIO analysis and process analysis, while the UK dataset from the Stockholm Environment Institute-York uses MRIO analysis. Both represent the most robust such data available for the respective countries. More detailed descriptions of the methodologies for the calculation of these data are given in Vringer et al (2010) and Paul et al (2010).

Appendix 2: Descriptive statistics of the dependent variables

Table A2.1 presents the distributions of the dependent variables annual greenhouse gas emissions, total annual expenditure and Household Emissions Intensity for UK and Dutch households in the survey data used in this thesis. See chapter 4, section 4.4, for more description of the variables.

Table A2.1 Distribution of the dependent variables for all households in the UK (2004-5) and the Netherlands (2000)

N: 6,798 (UK); 2,395 (NL). Weighted

	UK			Netherlands		
	Annual greenhouse gas emissions, kg CO _{2e} per annum	Total annual expenditure	Household Emissions Intensity	Annual greenhouse gas emissions, kg CO _{2e} per annum	Total annual expenditure	Household Emissions Intensity
Mean	20,204	£25,854	0.87	29,124	€24,714	1.19
Median	16,890	£20,824	0.84	26,870	€22,180	1.19
Skew (S.E.)	2.71 (0.03)	8.11 (0.03)	1.41 (0.03)	1.05 (0.05)	1.76 (0.05)	0.13 (0.05)
Kurtosis (S.E.)	15.73 (0.06)	182.26 (0.06)	5.37 (0.06)	2.33 (0.10)	8.70 (0.10)	0.47 (0.10)

Source: Author's own calculations. See section 4.2 for details of datasets used.

Appendix 3: Supplementary regression results for single households

The tables below present regression results for working age single households for the UK and the Netherlands for greenhouse gas emissions and expenditure. These results complement those for working age couple households presented in chapter 5, and are used to inform the scenario modelling in chapters 6 and 7.

Table A3.1 Regression estimates for household total annual greenhouse gas emissions, for UK working age single households

Adjusted R² = 0.346

Weighted, n= 1,641

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: 14,220 kg CO _{2e} per annum	Unstandardised beta coefficients		95% confidence intervals	
	Unit: kg CO _{2e} per annum per unit change in predictor variable			
	B	Std. Error		
(Constant)	-1211.37	1825.73	-4789.73	2367.00
Variables regarding head of household:				
Head of household usual weekly hours (inc overtime), for employed or self employed	9.33	26.63	-42.88	61.53
Head of household gross annual income from employment and self-employment, £	0.15	0.05	0.05	0.24
Head of household gross annual private non-earned income from investments, pensions and other, £	0.47	0.06	0.35	0.59
Head of household gross annual income from Social Security benefits, £	0.21	0.10	0.01	0.41
Variables regarding other household members:				
Gross household annual income from sources other than head of household, £	0.21	0.05	0.11	0.31
Number of adults	4201.88	736.76	2757.85	5645.90
Number of children - age under 2	1739.59	874.20	26.19	3453.00
Number of children - age 2 and under 5	1247.20	579.92	110.57	2383.83
Number of children - age 5 and under 18	2726.83	298.26	2142.26	3311.40

Table continues on next page.

Table A3.1 continued.

	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: kg CO_{2e} per annum per unit change in predictor variable</i>			
	B	Std. Error		
Other control variables:				
Male age, years	61.17	20.41	21.18	101.17
Age male left full time education	14.23	28.56	-41.74	70.20
Household class: (Reference value: routine worker)				
Higher Professionals	3106.18	1477.70	209.94	6002.41
Intermediate	2117.92	975.04	206.87	4028.96
Large Employers & Higher Managerial	4925.26	2073.47	861.33	8989.19
Lower Managerial & Professionals	2775.11	868.01	1073.84	4476.39
Lower Supervisory & Technical	1820.13	923.66	9.80	3630.46
Never Worked and Long-Term Unemployed	-1714.26	946.64	-3569.64	141.12
Semi-Routine	-78.17	695.08	-1440.50	1284.16
Small Employers and Own Account Workers	2428.14	1296.76	-113.46	4969.75
Students	2637.03	2137.39	-1552.19	6826.24
Not classifiable for other reasons	-453.13	874.26	-2166.64	1260.38
Occupation not stated	-2186.96	1051.30	-4247.47	-126.46
Government region of residence: (Reference value: London)				
Eastern	990.78	1021.93	-1012.16	2993.72
East Midlands	1242.17	1176.34	-1063.41	3547.74
Northern Ireland	2013.48	882.68	283.46	3743.51
North East	-312.53	899.95	-2076.39	1451.33
North West and Merseyside	698.65	812.40	-893.62	2290.92
Scotland	165.85	874.40	-1547.95	1879.66
South East	-5.07	857.98	-1686.68	1676.53
South West	3217.00	1280.26	707.74	5726.25
Wales	1002.19	974.43	-907.65	2912.03
West Midlands	-687.51	883.00	-2418.15	1043.13
Yorkshire and the Humber	1369.09	981.90	-555.41	3293.58

Table A3.2 Regression estimates for household total annual greenhouse gas emissions, for Dutch working age single households

Adjusted R² = 0.484

Weighted, n= 491

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: 19,077 kg CO _{2e} per annum	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: kg CO_{2e} per annum per unit change in predictor variable</i>			
	B	Std. Error		
(Constant)	-986.18	2116.07	-5133.60	3161.24
Variables regarding head of household:				
Head of household usual weekly hours	96.00	42.41	12.87	179.13
Head of household gross annual income from employment and self-employment, €	0.35	0.05	0.25	0.46
Variables regarding other household members:				
Gross household annual income from sources other than head of household's earned income, €	0.32	0.05	0.21	0.42
Number of adults	4665.72	1310.30	2097.57	7233.87
Number of children - age under 2	5324.68	1726.62	1940.55	8708.80
Number of children - aged 2 and under 5	2509.11	1074.10	403.90	4614.31
Number of children - aged 5 and under 18	4003.01	575.57	2874.91	5131.11
Other control variables:				
Male age, years	77.32	32.87	12.90	141.74
Male education level:				
(Reference value: no educational qualifications)				
Highest educational attainment: level 3	1319.45	1142.19	-919.19	3558.09
Highest educational attainment: level 4	2156.84	1064.27	70.90	4242.78
Highest educational attainment: level 5	4538.92	1312.60	1966.27	7111.57
Highest educational attainment: level 6	1936.35	1872.60	-1733.87	5606.58
Highest educational attainment: unknown	2376.07	3812.06	-5095.43	9847.57
Household class:				
(Reference value: unemployed)				
Elementary	-2630.62	1874.69	-6304.93	1043.70
Lower	-1224.03	1580.72	-4322.17	1874.12
Middle	-2738.42	1501.89	-5682.07	205.22
Higher	-1213.34	1697.81	-4540.99	2114.30
Academic	-2291.36	2297.01	-6793.42	2210.70
Unknown	(omitted – no cases)			

Table A3.3 Regression estimates for total annual household expenditure, for UK working age single households

Adjusted R² = 0.218

Weighted, n= 1,641

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: £19,924 per annum	Unstandardised beta coefficients <i>Unit: £ per annum per unit change in predictor variable</i>		95% confidence intervals	
	B	Std. Error		
(Constant)	6257.72	3002.62	372.70	12142.74
Variables regarding head of household:				
Head of household usual weekly hours (inc overtime), for employed or self employed	23.16	40.41	-56.04	102.36
Head of household gross annual income from employment and self-employment, £	0.31	0.08	0.16	0.46
Head of household gross annual private non-earned income from investments, pensions and other, £	0.53	0.06	0.40	0.66
Head of household gross annual income from Social Security benefits, £	0.16	0.12	-0.09	0.40
Variables regarding other household members:				
Gross household annual income from sources other than head of household, £	0.34	0.07	0.20	0.49
Number of adults	4234.47	1090.43	2097.27	6371.67
Number of children - age under 2	816.64	1196.68	-1528.80	3162.09
Number of children - age 2 and under 5	1275.04	950.96	-588.81	3138.90
Number of children - age 5 and under 18	2535.46	446.97	1659.40	3411.51
Other control variables:				
Male age, years	-50.55	44.94	-138.63	37.52
Age male left full time education	-5.60	59.68	-122.57	111.36
Household class: (Reference value: routine worker)				
Higher Professionals	5688.23	2423.43	938.39	10438.07
Intermediate	2406.14	1396.92	-331.77	5144.06
Large Employers & Higher Managerial	16605.12	10722.79	-4411.16	37621.41
Lower Managerial & Professionals	3131.33	1499.23	192.90	6069.76
Lower Supervisory & Technical	116.43	1471.90	-2768.45	3001.30
Never Worked and Long-Term Unemployed	-834.22	1282.71	-3348.30	1679.85
Semi-Routine	-637.21	1104.39	-2801.77	1527.35
Small Employers and Own Account Workers	3667.03	2028.89	-309.52	7643.59
Students	13272.73	6036.13	1442.13	25103.33
Not classifiable for other reasons	625.04	1259.26	-1843.07	3093.14
Occupation not stated	-833.21	1445.90	-3667.11	2000.70

Table continues on next page.

Table A3.3 continued.

	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: £ per annum per unit change in predictor variable</i>			
	B	Std. Error		
Other control variables <i>continued</i>:				
<i>Government region of residence:</i> (Reference value: London)				
Eastern	1058.53	1504.95	-1891.12	4008.19
East Midlands	-1087.70	1607.47	-4238.29	2062.89
Northern Ireland	-1991.61	1266.84	-4474.56	491.34
North East	-1784.11	1294.86	-4321.99	753.76
North West and Merseyside	-1359.10	1219.99	-3750.24	1032.04
Scotland	-2080.88	1614.75	-5245.73	1083.96
South East	-469.35	1283.43	-2984.82	2046.13
South West	2335.94	1716.98	-1029.29	5701.16
Wales	-1545.93	1491.74	-4469.68	1377.82
West Midlands	-2167.28	1361.53	-4835.82	501.27
Yorkshire and the Humber	4526.39	4322.42	-3945.40	12998.17

Table A3.4 Regression estimates for total annual household expenditure, for Dutch working age single households

Adjusted R² = 0.483

Weighted, n= 491

Bold figures are statistically significant, at the 5% level

Mean value of dependent variable: €16,695 per annum	Unstandardised beta coefficients		95% confidence intervals	
	<i>Unit: € per annum per unit change in predictor variable</i>			
	B	Std. Error		
(Constant)	1520.20	1906.28	-2216.04	5256.43
Variables regarding head of household:				
Head of household usual weekly hours	12.35	25.12	-36.90	61.59
Head of household gross annual income from employment and self-employment, €	0.34	0.05	0.25	0.44
Variables regarding other household members:				
Gross household annual income from sources other than head of household's earned income, €	0.31	0.05	0.21	0.40
Number of adults	2839.63	1172.06	542.44	5136.83
Number of children - age under 2	3439.15	1786.02	-61.38	6939.67
Number of children - aged 2 and under 5	1958.46	961.45	74.05	3842.87
Number of children - aged 5 and under 18	2748.88	487.58	1793.25	3704.51
Other control variables:				
Male age, years	55.34	25.84	4.70	105.98
Male education level:				
(Reference value: no educational qualifications)				
Highest educational attainment: level 3	-64.42	1119.03	-2257.67	2128.84
Highest educational attainment: level 4	1036.80	1108.72	-1136.24	3209.84
Highest educational attainment: level 5	3688.76	1289.60	1161.19	6216.34
Highest educational attainment: level 6	2265.00	1525.98	-725.87	5255.86
Highest educational attainment: unknown	2238.43	2790.94	-3231.71	7708.57

NB. Class variables are omitted from the model as they are found to reduce model fit and beta coefficients are not statistically significant (at the 5% level)

Appendix 4: Data on mean household emissions and expenditure changes due to activation

Table A4.1 to Table A4.4 below present the data underlying the graphs presented in chapter 6, Figure 6.6 and Figure 6.7. They show the estimated mean effects on household greenhouse gas emissions and household expenditure of activating a non-working household member. They represent the best estimate of mean change in household emissions and expenditure when a household in the originator demographic group (column 1) has a household member activated (so moving to the destination demographic group indicated in column 2). Columns 3 and 4 present the mean emissions/expenditure of households in the originator and destination groups respectively. The final estimate of emissions/expenditure for an activated household is presented in column 7. This is the mean emissions/expenditure of the destination group plus a correction factor determined by the statistically significant differences between the groups in key sociodemographic characteristics, as described in the research design. Column 7 equals column 4 corrected for these composition differences between the originator and destination groups. The size of correction applied is based on the differences between the mean values for the sociodemographic variable in question, multiplied by the beta coefficient linking that variable to greenhouse gas emissions/expenditure, as calculated and presented in chapter 5. For instance, there are statistically significant differences between older single males not working and older single males working in mean numbers of adults living in the household and mean age of the male. The differences in these means are multiplied by their corresponding beta coefficients to give a correction factor which is then added to the mean emissions in the destination group (column 4) to give the value in column 7. Column 7 thus provides the best estimate, based on the scenario modelling assumptions, of the mean effect of activating a household member and so moving the household from the given originator group to the given destination group.

Table A4.1 Mean greenhouse gas emissions of households, before and after their activation, by demographic group, UK

		Originator demographic group [column 1]	Destination demographic group [column 2]	Mean household emissions of originator group, kg CO _{2e} per annum [column 3]	Mean household emissions of destination group, kg CO _{2e} per annum [column 4]	Significant difference in means?	Corrections made for differences in mean values for following characteristics:	Estimated household mean emissions after activation, corrected for composition effects, kg CO _{2e} per annum [column 7]	Mean estimated increase in household emissions due to activation	
									kg CO _{2e} per annum [column 7 minus column 3]	% increase
Older workers	Single	1. Male, not working	2. Male, working	8,814	14,524	**	No. adults*, age**	14,933	6,120	69%
		3. Female, not working	4. Female, working	14,256	17,565	**	Age**, education level**	17,490	3,233	23%
	Couple	5. Male not working, Female not working	6. Male working, Female not working	22,511	29,042	**	Children 5- <18**, age**, education level*	29,358	6,847	30%
		6. Male working, Female not working	8. Both working	29,042	29,951		Age**	29,787	745	3%
		7. Male not working, Female working	8. Both working	28,401	29,951		Children 5- <18*, age**	29,817	1,416	5%
Younger workers	Single	10. Male or female, not working, no children	11. Male or female, working, no children	9,955	14,654	**	Education level**	14,654	4,699	47%
		12. Male or female, not working, with child(ren)	13. Male or female, working, with child(ren)	11,886	19,107	**	No. adults**, children 0- <2**, children 2- <5**, age**, education level**	19,538	7,653	64%
	Couple	14. Male not working, Female not working	15. Male working, Female not working	17,036	26,083	**	Education level**	26,199	9,163	54%
		15. Male working, Female not working	17. Both working	26,083	26,282	**	Children 0- <2**, children 2- <5**, children 5- <18**	25,554	-529	-2%
		16. Male not working, Female working	17. Both working	25,597	26,282		-	26,282	685	3%

*, ** Significant difference at the 5% (*)/1%(**) level (2-tailed Wilcoxon Mann-Whitney test)

Source: Author's own calculations. See section 4.2 for details of datasets used.

Table A4.2 Mean expenditure of households, before and after their activation, by demographic group, UK

		Originator demographic group [column 1]	Destination demographic group [column 2]	Mean household expenditure of originator group, £ per annum [column 3]	Mean household expenditure of destination group, £ per annum [column 4]	Significant difference in means?	Corrections made for differences in mean values for following characteristics:	Estimated household mean expenditure after activation, corrected for composition effects, £ per annum [column 7]	Mean estimated increase in household expenditure due to activation	
								£ per annum [column 7 minus column 3]	% increase	
Older workers	Single	1. Male, not working	2. Male, working	10,638	18,768	**	No. adults*, age**	19,288	8,651	81%
		3. Female, not working	4. Female, working	15,861	21,438	**	Age**, education level**	21,438	5,577	35%
	Couple	5. Male not working, Female not working	6. Male working, Female not working	25,998	34,494	**	Children 5- <18**, age**, education level*	35,338	9,340	36%
		6. Male working, Female not working	8. Both working	34,494	37,838	**	Age**	37,838	3,344	10%
		7. Male not working, Female working	8. Both working	33,493	37,838	**	Children 5- <18*, age**	38,315	4,822	14%
Younger workers	Single	10. Male or female, not working, no children	11. Male or female, working, no children	15,648	23,288	**	Education level**	23,288	7,640	49%
		12. Male or female, not working, with child(ren)	13. Male or female, working, with child(ren)	14,339	25,361	**	No. adults**, children 0- <2**, children 2- <5**, age**, education level**	25,924	11,584	81%
	Couple	14. Male not working, Female not working	15. Male working, Female not working	19,888	35,596	**	Education level**	35,596	15,708	79%
		15. Male working, Female not working	17. Both working	35,596	37,493	**	Children 0- <2**, children 2- <5**, children 5- <18**	35,887	292	1%
		16. Male not working, Female working	17. Both working	45,061	37,493		-	37,493	-7,567	-17%

*,** Significant difference at the 5% (*)/1%** level (2-tailed Wilcoxon Mann-Whitney test)

Source: Author's own calculations. See section 4.2 for details of datasets used.

Table A4.3 Mean greenhouse gas emissions of households, before and after their activation, by demographic group, the Netherlands

		Originator demographic group [column 1]	Destination demographic group [column 2]	Mean household emissions of originator group, kg CO _{2e} per annum [column 3]	Mean household emissions of destination group, kg CO _{2e} per annum [column 4]	Significant difference in means?	Corrections made for differences in mean values for following characteristics:	Estimated household mean emissions after activation, corrected for composition effects, kg CO _{2e} per annum [column 7]	Mean estimated increase in household emissions due to activation	
									kg CO _{2e} per annum [column 7 minus column 3]	% increase
Older workers	Single	1. Male, not working	2. Male, working	18,341	22,863		No. adults**, age**	23,638	5,296	29%
		3. Female, not working	4. Female, working	15,287	22,434	**	No. adults**, age**	23,312	8,025	52%
	Couple	5. Male not working, Female not working	6. Male working, Female not working	30,135	40,100	**	No. adults*, children 5- <18**, age**, education level**	41,621	11,486	38%
		6. Male working, Female not working	8. Both working	40,100	40,886		Children 5- <18*, age**	40,332	231	1%
		7. Male not working, Female working	8. Both working	37,447	40,886		Children 5- <18**, age**	39,344	1,897	5%
Younger workers	Single	10. Male or female, not working, no children	11. Male or female, working, no children	12,017	19,062	**	Age**, education level**	20,323	8,306	69%
		12. Male or female, not working, with child(ren)	13. Male or female, working, with child(ren)	22,753	26,470		No. adults*, children 0- <2*, age*	26,584	3,831	17%
	Couple	14. Male not working, Female not working	15. Male working, Female not working	20,108	37,285	**	Children 0- <2**, education level**	38,812	18,705	93%
		15. Male working, Female not working	17. Both working	37,285	39,647	**	Children 0- <2*, children 2- <5*, children 5- <18**, age*, education level**	38,357	1,072	3%
		16. Male not working, Female working	17. Both working	22,905	39,647	**	Education level**	40,476	17,571	77%

*,** Significant difference at the 5% (*)/1%** level (2-tailed Wilcoxon Mann-Whitney test)

Source: Author's own calculations. See section 4.2 for details of datasets used.

Table A4.4 Mean expenditure of households, before and after their activation, by demographic group, Netherlands

		Originator demographic group [column 1]	Destination demographic group [column 2]	Mean household expenditure of originator segment, € per annum [column 3]	Mean household expenditure of destination segment, € per annum [column 4]	Significant difference in means?	Corrections made for differences in mean values for following characteristics:	Estimated household mean expenditure after activation, corrected for composition effects, € per annum [column 7]	Mean estimated increase in household expenditure due to activation	
									€ per annum [column 7 minus column 3]	% increase
Older workers	Single	1. Male, not working	2. Male, working	15,965	18,356		No. adults**, age**	18,801	2,836	18%
		3. Female, not working	4. Female, working	13,569	20,123	**	No. adults**, age**	20,626	7,058	52%
	Couple	5. Male not working, Female not working	6. Male working, Female not working	23,761	34,778	**	No. adults*, children 5- <18**, age**, education level**	36,379	12,618	53%
		6. Male working, Female not working	8. Both working	34,778	34,322		Children 5- <18*, age**	33,983	-795	-2%
		7. Male not working, Female working	8. Both working	31,174	34,322		Children 5- <18**, age**	33,372	2,198	7%
	Younger workers	Single	10. Male or female, not working, no children	11. Male or female, working, no children	11,599	16,531	**	Age**, education level**	17,524	5,925
12. Male or female, not working, with child(ren)			13. Male or female, working, with child(ren)	19,261	22,918		No. adults*, children 0- <2*, age*	23,564	4,303	22%
Couple		14. Male not working, Female not working	15. Male working, Female not working	16,231	30,251	**	Children 0- <2**, education level**	32,032	15,801	97%
		15. Male working, Female not working	17. Both working	30,251	33,878	**	Children 0- <2*, children 2- <5*, children 5- <18**, age*, education level**	33,308	3,057	10%
		16. Male not working, Female working	17. Both working	18,615	33,878	**	Education level**	34,845	16,231	87%

*,** Significant difference at the 5% (*)/1%** level (2-tailed Wilcoxon Mann-Whitney test)

Source: Author's own calculations. See section 4.2 for details of datasets used.