

On the Economics of Happiness and Climate Change



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On the Economics of Happiness and Climate Change

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Chapter 1.

Introduction

1.1 Background, motivation and approach

The present study bridges two fields of research which are currently receiving much attention in the literature, namely the economics of happiness and the economics of climate change. The intention is to engage with the literatures in both fields and see how they feed into each other. This is motivated by the intuition that insights from the economics of happiness are highly relevant for our understanding of the consequences of climate change and appropriate policy responses. Alternatively, climate change economics can inform well-being studies about environmental and climate factors underlying happiness.

Before moving to the interface between the economics of happiness and the economics of climate change, it is helpful to define some of the key concepts used throughout the thesis, starting with life satisfaction, happiness and subjective well-being. In psychology, life satisfaction is defined as a cognitive and judgemental process which depends on a comparison of an actual situation with what is considered an appropriate standard (Diener et al. 1985). While subjective well-being is commonly understood as embracing the concepts of life satisfaction and happiness, not all observers see the two as equivalent. Happiness is empirically tested by a particular series of questions. One method, developed by Kahneman et al. (2006), asks people to report their feelings before and after particular experiences, which yields a measure of experienced affect or happiness.

Happiness has furthermore different definitions in the hedonic and the eudaimonic philosophical approaches. Hedonic happiness stands for the positive affect associated with obtaining material objects or pleasurable experiences (Waterman et al. 1993), while eudaimonic happiness implies living in a manner which is consistent with one's best potentials, and thus bringing a purpose and meaning to life. Hedonic happiness is located empirically closer to life satisfaction and Kahneman measures of experienced happiness, while eudaimonic happiness is related to scales of positive psychological functioning and human development. Despite the distinction in the two approaches, empirically they tend to tap a largely overlapping construct (Nave et al. 2008, Ryan and Deci 2001). According to Waterman et al. (1993), whereas some activities give rise to both eudaimonic and hedonic happiness, not all forms of hedonic enjoyment give rise to eudaimonic happiness. In view of these definitions, and given the high correlations between life satisfaction and happiness, the terms are used interchangeably throughout the text, while acknowledging the conceptual differences between them.

Other central terms relevant to this thesis relate to climate change. Throughout the chapters extreme events are defined following the classification of IPCC (2007) into episodes of heat waves in urban metropolitan areas, heavy precipitation, floods, droughts, tropical cyclones, forest fires, loss of permafrost, and a large rise in the sea level.

Happiness studies are particularly relevant for the economics of climate change as subjective well-being can be considered the closest – even though imperfect – observable proxy for utility (Clark et al. 2008). It probably merits more attention in economic analysis

than income. Not surprisingly, there is an emerging literature on well-being and environmental conditions (Ferreira et al. 2012, Murray et al. 2011, Maddison and Rehdanz 2011, Ferreira and Moro 2010, Luechinger 2009, MacKerron and Mourato 2009, Carroll et al. 2009, Luechinger and Raschky 2007, Moro et al. 2008, Brereton et al. 2008, Smyth et al. 2008, Welsch 2006 and 2007, Ferrer-i-Carbonell and Gowdy 2007, Rehdanz and Maddison 2005). The impact of extreme events associated with human-induced climate change on well-being has not been treated in this literature, despite IPCC (2007) projections on increasing episodes of droughts, heat waves and floods and the intensity of their adverse impacts. This will be one focus for the present study.

Relating climate change economics with happiness studies is furthermore triggered by the incomplete coverage of intangible welfare impacts – related to human health, environmental change and social inequality – in monetary valuation studies of climate change. Life satisfaction is a composite construct of tangible and intangible factors, where intangibles tend to carry a larger weight (Easterlin 2003). Moreover substitution between pecuniary and non-pecuniary domains is limited above a given income threshold (Easterlin 2013). Expressing intangible climate change impacts in terms of happiness losses and gains is a viable alternative to monetary valuation.

The present research is guided by two sets of questions. The first one can be formulated in the following manner:

- What are the effects of (extreme) climate events on individual happiness?
- How can these effects be quantitatively estimated?

The empirical method to analyze this relation revolves around the identification of proxies for extreme climate events and studying their relationships with well-being for the impacted population. Here floods, and to some extent forest fires, are taken as one approximation of extreme events. A survey on happiness in flood-affected regions was administered, which allows for conducting econometric analysis of life satisfaction and its determinants.

A second set of research questions addressed here is as follows:

- Can happiness research inform climate policy? What is the relevance of climate policy for happiness, or how does climate change abatement affect well-being?
- Assuming that effective climate policy reduce the rate of economic (income) growth, or even leads to a reduction in income and consumption, how would this influence subjective well-being?

To explore the happiness effect of a wider range of climate change mitigation strategies, including ones which are not solely policy-oriented, the sharing of goods was taken as one case of a community-based initiative resulting in a reduction of greenhouse gas emissions.

The differential impacts of income taxation and CO₂ pricing on happiness will be initially discussed on a conceptual-theoretical level in Chapter 2. The empirical approach to studying the effect of an income taxation (as one climate policy tool) on happiness takes Barcelona as a study area, where income (and consumption) reduction associated with the prolonged economic crisis in Spain in the period 2009-2011 was notable. Econometric analysis is used to isolate the effect of income reduction on happiness from a range of standard demographic variables. Next, to understand the drivers and welfare implications of sharing as a community-based strategy to slow down climate change the practice is firstly introduced as an independent variable in various happiness regressions. A separate

econometric analysis with sharing as a dependent variable is later undertaken to pursue the determinants of goods-sharing.

One finding in happiness research, initially observed by Easterlin (1974) and later by others, is especially relevant for our study: namely, satisfaction with life flattens out during episodes of long-run income growth in most wealthy nations. This is found for both GDP per capita and personal disposable income. As the drivers of this disassociation of income and happiness are dealt with in the second chapter of this thesis, here we only mention a few highlights and recent debates.

Empirical support for the Easterlin paradox is found in many studies. The paradox points at the divergence in the relation between happiness and income at present and in the long run; even though at a given moment richer individuals report a higher satisfaction with life, happiness does not increase in income over time. A few recent studies, however, challenge the null relationship between long-term growth and happiness (Sacks et al. 2012, Inglehart et al. 2008, Hagerty and Veenhoven 2003). The most often quoted study in this respect is Sacks et al. It shows that life satisfaction and GDP rise and fall together both in poor and rich nations. In a recent paper Easterlin (2013) responds to their findings, demonstrating that divergences in results are driven by confusion between short-term and long-term economic growth and by drawing references from transition countries for which data on subjective well-being from the pre-transition period is missing. He further shows that life satisfaction in transition countries follows a U-shaped pattern over time, which is comparable to the curve of economic growth in a post-transition period, though not caused by it. Generally, the results of most studies finding a positive relation between long-term economic growth and happiness tend to be induced by insufficiently large time-series and the presence of outliers in the data. Moreover, for a given level of GDP life satisfaction scores can vary considerably.

Furthermore, as explained in Chapter 2, the positive statistical association between income and happiness found in cross-section data can be largely attributed to relative income status. Higher income is associated with benefits in the form of consumption and status. Given that status is a zero-sum game and the marginal benefits of consumption decrease, it is not surprising that happiness over time flattens out in rich countries (Clark et al. 2008).

1.2 Outline of the thesis

Chapter 2 of this thesis defines the overall theoretical framework for the subsequent empirical studies. It mentions several deficiencies of CBA analysis focusing on non-market impacts of extreme events and surveys the relevant insights from the happiness literature. The chapter proceeds with a discussion of the implications of social comparison and adaptation for estimating the happiness costs of extreme climate events, occurring in the domains of human health, environment and social frictions. The capacity of happiness to adapt to losses in these domains is considered. The chapter further looks at climate policy while searching for a mix of instruments which is least costly in terms of happiness. The implications of a specific income tax which corrects for rivalry and adaptation to higher earnings as an element of climate policy are examined.

Subsequent chapters provide empirical evidence for some of the general insights derived in Chapter 2. Chapter 3 builds upon a survey of life satisfaction administered via face-to-face interview in all city districts of Barcelona. Applied research on happiness and

income is relevant for Spain in view of its current socio-economic situation characterized by severe economic crisis, budget austerity, and a high level of unemployment. As an illustration, at the moment of undertaking the survey (the third quarter of 2011), the unemployment rate for individuals below 25 years was 43.5%. The final data set, consisting of 840 observations, is used to study the effect of various parameters on happiness, including consumption and changes in income. Some of the other variables tested are located in the domains of social capital and work, such as flexible labour conditions, environmental awareness and the voluntary sharing of a house, a car, tools or other objects. The impacts of these on life satisfaction are tested. The effects of common natural hazards for Catalonia, such as droughts and forest fires, are also examined.

Chapter 4 is an empirical study focusing on the implications of extreme climate events for happiness. The chapter takes floods as a proxy for extreme events which occur as a result of climate change. Floods are considered the most commonly distributed natural hazard, associated with substantial social and economic damages. Data was collected in fifteen Bulgarian villages and towns, the majority of whom have been heavily affected by sudden floods over the last seven years. The data set consists of 600 observations, collected in face-to-face interviews, half of which drawn in flood-impacted households. Bulgaria represents an interesting case for happiness studies as it stands on the verge between the richer northern and poor southern countries, both economically and geographically. It furthermore exhibits the lowest level of life satisfaction for countries with a comparable level of per capita income. In the chapter the happiness impact of various degrees of floods and their distribution over time is tested in series of statistical regressions. Attention is also paid to the factors which could explain the relatively low subjective well-being in Bulgaria. Some of these are related to social capital, including trust and belief in the good intentions of others. The study further assesses the effect of recent versus past income increases on subjective well-being.

Chapter 5 deals with the sharing of CO₂-intensive goods, as a community-based approach to decreasing greenhouse gas emissions. The chapter first explores the various commercial and non-commercial formats of sharing, defined as the collective use of physical resources and goods in a consecutive or simultaneous manner. Key insights from the relevant literature are summarized and fed into a simple cost-benefit framework to explain the private and social logic of sharing. The model derives that sharing is socially beneficial when one or more of these conditions are met: the monetary and time savings are positive, uncooperative behavior is not too strong, rebound effects are minimal, or the aggregate environmental impacts are reduced. One conjecture made in the chapter, is that sharing could increase overall-well being, due to the offsetting effect it has on rivalry and conspicuous consumption. The key psychological, social and economic determinants of sharing a house, a car, electro-domestic appliances and tools are then examined, drawing on the data sets from Barcelona and Bulgaria. This allows for comparing the manifestations and frequency of sharing between Bulgaria and Spain. The way age, income, working and marital status, trust, generosity, friendships, type of urbanization, and the time spent on watching television influence sharing is then tested in regression analysis.

The last chapter concludes. It ties together the theoretical assertions from Chapter 2 and the empirical findings of subsequent chapters, arguing that a climate policy which is only concerned with the minimization of net economic costs is unlikely to work out.

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Chapter 2.

A happiness perspective on climate change and policy: theoretical considerations

2.1 Introduction

The economics of climate change has seen much debate over the last two decades. The research area is dominated by the application of cost-benefit analysis (CBA), often in combination with a particular integrated assessment model (Nordhaus 2007; Tol 2002; Stern et al. 2006). While initial studies employed models with a limited number of impacted sectors and climate variables, later ones widened the scope, including more scenarios and variables (Watkiss et al. 2009). Despite progress on many model aspects, several basic issues with climate CBA have not been, or perhaps cannot be, resolved (e.g. Wegner and Pascual 2011; Ackerman et al. 2009; van den Bergh 2004; Decanio 2005). Even researchers who have contributed to climate CBA have explicitly recognized its limitations (Tol 2008, Stern et al. 2006). Important shortcomings are as follows.

First, expressing all climate change impacts in monetary or income (GDP) terms has been criticized for failing to fully acknowledge the multiple dimensions of human well-being and ecosystems, including the implications of fairness over space and time (Wegner and Pascual 2011). Many, potentially large, effects of climate change such as social and political instability, poverty, biodiversity and ecosystem losses, mass migration, and conflicts over increasingly scarce resources are difficult, if not impossible, to assess monetarily. As a result, the related welfare effects are omitted or at best incompletely covered (Neumayer 2007, Atkinson and Mourato 2008). Some of these effects have been estimated using non-market valuation techniques but applying them to climate change is problematic because of a huge worldwide income disparity. Dietz et al. (2007) further note that events characterized by high-impact, low-probability and irreversibility raise tough questions about the limits of a welfare-economic approach.

Second, one may defend that climate CBA studies sometimes use a social welfare function instead of evaluating purely monetary indicators. However, this function is generally assumed to be increasing in per capita consumption, which is inconsistent with the finding that happiness and absolute income are not always strongly correlated over time.

The third complication concerns distributional effects. Many studies do not correct for the fact that the marginal utility of money is decreasing in income, (i.e. poor individuals have a higher marginal utility of income). The use of a single discount rate with an average value for the marginal elasticity of utility does not, however, recognize extreme world income disparities.¹ A few studies have tried to address income inequality by applying some type of income weighting procedure while still using a single discount rate. Some of them find that the costs of climate change impacts increase when equity weights are used (Antonoff et al. 2009), while others find an opposite effect (Hope 2008).

¹ According to the Ramsey rule the social discount rate equals the sum of the social rate of time preference and the product of the rate of consumption (or income) growth and the marginal elasticity of utility to income.

The previous remarks do not mean to deny that there has been progress in applied climate CBA studies, notably with respect to combining adaptation and mitigation (de Bruin et al. 2009) and dealing with uncertainty (Watkiss et al. 2009). Such developments, however, do not make the foregoing criticisms invalid.

This chapter contributes to the literature in two ways. First, it suggests an alternative approach to assessing the non-pecuniary impacts of climate change. Given that subjective well-being² is considered the closest, even though imperfect, proxy for utility (Clark et al. 2008), expressing utility losses caused by climate change in happiness terms might be more appropriate than in monetary units. Secondly, we evaluate climate policy from a subjective well-being perspective, searching for a combination of policy instruments that is least costly in happiness terms. The well-being costs of dangerous climate change³ can then be contrasted with the well-being costs of climate policy.

Few studies deal with the interface between happiness and climate change/policy (Cohen and Vandenberg 2008, van den Bergh 2010, and FitzRoy et al. 2012). They argue that a stringent climate policy is logical from a happiness angle even if it implies a slow-down of traditional growth. An increasing number of non-policy oriented studies find that climatic and environmental factors matter for subjective well-being (Ferreira and Moro 2010, Welsch 2006; Brereton et al. 2008; Ferrer-i-Carbonell and Gowdy 2007, and Moro et al. 2008). Based on a panel of 67 countries Rehdanz and Maddison (2005) explain differences in self-reported levels of happiness by variation in temperature and precipitation, using the means, extremes and the number of hot, cold, wet and dry months. They find that climate variables have a highly significant effect on self-reported happiness and conclude that climate change might alter the distribution of happiness between nations. This finding is later confirmed for a wider range of countries (Maddison and Rehdanz 2011). Murray et al. (2011) further show that individuals living in areas with less sunshine and more humidity tend to report lower levels of happiness.

Life satisfaction analysis has also been used to evaluate air quality and pollution, droughts, floods and environmental quality in general. Surveying 10,000 individuals in 30 Chinese cities, Smyth et al. (2008) show that people living in places with a high level of air pollution, environmental degradation and traffic congestion report a lower level of happiness than those located in greener and uncongested areas. Ferreira et al. (2012), Welsch (2006), Luechinger (2009) and MacKerron and Mourato (2009) find a strong negative impact of air contamination on happiness.

A focus on happiness is not a plea against monetary indicators (van Praag and Ferrer-i-Carbonell 2004, Welsch 2007). Monetary valuation of the costs of climate policy is often associated with a lower GDP growth rate. In fact, the integrated assessment models that are combined with CBA reflect an optimal economic (GDP) growth approach (van den Bergh 2004). As a result, practical climate policy analysis seems to be much concerned with a potential reduction in the rate of GDP growth. Economic growth, however, is not a guarantee for an increase in social welfare or individual well-being (Daly and Cobb 1989; Lawn and Clarke 2008; van den Bergh 2009, Easterlin 2013).

The remainder of the chapter is organized as follows. Section 2 summarizes the main findings of happiness research that are relevant for a welfare evaluation of climate

² Happiness is also referred to as life satisfaction or well-being here.

³ Dangerous climate change here refers to the climatic and environmental disruptions associated with an average yearly temperature increase by more than 2°C (IPCC 2007).

change and policy. Section 3 discusses the happiness impacts of extreme climate events, and Section 4 searches for a set of climate policy tools which have least, or positive, impact on happiness. Section 5 concludes.

2.2 Happiness research

2.2.1 Background

Interest in subjective well-being within economics has been growing steadily over the past decades. Frey (2008) describes happiness as a by-product of a good life which produces satisfaction with life over the long run. This definition is relatively close to Aristotle's notion of eudaimonia, meaning the highest human good involving virtue and the realization of one's potentials (Deci and Ryan 2008). In the hedonistic tradition happiness is generally defined as the result of avoiding pain and seeking pleasure (Bruni and Porta 2005).

Subjective well-being studies use questionnaires that elicit overall contentedness with life by means of self-reports. In economics well-being is usually modelled as jointly determined by temperament, income, marital status, leisure, health, employment, social capital, culture and political background variables (van Praag and Ferrer-i-Carbonell 2004; Frey and Stutzer 2005). Life satisfaction measures are generally found to be reliable, consistent and having a relatively high degree of stability over time (Ehrhardt et al., 2000, Eid and Diner 2003, Krueger and Schkade 2008).

A major cause of concern has been the discovery that since the 1960s happiness in the US, Japan and most of Western Europe has not risen despite considerable increases in per capita income (Easterlin 1974; Myers and Diener 1996; Blanchflower and Oswald 2000; Diener et al. 1993; Brockmann 2008; Frey 2008). Many explanations for the so-called "Easterlin Paradox" have been put forward.⁴ Probably the most consensual one is that the positive effect of income increase is dampened by adaptation to higher earnings and rising aspirations associated with systematic comparisons with a reference group and (Clark and Oswald 1996; Ferrer-i-Carbonell 2005; Luttmer 2005; Clark et al. 2008a). Below we discuss social comparison and adaptation in view of their relevance for climate policy.

2.2.2 Social comparison

Status-seeking and rivalry are some of the key factors which offset the positive effect of income increases on happiness. Income aspirations consistently increase with the growth of average incomes in one's neighbourhood, peer group, country and even the world as a whole (Clark and Oswald 1996; Blanchflower and Oswald 2004, Brekke and Howarth 2002; Vendrik and Woltjer 2007).⁵ Higher income aspirations are often associated with a

⁴ The Easterlin paradox has been well established in the literature although debates on the historical evidence about it continue. A number of recent studies find proofs for a positive relation between income increase and happiness over time (Sacks et al. 2012, Inglehart et al. 2008, Hagerty and Veenhoven 2003). Easterlin (2005), (2012) and Easterlin et al. (2010) discuss these studies and argue that there is a confusion between a short-term (positive) relation between subjective well-being and GDP, and a long-term decoupling (between the two). Some of the confusion also comes from drawing inferences from transition countries where data on subjective well-being from the pre-transition period is missing.

⁵ The literature is not in a complete agreement on this matter. Clark et al. (2008b) and Senik (2004) find a positive effect of relative incomes on life satisfaction for Denmark and Russia,

lower experienced well-being (Frey, 2008). Individuals whose neighbours have higher earnings, for example, often report lower levels of happiness (van de Stadt et al. 1985; McBride 2001; Luttmer 2005). In the words of Easterlin (1995), raising everyone's incomes fails to increase everyone's happiness because the positive effect of higher earnings cancels out with the negative effect of increasing (reference) income standards. Eventually individuals find themselves trapped in a continuous rat-race for higher social status through material acquisitions which negatively affects happiness.

Evidence of the importance of relative consumption is not only available for rich countries. In rural China relative income is found to be twice as important for happiness as absolute income (Knight et al. 2007). Studies from Latin America show that having wealthier neighbours, or friends from the city generally lowers self-reported happiness (Graham and Felton 2006).

Social comparison can also work the other way round. Eggers et al. (2007) find that unemployment during the economic transition in Russia did not have a pronounced impact on subjective well-being because it was experienced by the majority of the population. Similarly, Clark and Oswald (1994) find that unemployment affects more strongly the well-being of the people living in the areas of the UK with few jobless individuals, than in areas with high levels of unemployment. Both authors conclude that reference standards of a good life may adapt (downwards) when individuals observe their peers passing through the same economic hardships, which will turn out to be relevant for our later discussion.

2.2.3 Hedonic adaptation

The other major process which moderates the positive effect of income increase on well-being is "hedonic" adaptation. It is relatively well documented in the literature that people habituate to increased earnings or material standards, which makes their happiness fall back to earlier levels (van Praag and Kapteyn 1973; van de Stadt et al. 1985; Diener and Diener 2002; Easterlin 2003; Stutzer 2003; Frey 2008). McBride (2007) finds that adaptive income aspirations have a strong, negative influence on life satisfaction. It is the so-called "distorted memories of past experience" which make it easy to overestimate the well-being gains associated with higher incomes (Frey and Stutzer 2005). Using a sixteen-year panel data of approximately eight thousand people in Germany, Di Tella et al. (2010) find that the initial rise in happiness caused by an income increase vanishes completely after four years, implying that life satisfaction drops back to its original level. A well-known study of Brickman and Janoff-Bulman (1978) shows that lottery winners are not happier than individuals in a control group with similar characteristics. Studying a sample of employed males in the US, Hamermesh (1999) further finds that job satisfaction does not increase during a period of rising real wages.

Nonetheless the literature is not completely congruent on the issue of how far happiness adapts to income increase. For example, Ferrer-i-Carbonell and van Praag (2008) find for Germany (no) adaptation to decreases (increases) in household income. A recent study finds that rises in household earnings bring lasting increases in life

respectively. In the case of Denmark, people were found to be happier when their neighbours are richer but also when their percentile ranking improves. In the study of Senik on Russia the positive effect of relative income is registered in times of an economic crisis, and has a cognitive element, i.e. it is understood as an overall improvement of employment prospects.

satisfaction in both poor and wealthy countries (Diener et al. 2013). The authors, however, use a relatively short time period (2005-2011) and explain increases in happiness using a relatively small set of variables, meaning that the coefficient of household income increase might capture (i.e. be a proxy of) wider individual or social changes.

Particularly interesting and hardly explored is the subject of adaptation to income decreases. Di Tella et al. (2010) find that people report a similar level of happiness after a 10% income decline as equally rich individuals who see their wage increased by 21%. Diener and Diener (2002) argue that increases in income can exercise a positive as well as a negative effect on well-being, depending on the discrepancy between desires and possessions. Opinions about the asymmetry between the welfare effects of income gains and losses diverge. Kahneman and Tversky (1979) argue that income losses are more impactful than income gains of the same size. Di Tella et al. (2010), however, do not find evidence for such an asymmetry for subjective well-being.

Adaptation further differs between happiness domains. Increased noise and traffic stress, and reduced physical exercise, network of friends and free time have a lasting negative impact on happiness (Frank 2005). Even though individuals generally believe they get accustomed to increased traffic, noise and pollution, these environmental stimuli have long lasting repercussions on the human body and mind (Ferreira et al. 2012, MacKerron and Mourato 2009, Brereton et al. 2008, Smyth et al. 2008).

2.3 Evaluating happiness costs of extreme climate events given social comparison and hedonic adaptation⁶

This section looks at how changes in the domains of environment, health and social conditions caused by extreme climate events, or dangerous climate change, could resonate with happiness.

2.3.1 Environmental impacts

A growing number of studies demonstrate that disruptions in climatic and environmental factors are associated with non-negligible changes in happiness (Maddison and Rehdanz 2011, Murray et al. 2011, Ferreira and Moro 2010, Moro et al. 2008, Brereton et al. 2008, Rehdanz and Maddison 2005, Van der Vliert et al. 2004). Carroll et al. (2009) shows that experiencing episodes of droughts during the spring leads to a substantial reduction in life satisfaction for people in rural areas. Luechinger and Raschky (2007) further evaluate the relation between floods and well-being for 16 European countries and find that flood disasters have a significant negative effect on reported life satisfaction. A person living in a flood-prone region is likely to suffer a permanent reduction in life satisfaction in comparison with an individual living in a flood-safe area.

In spite of these studies, the standard literature on life satisfaction does not give much attention to environmental factors. This might imply an incomplete treatment of the components of life satisfaction. The relevance of an environmental component is

⁶ Extreme events include heat waves in urban metropolitan areas, heavy precipitation events, floods, droughts, tropical cyclones, forest fires, loss of permafrost and a large rise in the sea level (IPCC 2007).

illustrated by extreme climate events that can have a permanent or even irreversible impact on happiness.

2.3.2 Social impacts: migration and equity

Forced migration and increased inequality are two likely and major social consequences of extreme climate events. IPCC (2007) reports that a very high sea level and desertification, categorized as “likely climate change impacts”, may cause mass migration. The impact of migration on well-being has so far only been studied for labour migrants. Bartram (2007) notes that migration from the poor South to the rich North is likely to cause a significant increase in the level of material aspirations and a change in reference groups, and possibly a lower well-being. Vohra and Adair (2000) found that the life satisfaction of Indian migrant workers is predicted by the gap between freedom, respect, realization of personal goals, and social support in their home country and what they get in these terms abroad. In a study of the well-being of individuals who move from rural to urban areas of China, Knight and Gunatilaka (2007) found that migrants have a lower mean happiness despite their higher mean income. This is mainly due to false expectations of urban life and rising income aspirations.

Most of the literature on migrant welfare is based on surveying people who voluntarily decide to leave their home country and have done so individually. Many people living in environmentally stressed areas, however, may be forced to migrate in mass groups and experience considerable social hardship, or even conflict, in the new settlement areas. Migration induced by climate change is therefore prone to incur large and persistent drops in well-being.

Regarding equity, one of the difficulties in estimating the cost of climate change is the highly uneven distribution of impacts. Southern countries, and poor communities in particular, are the most vulnerable. They are located in areas prone to risks while having limited means to respond in protective or adaptive ways to extreme changes in the climate. In addition, they are often directly dependent on climate-sensitive resources, such as local food production, freshwater resources, and soil fertility (IPCC 2007). Climate change is therefore likely to exacerbate inequality, both within and across counties. Empirical evidence on the specific relationship between happiness and inequality is mixed. Studies indicate that this relationship can be positive, negative, or insignificant, depending on the sensitivity to, (and awareness of), inequality in different cultures, on the size of the sample, and the particular indicator used (Verme 2009).

Recent research by Ebert and Welsch (2009) for ten European countries finds a strong effect of inequality on life satisfaction. Using time series data for twenty years, the authors find that average income and equality measures strongly and positively correlate with subjective well-being. Surveying 123,688 people, Alesina et al. (2001) found that on average individuals in the US and Europe tend to report lower levels of happiness when inequality in the state, or country, is high. Some authors explain this finding by pointing at the importance of inequity aversion, social status and comparison for well-being. The increase in prevailing inequalities within countries as a result of extreme events can thus be considered as another factor which increases the well-being cost of climate change.

2.3.3 Health impacts: physical and psychological aspects

Heavy precipitation events and warm spells, classified as “very likely climate change impacts” by IPCC (2007), increase the risks of heat-related mortality, deaths, injuries, and infectious respiratory and skin diseases. Droughts and tropical cyclones, which might result from climate change, are associated with an increased risk of water- and food-borne diseases, post-traumatic stress disorders, and human casualties.

Health is one of the most important predictors of subjective well-being (Easterlin and Sawangfa 2007). The impact of health distortions on happiness varies with the severity of the disability (Okun et al. 1984, Gerdtham and Johannesson 1997). Brickman and Janoff-Bulman (1978) look at paralyzed accident victims and find that they are significantly less happy than individuals in a control group. Lucas (2007) shows that disability is associated with moderate to large drops in happiness, followed by little adaptation over time. Oswald and Powdthavee (2008) show that people who become severely disabled recover 30% of their mental well-being, while ones with moderate health disorder recover about 50%.

Extreme climate events can further affect the psychological determinants of well-being. An increased frequency of heat waves, floods, and storms in certain regions is likely to elevate the overall level of stress, worry and anxiety. A permanent increase in these three factors has been found to negatively impact subjective well-being (Karademas 2007). Reviewing the medical literature, Landis (1996) shows that persistent uncertainty makes the available internal resources ineffective, depletes adaptive energy and deters psychological restoration. Studying fear of crime in Los Angeles, Adams and Serpe (2000) find that the feeling of vulnerability has a major impact on life satisfaction through decreasing people’s sense of control over their lives. These findings are consistent with Kasser’s (2002) basic human needs theory, where safety and security are major components of well-being.

In line with this, extreme natural events are reported to have non-negligible psychological costs. Consider the floods in New Orleans in 2005. While thousands of people were seriously injured or died, others were not physically harmed but were in a state of shock and depression afterward (Zeidner 2009). Investigating the health and psychological distress associated with hurricane Katrina, Adeola (2009) finds that it had caused stress, depression, alcohol and drug abuse, suicidal symptoms, and somatic problems. He notes that catastrophes of this kind trigger various physical, emotional and psycho-social disruptions, as well as a clinical syndrome known as the post-traumatic stress disorder (PTSD), which may be prevalent in 5 to 60% of the victims a year after the disaster.

In sum, a higher frequency of extreme climate events is likely to have a lasting, negative impact on well-being when it involves severe health damages and affects the psychological determinants of subjective well-being (notably, feelings of safety and security and the sense of control over life). This effect is not finely captured in climate CBA assessments where perfect substitutability between money and human life and health is assumed.⁷ As we will argue below, the conversion of psychological, health, social and

⁷ Antonoff and Tol (2008), for example, value mortality at 200 times the annual income per capita and morbidity at 80% of the annual income per capita per year of illness.

environmental impacts in monetary cost/benefit terms provides an incomplete assessment, and probably an underestimation, of the scale of the climate change-related costs and threats.

2.4 A happiness assessment of climate policy

Stringent climate policy is generally considered expensive or demanding serious economic sacrifices, such as a loss of income (GDP) growth (van den Bergh, 2010). It will be argued that stringent climate policy need not be so expensive as suggested by climate CBA, for three reasons. First, the effect of income changes on life satisfaction is examined for rich countries where the largest reductions of carbon dioxide emissions need to be realized. Second, the possibility is considered that income increases provide imperfect substitution for losses in non-pecuniary domains such as health, community, serenity and environment. Third, it is argued that happiness evaluation provides further arguments against intergenerational discounting.

With regard to the first reason, as the cost of considerable emissions reduction falls mainly on rich countries, a drop in the rate of income growth and possibly even a reduction in income might occur. This is traditionally evaluated as negative, suggesting a loss of welfare. However, happiness research has found that the contribution of income growth to life satisfaction rapidly diminishes beyond a threshold income and even vanishes over time. This is usually explained by hedonic adaptation and social comparison. As a result, the decline in subjective well-being associated with a stringent climate policy that lowers income growth will be modest.

Regarding the second reason, if income and happiness rise and fall together only up to a given (income) threshold, substitution between income growth and the non-pecuniary determinants of happiness, such as health, social relations and a stable climate will be limited. Schematically, if $W(y, z)$ is a well-being function of y (income) and z (a vector of all other relevant happiness determinants), and if y^* denotes the (income) level beyond which increases in income result in miniscule, or zero, increases in happiness, then:

- for $y \leq y^*$, a change in y would lead to an increase in W ,
- for $y > y^*$, increasing y would result in miniscule, or zero, changes in W .

Thus, for $y > y^*$ an increase in income cannot compensate fully for changes in the non-pecuniary elements of vector z (such as health, social conditions and natural environment).

The limited tradability between income and the non-pecuniary dimensions of happiness casts doubts on the validity of the monetary estimations of the intangible (welfare) costs of climate change, derived in integrated assessment models. These are generally based on valuing health, environmental and social conditions in terms of growth in manufactured capital and associated goods and services. Assuming a (high) substitutability between natural and economic capital will thus lead to an underestimation of the costs of climate change and thus – of the potential benefits of stringent climate policy.

The third issue concerns intergenerational discounting. When climate impacts are translated into abstract, impersonal monetary costs and benefits, discounting over generations might seem straightforward. Nevertheless, many philosophers and economists have raised arguments against it. Intergenerational discounting effectively

means assigning less value to all future costs and benefits, including those associated with in the (non-pecuniary) domains of health, natural environment and social conditions. Discounting future environmental, health and social damages means assigning less value to the well-being of people living in the distant future. This immediately raises an ethical objection. If the happiness of future generations would be considered equally important as the happiness of the present generation, then discount rates should be set zero. Then the present value of the future costs of climate change damages would be much higher than what is currently calculated in climate-economy CBAs. In turn, higher benefits of a stringent climate policy would result.

In sum we have argued that climate policy delivers higher net welfare benefits to society than implied by current CBA studies. These benefits however depend on the particular tools used as the happiness effects may differ between instruments.

One widely supported policy advice for climate change mitigation is (higher) pricing of CO₂-intensive energy through carbon taxes or tradable emission permits. CO₂ pricing could, however, go along with unintended negative effects on happiness. In particular, if due to this policy instrument CO₂-intensive goods and services would become only affordable for a small group of relatively high-income individuals, then overall happiness might drop because of increasing status externalities and inequality effects. Increasing inequality in the access to goods inflates income aspirations and eventually dampens subjective well-being. More expensive basic consumption of energy due to CO₂ pricing could be avoided by block pricing. However, for other goods and services such a simple solution is not available. Thus, if carbon pricing is adopted, it needs to go along with instruments that ameliorate its negative effects on well-being.

One possible instrument is an income tax that corrects for rivalry. This has been proposed by Layard (2005), using a model with a utility function which incorporates reference income levels. The tax stimulates individuals to choose the number of working hours on the basis of their real needs rather than their relative position in terms of material consumption and wealth. The introduction of taxes correcting for rivalry is expected to push income aspirations downwards and discourage the pursuit of social status through earnings and positional consumption.⁸ There is a small literature on income taxation and relative consumption which is worth mentioning here. These studies are based on the foundational work by Mirrlees and Diamond (1971) which provides a framework for assessing a socially optimal tax system. Ireland (2001) and Aronsson and Johansson-Stenman (2008) find that correcting for rivalry and positionality requires higher marginal tax rates over the entire income range. Oswald (1983) shows that optimal marginal tax rates are higher in a “more jealous world” than in a “more altruistic” one. Kanbur and Tuomala (2009) conclude that not only higher overall marginal tax rates but also progressivity of taxes can be defended when jointly taking into account relative consumption and inequality aversion.

Moreover, as argued in Section 2, happiness continuously adapts to the increasing consumption of CO₂-intensive goods and services. Another type of tax, suggested by Layard (2005) and motivated by the so-called “self-defeating pursuit of higher incomes”, can moderate such a development and the associated trend of excessive working efforts to

⁸ For the UK Layard estimates that the sum of the tax rates which efficiently correct for habituation and rivalry is approximately equal to 67 % of income.

a level where the distorting effect of habituation (adaptation) is off-set. Frank (2005) refers to the unforeseen habituation to income increases, or to the negative effect of present consumption on future happiness, as a negative “internality”. Theoretically, this can be corrected by an income tax that incorporates unforeseen addiction to income increases in its design, reflecting a utility function that includes past earnings.

Coming back to climate policy, more progressive income taxation – possibly not raising total tax revenues – which is meant to increase public happiness by correcting for rivalry and habituation, can be part of an encompassing climate policy. Such taxation would particularly compensate for the negatives status externalities generated by carbon pricing. This works in two ways: by discouraging the consumption of CO₂-intensive goods; and by levelling the distribution of income, thus assuring more equal access to goods and services. As suggested by Kanbur and Tuomala (2009), an income tax that corrects for rivalry would stimulate a larger reduction in working efforts and consumption (and the associated CO₂ emissions) for higher income levels, reducing inequality and thus status externalities, and in turn increasing social welfare. In addition, the consumption of expensive goods (e.g., sports cars, holiday houses, yachts) which often generate both status and CO₂ emissions would be relatively much discouraged. is generally highly CO₂-intensive. Furthermore, total consumption might decrease but it would not necessarily negatively affect happiness because it would be preceded by falling reference standards and income aspirations.

2.5 Conclusions

It has been argued here that the complex social, psychological and environmental impacts of global warming call for a careful evaluation that can make use of insights from happiness research. Climate change is expected to put pressure on some of the major domains, or determinants, of well-being such as health, environmental and social conditions, including aspects of safety, security and social stability. As the capacity to adapt within these domains is modest in comparison with the pecuniary domains, impacts on happiness are expected to be structural and permanent. If extreme climate events result in mass migration and rising inequalities, the effects on well-being will be negative and lasting. This holds even more for the possible health-related and psychological damages associated with extreme climate events.

These non-pecuniary effects are, however, not captured well in climate CBA assessments, due to the assumption of perfect substitutability between monetary units and various social, health or environmental impacts. The weak relation between growth in income and subjective well-being over time points to the limited possibility of trading-off changes in the non-pecuniary domains of happiness and income. This challenges the capacity of monetary units to reliably indicate the scale of the environmental, health and social costs of climate change. Furthermore, it is ethically difficult to resist giving equal weights to the happiness of present and future generations which implies (close to) zero discounting. This would increase the present value of the high long-term costs of climate change compared to current discounting practises. In other words, the net benefits of climate policies would become clearer.

The subjective well-being impact of a stringent climate policy that lowers income, and thus consumption, will be transitory and smaller than the permanent reduction in life satisfaction associated with the predicted health-related, environmental and social

impacts of extreme climate events. The cost of limiting greenhouse gas emissions is furthermore likely to be overestimated when expressed in income (GDP) terms only. Less income, and less income growth, here translates in a smaller decrease, or no change at all, in well-being once income is above the happiness threshold determined by adaptation and social comparison.

Regarding climate policy instruments, it was argued here that progressive income taxation that corrects for rivalry and habituation can complement CO₂ pricing. Such a tax brings down reference income standards and moderates rivalry by narrowing the income distribution, which may limit the happiness losses due to CO₂ pricing. In addition, it discourages the consumption of CO₂-intensive goods.

More theoretical and empirical research is evidently needed to confirm some of these propositions. This would require incorporating relevant information from climate change science and “climate economics” into happiness research, as well as giving more attention to psychology and behavioural economics in climate policy studies.

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Chapter 3.

Income decline, forest fires and happiness: an empirical study for Barcelona

3.1 Introduction

Happiness has attracted much attention in economics over the last decade, resulting in a literature that is rapidly increasing in size and thematic diversity. Much research was stimulated by the finding that growth of per capita income has contributed little to life satisfaction in richer parts of the world over time (Blanchflower and Oswald 2004, Brockmann 2009, Clark et al., 2008, Diener et al. 1993, Diener and Biswas-Diener 2002, Di Tella and MacCulloch 2006, Easterlin 1995, Frey and Stutzer 2008, Gardner and Oswald 2001). One implication of this finding is that income cannot be interpreted as a perfect proxy for utility.⁹

This chapter undertakes a happiness analysis in a set-up that partially captures the disutility associated with a reduction of carbon intensive consumption. Data was obtained for the city of Barcelona in Catalonia, Spain. Applied research on happiness and income decline is especially relevant for Spain, given its current socio-economic conditions with public budget austerity and high levels of unemployment due to the financial-economic (and severe housing market) crisis. Some relevant indicators are: an unemployment rate of 21.52% for the 3rd quarter of 2011 and 43.5% for young people (below 25 years). An important cause for the widespread income reduction in Catalonia is fiscal cuts in public spending. For example, since 2009 the budget for education has been reduced by 12%, with cuts in university budgets rising up to 19%. This has resulted in an increase in university access fees by 66,7% and a dismissal of 3500 university workers. Reduction in public spending for health in Catalonia has been 11% during the same period, while cumulative salary cuts of public workers are approximately 15%.¹⁰

The relation between income increase and life satisfaction has been studied extensively. Few studies have, however, analysed the impact of an income decline on happiness. Ferrer-i-Carbonell and van Praag (2008), Diener and Diener (2002), and Di Tella (2004) are some of the notable exceptions. FitzRoy et al. (2012) argue that standard climate economics tends to underestimate the potential of climate change mitigation to raise subjective well-being, even if this implies a slowdown of GDP growth. Here we will examine how changes in personal income over periods of one, two and five years affect happiness. This is later considered a proxy for the relation between climate change abatement and well-being, assuming that effective policies to decrease carbon dioxide emissions are likely to be associated with reductions in carbon-intensive consumption and possibly - income. Attention is furthermore paid to the contribution of various types of consumption to happiness, and in particular the purchasing of or conspicuous goods and ecological products.

⁹ Life satisfaction is used here interchangeably with the terms happiness and well-being throughout the text.

¹⁰ Information from Instituto Nacional de Estadística, <http://www.ine.es>

A second tentative focus of this chapter concerns the happiness costs of extreme climate events which are typical for the region. As proxies of environmental change we use occurrences of droughts and forest fires in Catalonia. Evidence on the importance of climatic change for well-being is increasing. Studies demonstrate that droughts, temperature changes and floods have a lasting impact on well-being (Carroll et al., 2009, Luechinger and Raschky 2009, Welsch 2006, Rehdanz and Maddison 2005). Spain belongs to the regions that are expected to be severely affected by climate change, facing a high incidence of droughts and forest fires (IPCC 2007). Here we look at the effect of heat waves, forest fires and droughts on happiness. In 2007/2008 Catalonia suffered the most severe water deficit in the last 70 years, according to the National Institute of Meteorology of the University of Barcelona.¹¹ With regard to forest fires, the Catalan Statistics Institute has estimated that 576,7 hectares forest were lost in 2008 and 3451,8 hectares in 2009, due to 421 forest fire incidences in 2008 and 746 in 2009. The grave prospects of CO₂ emissions and climate change (IPCC 2007, Peters et al. 2011) the potential happiness costs of climate change become ever more relevant.

When studying happiness one should note that what exactly it constitutes differs between philosophical traditions. Following hedonistic philosophy, happiness can be defined as the absence of sadness and the seeking of pleasure, while according to the eudaimonic tradition happiness is what brings meaning and fulfilment in life, including the realization of one's potentials. Waterman et al. (1993) attempt to bridge the two concepts by suggesting that those who experience "eudaimonic living" will also experience "hedonic enjoyment", but not vice versa. Some researchers agree on the existence of a certain overlap between the two concepts (Ryan and Deci 2001). In what follows we adopt satisfaction with life as a multidimensional construct based on demographic parameters, emotional well-being, social life, values and concern for the environment and society, which is broader than the pure hedonistic concept, while capturing some aspects of the eudaimonic concept.

The remainder of this chapter is structured as follows. Section 2 presents the theoretical framework of the analysis and the particular models used. Section 3 presents the data, and Section 4 presents the empirical results. Section 5 draws on the implications of the findings for climate policy and Section 6 concludes.

3.2 Theory and empirical approach

In the present analysis we adopt a self-reported, or direct, approach to happiness analysis, based on asking individuals to assign a value to their level of life satisfaction. The standard question tested in much of the happiness literature was used: "Taking all things together, how satisfied do you feel with your life at present?" Answers are numerical and range from one to ten, where one corresponds to complete dissatisfaction and ten to complete satisfaction with life. The reliability of the happiness measure has been extensively tested and correlations have been documented between satisfaction with life and various objective physiological and medical criteria (Krueger and Schkade 2008, Di Tella and MacCulloch 2006, Kahneman and Krueger 2006). Findings also show that reported

¹¹ Infomet: <http://www.infomet.fcr.es>.

satisfaction with life is relatively stable and reflects actual changes in life circumstances (Ehrhardt et al. 2000, Eid and Diner 2003, Krueger and Schkade 2008).

The present modelling approach is based on the assumption that self-reported satisfaction with life can be thought of as a proxy of utility and explained with the variation in a number of observable characteristics. The two approaches most frequently used in the literature are Ordinary Least Squares (OLS) and Ordered Probit (OP) (van Praag and Ferrer-i-Carbonell 2011).

The OLS model we adopt here is:

$$LS_n = \beta_0 + \beta_1 X_{1p} + \dots + \beta_p X_{np} + \varepsilon_n \quad (1)$$

where LS is a measure of satisfaction with life, p is number of characteristics which jointly determine happiness, n is number of observations, and β reflects strength (and size) of the contribution of a particular variable to life satisfaction. Estimates of β are derived by minimizing the sum of squared residuals.

Considering that the dependent variable is always a discrete number between 1 and 10, the alternative statistical approach commonly used is OP. It assumes that answers are only ordinarily comparable and explains the response of happiness ranking by the probability that an individual has a particular level of happiness, given a number of personal characteristics.

Following Ferrer-i-Carbonell & Frijters (2004), the two model specifications provide comparable results and are equally robust. In order to explore possible variations we estimated both models, but as the results were very similar we present later only the results of OLS regressions (the OP results are available upon request).

Certain demographic variables are considered key for happiness. These are age, gender, education, marital and employment status, health, ethnicity, income and leisure. The set of factors which influence satisfaction with life can, however, be extended with variables such as personality traits, temperament, trust and confidence in others, social relations, state of the natural environment, commuting, political and personal freedom. Some happiness determinants (i.e. particular life circumstances), however cannot be easily captured and usually remain hidden in the error term.

The baseline equation we estimate is as follows:

$$LS_i = \beta_0 + \beta_1 Z_i + \beta_2 \ln Y_i + \beta_3 E_i + \beta_4 C_i + \varepsilon_i \quad (2)$$

Here index i refers to the number of observation, Z_i is vector of demographic and socio-economic variables (gender, age, and marital, health, education and employment status, free time activities, environmental awareness, social interactions and temperament), $\ln Y_i$ is the natural logarithm of monthly net income in the present year, E_i is a dummy which registers experience with extreme events, such as a drought and a forest fire. Apart from climatic variables we are also interested in finding proxies of comparison income, income decrease and status-based consumption. The vector C_i reflects the frequency of purchasing conspicuous goods, which is incorporated as a proxy for status-based consumption.

As Clark et al. (2008) and Easterlin (2001) suggest, comparison income can be based on internal reference points, such as own past earnings, or on external ones, such as incomes associated with demographic groups, family, co-workers, or other citizens in a

country. In a literature reviews on relative income and happiness, Clark et al. (2008) estimate that about two-thirds of income is status-related and has no effect on happiness. Their study also shows that 60 percent of the effect of income increases vanishes within two years due to adaptation. The authors suggest that only around 13 percent of the initial happiness effect of an income increase remains in the long run and that even this figure might be an overestimation as new generations start with higher aspiration levels than older ones. Given these findings we are interested in testing whether adaptation and social comparison intermediate the effect of income decreases, and generally whether there is a relation between a reduction in earnings and happiness, especially in the context of the economic crisis in Spain. For this purpose an extended version of (2) including *changes in monthly net income* is estimated.

$$LS_i = \beta_0 + \beta_1 Z_i + \beta_2 \ln Y_{1i} + \beta_3 E_i + \beta_4 C_i + \beta_5 \Delta Y_{1i} + \varepsilon_n \quad (3)$$

Here ΔY_{li} represents income change, and l is a time-lag index, which ranges between one and five. The change in income variable ΔY_{li} is expressed in several different ways: as a percentage change, in logarithmic form, and as a dummy variable reflecting whether a decrease (or increase) of income has taken place with respect to a particular year.

3.3 Data

The analysis in the following sections is based on an independent survey administered in 2011 among 950 individuals in Barcelona. Data is cross-sectional and includes questions on past income and (past) happiness. The rejection rate ranged between 80% and 90%, depending on the urban district and age group. Survey agencies report that high rejection rates are common for Barcelona and can be explained by the fact that citizens are over-saturated with marketing and publicity surveys.

The major part of the data was collected in face-to-face interviews in randomly selected houses in all city districts (and 60 respondents filled in the questionnaires on the Internet). The age structure of the sample is representative for the individuals below 65 years. The number of respondents above the age of 65 years is 40% lower than what a representative sample for Barcelona would look like. This is partly a result of dropping 50 responses for missing values on key parameters such as income. Many of these belonged to senior individuals who refused to disclose their incomes, most probably for reasons of personal security. Frijters and Beaton (2012) find a similar structural problem in administering surveys, namely that most unhappy elderly individuals are unwilling to respond to surveys. The number of individuals older than 65 in the sample, however, remains fairly high (117). The under-representation of senior individuals is corrected by applying weighting and dummy variables in the regression analysis. After dropping responses with missing values, the final sample size drops to 840 individuals, 85% of whom having a Spanish or Catalan nationality.

The questionnaire included sections on free time, consumption, commuting, social relations, income, temperament, extreme events. The distribution of key demographic parameters is provided in Table 3.1 Hereafter, some highlights from the descriptive statistics per category are provided.

Table 3.1 Key descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Income 2011 (euro)	1310	1224	200	9000
Income 2010 (euro)	1334	1209	200	9000
Income 2009 (euro)	1374	1265	200	9000
Life satisfaction 2011	7,20	1,66	1	10
Life satisfaction 2010	6,95	1,78	1	10
Life satisfaction 2009	6,93	1,88	1	10
Female	0,53	0,5	0	1
Age	42,97	16,35	18	93
Education [1]	4,11	1,11	1	5
Separated	0,13	0,34	0	1
Recently separated	0,09	0,29	0	1
Single	0,27	0,44	0	1
In a relationship	0,6	0,49	0	1
Number children	0,96	1,24	0	8
Working full-time	0,46	0,5	0	1
Having flexible working conditions	0,22	0,41	0	1
Unemployed	0,09	0,28	0	1
Number doctor visits per year	1,28	2,62	0	40
Frequency of spiritual activity [2]	1,88	1,39	1	6
Frequency of doing sports [2]	3,65	1,92	1	6
Ecological consumption	0,25	0,43	0	1
Sharing (willingness to continue)	0,68	0,47	0	1
Frequency of feeling anger [3]	2,76	0,95	1	5
Frequency of feeling worried [3]	3,4	0,97	1	5
Experiencing a forestfire	0,11	0,31	0	1
Experiencing a drought	0,1	0,3	0	1
% of the time one feels happy	3,76	1,09	1	5
% of the time others are happy	2,93	2,66	1	75
Number close friends	6,85	5,85	0	40
Commuting by car [4]	1,88	1,16	1	6
Commuting by public transport [4]	2,66	1,26	1	6
Buying clothes [5]	4,92	1,1	1	7
Buying electronic devices [5]	3,29	1,14	1	6
Buying furniture [5]	2,51	1,21	1	7
Buying a car [5]	1,46	0,68	1	4
Income increase last year [6]	0,17	0,37	0	1
Income increase two years ago [6]	0,22	0,42	0	1
Income increase five years ago [6]	0,32	0,47	0	1
Income decrease last year [6]	0,18	0,38	0	1
Income decrease two years ago [6]	0,24	0,43	0	1
Income decrease five years ago [6]	0,24	0,43	0	1

[1] Without education=1, primary studies=2, secondary studies=3, professional studies=4, univ. degree=5

[2] Daily=6, weekly=5, monthly=4, less frequency than once a month=3, yearly=2, never=1

[3] Very often=5, often=4, sometimes=3, rarely=2, almost never=1

[4] More than 20h=6, between 10 & 20h=5, between 5 & 10h=4, between 2 & 5h=3, between 0 & 2h=2, 0h=1

[5] Every 2 weeks=7, monthly =6, every 6 months=5, yearly=4, every 5 years=3, every 10 years=2, never=1

[6] Dummies: means reflect proportion of sample experiencing income increase/decrease

Work

Worth noting is the particularly high percentage of individuals having flexible working conditions, or working without a contract and a fixed job. They make up more than one fifth of the sample and are the largest group after full-time workers. As a comparison,

Eurostat reports that part-time workers make up 13.2% of the labour force for 2011 in Spain.

Free time

The quantity of free time and quality of leisure are known to be important domains of happiness (van Praag and Ferrer-i-Carbonell 2004, Frank 2004). Some 40% of the respondents go out and socialize at least once a week, 15% do sports and 65% use a computer and a TV daily for entertainment. Few respondents practice spiritual activities regularly.

Social relations, friendships and sharing

Inspired by findings on the importance of social capital for happiness (Helliwell 2006, Bjornskov 2003, Konow and Early 2007) we also included variables like *trust*, *self-interest*, *willingness to share* and *confidence in the others*. The belief that people are mainly selfish is shared by 76% of respondents. At the same time 58% of respondents state that the others can be trusted. The average number of close friends is 7. An innovative feature of the study is the inclusion of questions on the practice of house-, car-, and equipment-sharing. The results demonstrate that 26% of the respondents share a car, 50% - a house (not only with a partner), 39% - various tools and 55% - electronic devices. About 68% of the respondents state they prefer sharing (to non-sharing).

Consumption and commuting

The highlights from the reported consumer behavior can be described as follows: 46% of the sample buy clothes every 6 months, 35% purchase electronic equipment annually, 30% purchase furniture every five years, 17% buy a piece of furniture once a year, and 9% change their car every five years. Ecological products are preferred by 26% of the sample. Commuting by public transport is more common than commuting by car.

Income

As indicated in Table 3.1, between 2009 and 2011 average net monthly incomes were falling. The deteriorating economic situation in Spain is furthermore reflected in Figure 3.1, which shows that the fraction of individuals receiving less than 630 € per month is increasing and the fraction of individuals with earnings higher than 1500 is diminishing. The data reveals a slightly more uneven income distribution than what the European Social Survey (ESS) finds for 2011 for the Spain in general. While the fraction of individuals with an income lower than 1050 € per month is 32% in the ESS for Spain, in our sample it is 44%. The individuals with an income higher than 3500 € per month make 8% of the ESS sample, and 4% in ours. This difference is possibly due to our sample being limited only to Barcelona city, while the majority high-income individuals reside in urban districts outside the city.

The data show a decline in average income over the last five year, suggesting that external reference points change together with internal ones. In particular, the proportion between own salary and reference group salaries remains approximately the same, while the proportion between own present and own past earnings goes through a series of changes. We can therefore study the happiness effect of a widespread income decrease which implies simultaneous income declines in individuals' reference groups. As shown in

Table 3.1, the percentages of individuals who presently have lower incomes than one and two years ago is slightly higher than the percentage of individuals with higher incomes for the same time period.

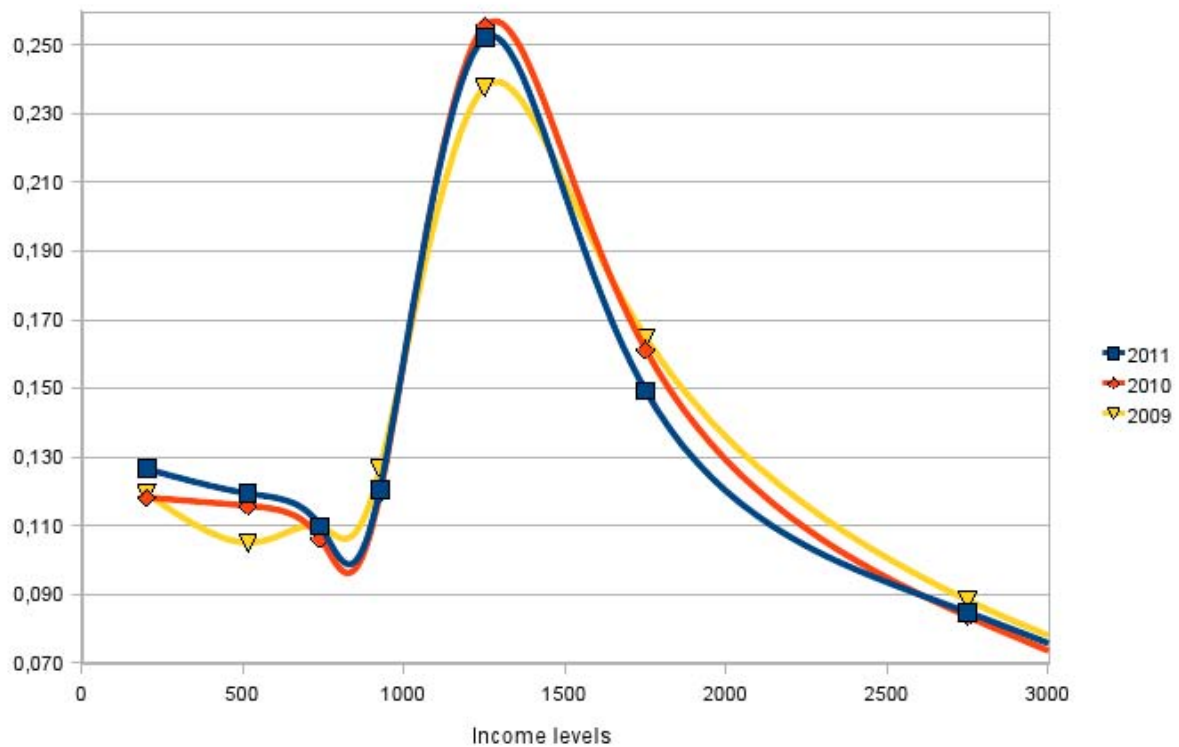


Figure 3. 1 Distribution of income levels for the period 2011-2009

Satisfaction with life

Descriptive statistics show that individuals perceive themselves as happier than the others and as happier at present than in earlier years. About 30% of the respondents state that they feel happy all of the time and only 5% believe that other people are happy all of the time. This can also be seen in the averages of these variables in Table 3.1. The mean self-reported life satisfaction in Barcelona for 2011 is 7.2, which is slightly below the level reported by ESS for the same year in Spain (7.57).

Income versus life satisfaction

Figure 3.2 plots the means of income and life satisfaction for the period 2009-2011. The figure shows that while average income is falling, self-reported satisfaction has an upward trend. Happiness statements for 2009 and 2010 are, however, retrospective. Assessment of past happiness could differ from valuation done at the very moment (or year). According to Kahneman and Riis (2005), past happiness is based on the “remembering and evaluating self” rather than on the “experiencing self”. They note that past experiences are normally evaluated by the memories of several peak periods rather than by summing happiness of each single moment. Given that data on happiness is based on ex-post evaluation, the increase in mean happiness might be due to a negative assessment of the past. The income-happiness dichotomy may also be an indication of the Easterlin paradox (Easterlin 1995). We also find an income threshold in the data beyond which correlation

between present income and present happiness changes sign. While for monthly earnings lower than 1750 € satisfaction with life and income correlate positively, beyond this threshold correlation is negative.

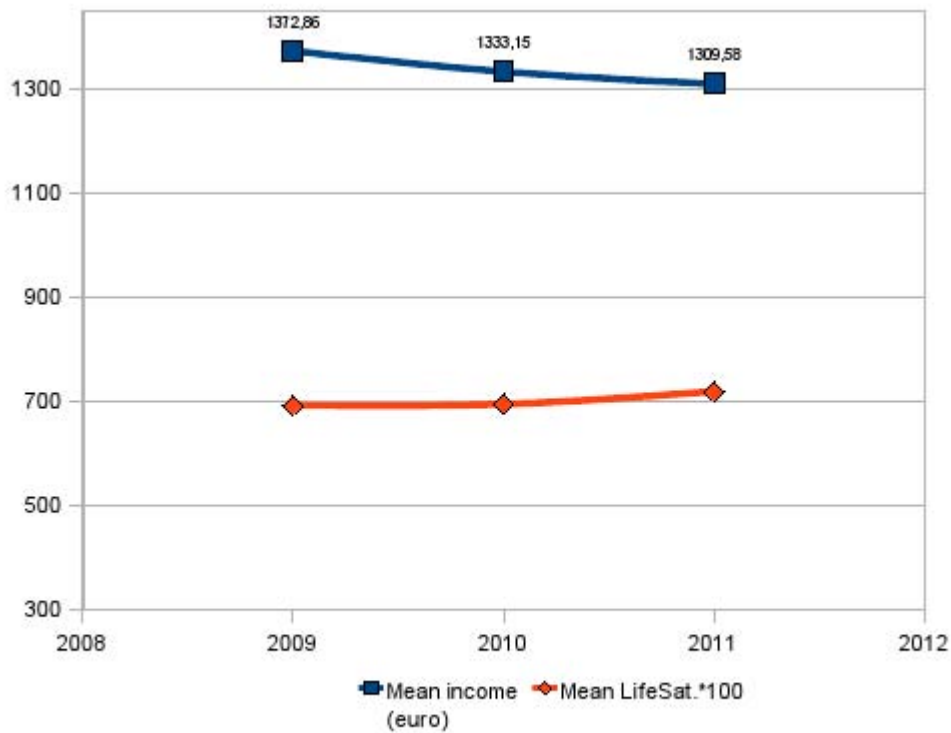


Figure 3.2 Average incomes and happiness in Barcelona for the studied period

Extreme events and climate change awareness

The questionnaire further included a section with questions related to experiencing extreme climate events. From all respondents 10% declare to have experienced a drought, 12% a flooding, 18% a heat wave, and 11% a forest fire. Experiences with heat waves, droughts and forest fires in the sample correlate highly and positively, implying that the three variables are likely to capture an overlapping climatic phenomenon. Generally, awareness about climate change is high: 73% of the respondents are aware of the implications of climate change and 95% of these find global warming worrisome, while 20% claim to distrust the scientific projections for global warming.

3.4 Empirical results

The OLS estimations of equations (2) and (3) are given in Tables 3.2 and 3.3, respectively. The demarcation principle between the models in both tables is the presence of variables that reflect conspicuous consumption (Model 1 excludes them). The letters in the titles of the models in Table 3.3 reflect the incorporation of an income decrease variable with respect to one, two and three years ago.

To correct for possible under-representation of older individuals the regressions were also weighted.¹² The difference between the results of the weighted and non-weighted model specifications was not significant. Below we discuss the model results without weighting, while the weighted versions are available upon request.

The effect of aging is negative and significant but does not follow the U-shape often found in other studies. The dummy variable corresponding to the individuals older than 65 was insignificant. This can be explained by the fact that elderly people we surveyed in Barcelona often declared feeling unsafe and socially isolated. There are some indications in the literature that elderly people living in the countryside are happier for having stronger ties with the community, better health conditions and more security (Warburton 2009). In a recent paper Frijters and Beaton (2012) comment that the typical U-shape is a result of structural problems in surveying which can be confirmed in our dataset.

The regression results for the demographic variables are generally consistent with other studies. Women are happier than men and the dummies for *past* and *recent separation* are significant and have the expected negative signs. Having *flexible working conditions* has a pronounced and negative effect on life satisfaction in all model specifications. While more flexibility in work is normally expected to enhance personal freedom and well-being, in the Spanish context flexible working conditions often imply having a precarious and unstable job, which can contribute to stress and material insecurity. *Unemployment* has the expected negative sign but is significant in only one specification (Table 3.3). Working *full-time* is not significant in any of the models and is therefore not included in the final results. The effect of working status on happiness was furthermore tested in an additional specification (based on equation 2), where the variable *working hours* was added in place of *full-time work*. While the new variable is not significant with the entire sample, restricting the sample to the individuals working more than two days per week provided a significant and negative coefficient. High working efforts thus tend to have a negative impact on life satisfaction, although the exact threshold beyond which the increase of formal working hours starts to have a negative effect on happiness cannot be defined with precision.

The variables frequency of doing sports, going out, gardening, spiritual activities, watching TV, and using a computer were also tested. Among these, the only significant ones are the frequency of doing sports and spiritual activities, appearing to be strong positive determinants of well-being in all model specifications (the endogeneity tests for these two variables was negative). Among the variables on social capital, only the willingness to share (a house, car, instruments, and electric devices) appears significant. Its estimate is positive and significant at 5% in all model specifications. Psychological characteristics of individuals, such as how often one feels angry and worried, have a pronounced negative effect on happiness. These variables were also tested for endogeneity, which was rejected for both cases.

The influence of ethnicity on satisfaction with life was not significant, nor did it improve the overall fit of the model. This can probably be explained by the fact that Latin American respondents make up the majority of non-Spanish individuals in the sample and their satisfaction with life is not significantly different from the levels reported by Spanish

¹² The weight applied to the responses of individuals older than 65 is 1.66, of those younger than 30 0.78, and of those between 30 and 44 0.84. These values are derived from Catalan statistics on the age distribution of the population of Barcelona.

and Catalan nationals. This is confirmed by the well-being measurement of the Gallup and the World Value Survey for 2011.

Table 3.2 Regression results

Life satisfaction	Model 1a		Model 2		Model 1b	
	coef.	s.e.	coef.	s.e.	coef.	s.e.
Female	0,20*	0,11	0,23**	0,11	0,21*	0,11
Age	-0,01***	0,00	-0,01***	0,00	-0,01***	0,00
Recent separation	-0,57***	0,19	-0,54***	0,19	-0,57***	0,19
Separated	-0,58***	0,17	-0,52***	0,18	-0,58***	0,17
Flexible work	-0,27*	0,14	-0,25*	0,14	-0,27*	0,14
Unemployed	-0,28	0,2	-0,3	0,21	-0,30	0,20
Doctor visits	-0,05**	0,02	-0,05**	0,02	-0,05**	0,02
Log Income 2011	0,15*	0,08	0,07	0,08	0,14*	0,08
Furniture-purchase			0,09*	0,05		
Car-purchase			0,19**	0,09		
Spiritual activities	0,13***	0,04	0,13***	0,04	0,14***	0,04
Sport	0,08***	0,03	0,07**	0,03	0,08***	0,03
Ecological consumption	0,30**	0,12	0,28**	0,12	0,30**	0,12
Share	0,27**	0,12	0,25**	0,12	0,28**	0,12
Angry	-0,37***	0,06	-0,38***	0,06	-0,38***	0,06
Worried	-0,24***	0,06	-0,24***	0,06	-0,24***	0,06
Forest fire	-0,33*	0,17	-0,32*	0,17		
Drought			8,07		-0,13	0,18
_cons	7,99	0,58		0,59	8,05	0,58
R-squared	0,21		0,22		0,21	
AdjR-squared	0,20		0,21		0,2	
Number of obs	806		791		806	

* is significant at 10% level, ** at 5% *** at 1 %

Consumption

A preference for buying ecological goods is positive and significant at 5% in all specifications. As inverse causality cannot be completely ruled out in the case of ecological consumption (i.e. happier people might care more about the environment). Applying a Durbin-Wu-Hausman test showed that endogeneity can be rejected. The other variables reflecting consumption practices which were tested are: the *frequency of purchasing clothes, cars, electronic devices, furniture, and the ownership of a vacation/secondary house*. The significant variables from this set are the *frequency of purchasing cars and new furniture*, which are both positive. The two types of goods share the features of conspicuous goods, and can be taken as an indication of status-based consumption. This holds especially for the frequency of changing car which is highly significant in all specifications, unlike the frequency of purchasing furniture.

Verhoef and van Wee (2000), for example, show that cars are often valued more for the associated status effect than use value. This can be seen by looking at how

satisfaction with life changes with car use, along each of the income categories in the sample. Keeping income constant, tripling the number of hours of car-commuting is associated with a sharp decline in the level of happiness. Furthermore, for each of the income categories, reported satisfaction with life of the people who change their car every 5 years is lower than of those who change their car less frequently. This is an indication of a short-lasting effect of car purchase on happiness. Changing the personal vehicle can serve as a strategy to regain the social prestige and satisfaction lost as one gets accustomed to the old one.

The inclusion of *car-* and *furniture-purchase* in the regression, however, reduces the size of the income coefficient by almost 50% and makes it no longer significant (as Tables 3.2 and 3.3 show). This result is logical, given that purchasing conspicuous goods is a function of income. It also means that the coefficient of *car-purchase* in Model 2 reflects not only social status but also the effect of higher earnings on happiness. For this reason we also present versions of equations (2) and (3) without the inclusion of conspicuous goods in the final results.

Income change

The standard finding that at a given point in time wealthier individuals report higher happiness level is confirmed by the significance and positive sign of the income coefficient. The reported income levels over the past five years allow for studying whether earning less (or more) than in the past makes a difference for well-being. Obviously, any results should be interpreted with care given that a happiness–income analysis is normally done with a panel data containing series for more than 10 years.

We find that income increases (in absolute, percentage, logarithmic and relative logarithmic terms) which have taken place one, two or five years ago (with respect to 2011) do not influence the satisfaction with life of the citizens of Barcelona. The three types of dummies reflecting incomes increases of magnitude higher than 90, 60 and 30% (measured in 2011 with respect to 2006) were all not significant, though having a positive sign.

Given the economic situation in Spain, what we are particularly interested in is the effect of reductions in income. Table 3.3 presents estimations of equation (3), where income decreases are introduced in the form of dummy variables accounting for the individuals who have a lower level of earnings at present than one, two and five years ago. Specifications of income decreases in absolute, logarithmic, relative logarithmic and percentage change terms were also tested and provided similar results. In Models 1a and 2a, having an income which is lower than one year ago is associated with a higher, rather than a lower, level of life satisfaction. This curious result is obtained for all model specifications and is highly significant (at 1%). One explanation for the positive effect of a recent decrease in incomes on happiness could be increased autonomy and availability of time for activities one considers meaningful (Verme 2009).

The empirical relation between income decrease and happiness is, however, more varied. While earning less than two years ago has no effect on life satisfaction, the variable reflecting that one has lower income than five years ago is significant and has a negative sign. This result is, however, not very strong though as it appears only in model specification 2 and the estimate is significant at 10%. It should be noted that the changes in income which the majority of individuals have experienced are not marginal. While the

average absolute rise in individual earnings over the period 2006-2011 is 653 €, the mean decline in earnings is as high as 1017 €. Among the individuals who saw their income decrease during this period 27% experienced a reduction of more than 60%.

Table 3.3 Regression results with income decrease parameters.

Life satisfaction	Model 1a		Model 2a		Model 1b		Model 2b		Model 1c		Model 2c	
	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.
Female	0,21*	0,11	0,24**	0,11	0,20*	0,11	0,22**	0,11	0,19*	0,11	0,21*	0,11
Age	-0,01***	0,00	-0,01***	0,00	-0,01***	0,00	-0,01***	0,00	-0,01***	0,00	-0,01***	0,00
Recent separation	-0,61***	0,19	-0,58***	0,19	-0,57***	0,19	-0,54***	0,19	-0,56***	0,19	-0,53***	0,19
Separated	-0,55***	0,17	-0,5***	0,18	-0,59***	0,17	-0,53***	0,18	-0,59***	0,17	-0,53***	0,18
Flexible work	-0,31**	0,14	-0,30**	0,14	-0,26*	0,14	-0,24*	0,14	-0,24*	0,14	-0,21	0,14
Unemployed	-0,42**	0,21	-0,42**	0,21	-0,27	0,21	-0,27	0,21	-0,22	0,21	-0,21	0,21
Doctor visits	-0,05**	0,02	-0,05**	0,02	-0,05**	0,02	-0,05**	0,02	-0,05**	0,02	-0,05**	0,02
Log Income 2011	0,19**	0,08	0,11	0,08	0,14*	0,08	0,06	0,08	0,13*	0,08	0,04	0,08
Income_de-1 [2]	0,41***	0,15	0,36**	0,15								
Income_de-2 [3]					-0,04	0,13	-0,09	0,14				
Income_de-5 [4]									-0,19	0,13	-0,24*	0,13
Furniture-purchase			0,08	0,05			0,10**	0,05			0,10**	0,05
Car-purchase			0,18**	0,09			0,19**	0,09			0,19**	0,09
Spiritual activities	0,13***	0,04	0,13***	0,04	0,13***	0,04	0,13***	0,04	0,13***	0,04	0,13***	0,04
Sport	0,08***	0,03	0,07**	0,03	0,08***	0,03	0,07**	0,03	0,08***	0,03	0,07**	0,03
Ecological consumption	0,30**	0,12	0,29**	0,12	0,30**	0,12	0,28**	0,12	0,30**	0,12	0,28**	0,12
Share	0,28**	0,12	0,26**	0,12	0,27**	0,12	0,26**	0,12	0,28**	0,12	0,26**	0,12
Angry	-0,38***	0,06	-0,38***	0,06	-0,37***	0,06	-0,38***	0,06	-0,37***	0,06	-0,37***	0,06
Worried	-0,24***	0,06	-0,24***	0,06	-0,24***	0,06	-0,24***	0,06	-0,24***	0,06	-0,24***	0,06
Forest fire	-0,33*	0,17	-0,32*	0,17	-0,32*	0,17	-0,32*	0,17	-0,32*	0,17	-0,32*	0,17
_cons	7,71	0,59	7,82	0,59	8,02	0,59	8,14	0,6	8,1	0,59	8,21	0,59
R-squared	0,22		0,23		0,21		0,22		0,22		0,23	
Adj.R-sqrd	0,21		0,21		0,2		0,21		0,2		0,21	
Numb. obs	806		791		806		791		806		791	

[1] * is significant at 10% level, ** at 5% *** at 1 %, [2] a dummy variable reflecting an income decrease one year ago, [3] a dummy variable reflecting an income decrease two years ago,[4] a dummy variable reflecting an income decrease five years ago.

One explanation for the small and multi-directional impact of income decline on happiness in the context of economic crisis in Spain could be the effect of social comparison, which

drives aspirations down when all relevant others also face financial difficulties. This has also been found in other studies (Verme 2009).

Extreme events

Equations (2) and (3) are estimated separately for *drought* and *forest fire*, as specifications with their joint inclusion makes the *forest fire* variable not significant. The coefficients of the two climate variables have negative signs, but only *forest fire* appears significant in all model specifications. This is despite the few incidences of extreme events in the sample: only 90 individuals report to have experienced a forest fire. The significance of forest fire experiences in a sample for an urban context is surprising. Carroll et al. (2007), for example, find that springtime droughts – another extreme event – are associated with a decline in life satisfaction of rural communities, and not of urban ones. The result makes sense, however, considering that forest fires in Catalonia are a frequent phenomenon due to the dry and hot climate. The significant coefficient estimate of *forest fires* suggests that happiness might not always adapt, or regain its initial level, after experiencing an environmental distress.

3.5 Discussion and policy relevance

The previous findings are interesting in themselves, as a descriptive study of well-being in Barcelona. Given the underlying focus of this study, namely undertaking a happiness analysis in a set-up that can provide useful insights for the design and impacts of effective climate policy, two results merit a closer look. One of them concerns the way a combination of income declines and conspicuous consumption affect well-being. The other is related to the impact of climatic events on happiness.

One way of looking at the small and mixed effect of income decline on well-being is as a net effect. Some individuals might have experienced certain disutility 1, 2 or 5 years ago and have later adapted, but others might have not adapted. The positive relation between income reduction and subjective well-being in the short-term is surprising as the financial cuts, unemployment and income losses due to the crisis in Catalonia were by no means equitably distributed. Individuals might not have suffered an immediate and serious decrease in happiness due to the crisis, because they were compensated by additional changes in life circumstances. For example, some individuals who lost their work engaged in social mobilization or other activities, which may have generated more satisfaction than their previous work. This is a hypothesis which evidently requires more research. Some evidence on this matter for Barcelona can be found in Conill et al. (2012).

One of the common concerns encompassing climate policy has to do with its high economic cost, or the limits that it might imply in terms of consumption (and income). The modest evidence on the relation between income decline and happiness associated with the economic crisis in Spain, shows that the immediate effect of lower consumption might not be negative, especially if it is associated with a widespread fall in income aspirations. One careful conclusion that can be drawn from these results is that the overall effect of climate policy which limits consumption (and income) is likely to be non-negative if it is accompanied by compensatory activities and life-style changes, such as lowering of working efforts and reference income standards, without endangering basic material necessities.

This is also shown by the significance of the variables associated with purchasing expensive goods in the life satisfaction regression. Yet, the results indicate that it is the frequency of purchasing cars and furniture which matters, rather than the pure use of these goods. In other words, purchasing comes out as a strategy to maintain one's starting level of happiness when due to habituation and social comparison the satisfaction obtained from older expensive goods wears off. The importance of status-based consumption for life satisfaction indicated by this finding implies that climate policy which does not take conspicuous consumption and unequal access to status goods into account, might have a negative effect on happiness. This implies that climate policy should consider tools which 'correct' for rivalry and adaptation to an increasing purchase of CO₂-intensive goods.

As suggested in the literature, happiness adaptation to changes in non-pecuniary domains, such as personal relationships, free time, health, autonomy and environment, is limited (Easterlin 2003). The evidence for a permanent negative impact of forest fires on happiness found here indicates that happiness adaptation to climate change related damages might be incomplete and result in lower levels of well-being. Nevertheless, given the small sample size and short time stretch of the study we should interpret these results with care.

3.6 Conclusions

This chapter provides empirical evidence for the city of Barcelona on the happiness effects of a decline in income, conspicuous consumption and extreme climate events. Barcelona is a relevant case for study given that the recent crisis has led to a considerable decline in personal incomes and associated consumption. At the same time droughts and forest fires are typical for the region, and likely to intensify with climate change. Apart from the standard results on social and demographic variables some interesting new findings stand out. Flexible working conditions and a overworking have a pronounced negative effect on life satisfaction, while sports, spiritual activities and the voluntary sharing of a house, a car, tools or other objects emerge as positive determinants of happiness.

We find no evidence for a decrease of happiness associated with income declines that have occurred one or two years ago. Recent reductions in income even exhibit a positive relation with subjective well-being. Having lower incomes in the long-run is, however, associated with lower happiness in some of the model specifications tested here. The higher frequency of purchasing conspicuous goods emerges as a positive determinant of happiness. The purchase of dear goods seems a strategy to maintain one's level of life satisfaction when due to adaptation and social comparison the well-being gains obtained from earlier conspicuous acquisitions wear off. Another remarkable result is that, even for citizens in a large-scale urban district as Barcelona, experiencing forest fires lowers life satisfaction.

The dual relation between income reduction and subjective well-being suggests that climate policy which affects income and consumption may not necessarily reduce overall happiness. This is especially the case if climate policy corrects for habituation and rivalry, and at the same time is able to stimulate compensatory life-style changes that lower working efforts and reference consumption standards.

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Chapter 4.

Floods and happiness: an empirical study for Bulgaria

4.1 Introduction

Floods are the most frequently occurring natural hazard, associated with substantial economic and social damages (Samuels 2004). Rising water levels and floods, following heavy precipitation, have been occurring at an increasing rate in many countries around the world. Much of these can be associated with anthropogenic climate change, river regulation measures, and changes in land cover and use (Plate 2002).

One innovative and relevant economic approach to value natural disasters like floods is based on the use of life satisfaction data. The resulting happiness-based valuation could spare researchers some of the common weaknesses of stated and revealed preference models. As Luechinger and Raschky (2007) note, revealed preference methods are based on stringent assumptions and require a complete data set of value-determining factors, while the hypothetical nature of contingent valuation surveys is associated with biased results and strategic behavior.

Happiness studies in economics have some history (Clark et al. 2008, McBride 2007; Frey and Stutzer 2005; Luttmer 2005; Blanchflower and Oswald 2004; van Praag and Ferrer-i-Carbonell 2004; Diener and Diener 2002; Clark and Oswald 1996; Easterlin 1995). The recent inclusion of environmental factors in the list of happiness determinants has given rise to a small literature on subjective well-being and the environment. Here environmental degradation is generally found to negatively affect subjective well-being, unlike environmental amenities which tend to exert a strongly positive effect (Moro et al. 2008, Brereton et al. 2008). Various studies find that poor air quality bears a negative effect on subjective well-being (Ferreira et al. 2012; Luechinger 2009; MacKerron & Mourato 2009; Welsch 2006 and 2007). Residents of Chinese cities with a high level of traffic congestion and environmental degradation tend to report a lower happiness level than those living in greener areas (Smyth et al. 2008). Even concern with biodiversity preservation has been shown to positively contribute to life satisfaction (Ferrer-i-Carbonell and Gowdy 2007).

Life satisfaction analysis is increasingly used for evaluating local climate conditions (Ferreira and Moro 2010, Van der Vliert et al. 2004). Frijters and van Praag (1998), for example, find that well-being in Russia is negatively influenced by harsh winters. Rehdanz and Maddison (2005) explain differences in self-reported levels of happiness by the variation in temperature and precipitation levels during the most hot, cold, wet and dry months of the year. In a later study, using a larger range of countries, the authors find that climates characterized by periods of longer heating and cooling are associated with significantly lower levels of life satisfaction (Maddison and Rehdanz 2011). Murray et al. (2011) study various regions in Europe and find that lower levels of sunshine and a higher degree of humidity tend to lower happiness.

Extreme climate conditions have been found to significantly affect happiness. Carroll et al. (2009) report that episodes of droughts during the spring can cause a substantial reduction in life satisfaction for people in rural areas. The authors explain this result with the possible drop in expected future incomes, caused by insufficient rainfalls,

and the psychological stress associated with it. No evidence is found for an effect of droughts on the life satisfaction of urban citizens. Studying the relation between floods and well-being for a number of European countries, Luechinger and Raschky (2007) find that flood disasters have a significant, negative effect on reported life satisfaction. A person living in a flood-prone region is likely to suffer a permanent reduction in life satisfaction in comparison with an individual living in a flood-safe area.

The literature mentioned above points to the importance of environmental conditions and changes for subjective well-being. Nevertheless the relation between extreme (climate) events and life satisfaction has received sparse attention, despite IPCC (2007) projections of an increasing frequency of droughts, heat waves and flood episodes, especially in Southern Europe. This chapter provides an empirical study of the impact of extreme climate events on subjective well-being. The particular approach pursued is to identify proxies of extreme events and analyse the changes in happiness that these incur. We take severe floods as a proxy of extreme climatic events since they are more common and more likely (than, for example, tropical storms and hurricanes) according to IPCC (2007). For this purpose, we gather data on life satisfaction and various demographic variables from eleven villages and small towns in Bulgaria that were heavily affected by sudden floods during the past seven years. The happiness effects of various types of floods are then tested through statistical regression. Bulgaria represents a particular and interesting case for happiness studies as it is positioned on the verge between the rich northern and poor southern countries, both economically and geographically. Furthermore Bulgaria has the lowest levels of life satisfaction among the countries with comparable per capita income level, (as Figure 4.1 shows). While a relatively low level of subjective well-being is common for transition countries (Hayo 2007), Bulgaria is an outlier. Since the data contains observations on past income over the last five years, we also study the relationship between subjective well-being and changes in income. This allows for comparisons between the effects of income changes and floods on happiness.

The present chapter is organized as follows. Section 2 describes the recent history of floods in Bulgaria. Section 3 presents the survey and a descriptive data analysis. The theoretical model and results of the regression analysis are given in sections 4. Section 5 discusses the results and Section 6 concludes.

4.2 Floods in Bulgaria during 2005-2010

Bulgaria has undergone several large waves of floods in the last decade. They can be classified as severe (implying substantial material and health damages associated with the flooding of an entire urban area), heavy (implying substantial material damages for part of a urban area) and medium (implying small to medium-size material damages). Severely affected households make up 6,5% of our sample, heavily affected 31% and moderately affected – 16,5%.

The floods have occurred in three historical waves: one taking place in 2005, another in 2007 and a third one in 2010. Our data, obtained through a survey, covers eleven locations where floods have occurred. Table 4.1 provides an overview of the surveyed urban areas and floods. In addition, it mentions the causes of each inundation and the scale of associated damages.

An example of a recent flood is Kostinbrod in the North-west part of the country. It occurred in 2010 and can be classified as having a medium impact. With regards to the

flood waves of 2007, data was collected in two of the most severely impacted settlements: the town of Tsar Kaloyan and the village of Bazovets (North-central part of the country). The inundation in Tsar Kaloyan was particularly severe and led to the death of 7 elderly people.

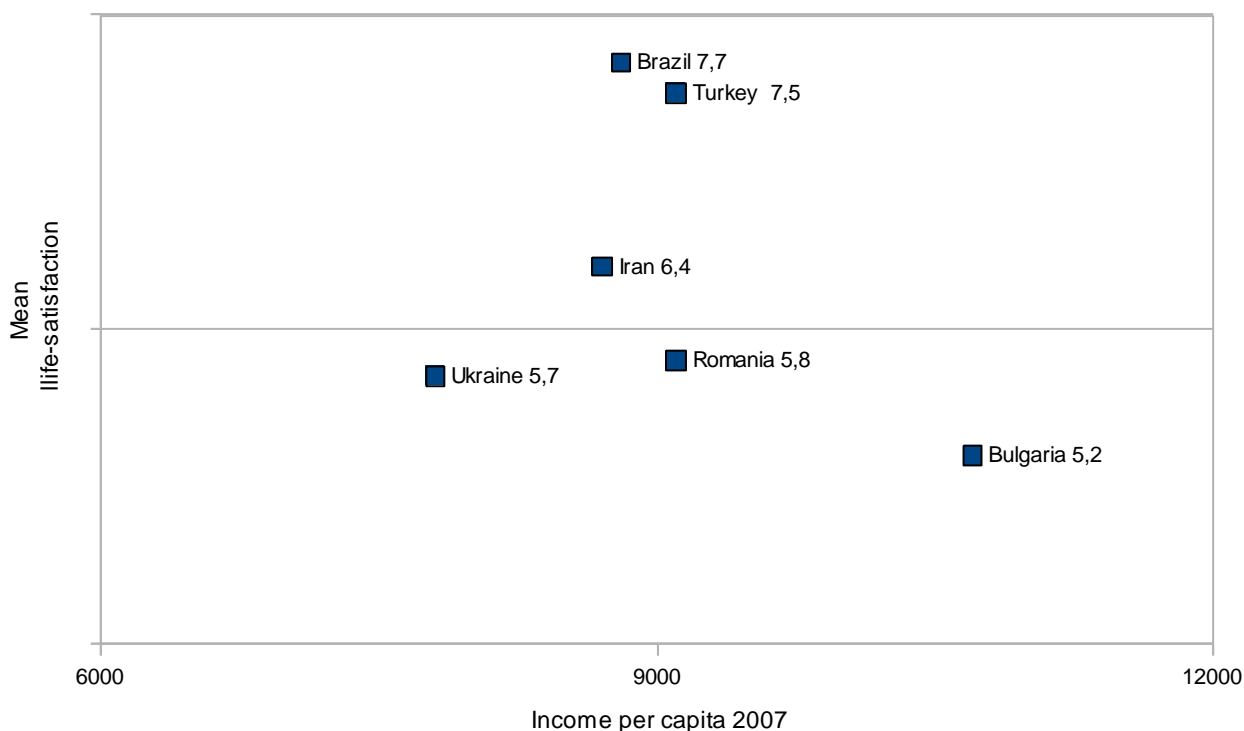


Figure 4.1 Mean life satisfaction for countries with comparable GDP per capita.

The most widespread and devastating series of floods which Bulgaria experienced over the last decade took place throughout 2005. The inundations resulted in 31 deaths, a flooding of 6,238 residential and public buildings, a complete destruction of 176 buildings and rendering 196 others unfit for living, a destruction of 21 bridges, and breaches in four dam walls¹³. Reports in popular media indicate that approximately 13 000 people were heavily affected and about 60 000 suffered medium to mild damages.¹⁴ As shown in Table 4.1, the major part of the dataset covers settlements that experienced floods in 2005. These include Baniska, Ryahovo and Koprivets (in the North-centre), and Kostenets, Ihtiman, Gorna Malina, Elin Pelin and Kalugerovo (in the west part of the country). Some of the settlements, like Ryahovo, Tsar Kaloyan, Ihtiman, Bazovets and Kostenets, were inundated twice. Majority of the floods have been caused by heavy rainfalls, followed by a swift rise of the water level in rivers and some by breaking of dam walls.

¹³ NATO, Assisting with flood relief in Bulgaria, 22.07.2005
<http://www.nato.int/eadrcc/2005/bulgaria/050722a.pdf>

¹⁴ In the Bulgarian press:
http://www.capital.bg/multimedia/infografiki/2012/02/06/1760430_multimedia_navodnenii_ata_v_bulgariia

Table 4.1 Description of the surveyed villages and towns

Place	Type	Year flood	Cause	Impacts	% sample
Kostinbrod	Town, 12014 residents	2010	Heavy rainfalls and a rising river bed.	A medium flood: Flooded gardens and 50 houses (cellars and first floors). 50% of the surveyed in town were affected by floods.	10%
Tsar Kaloyan	Town, 4022 residents	2007	Breaking of a wall of a nearby dam.	A severe flood: 7 deaths, 1100 families affected 70% of public infrastructure heavily damaged, 40 houses completely destroyed, and 540 others with substantial damages.	7%
Bazovets	Village, 1007 residents	2007	Heavy rainfalls and a rising river bed.	A heavy-flood: inundated streets, house cellars and first floors and substantial material damages.	4%
Koprivets	Village, 972 residents	2005	Heavy rainfalls and a rising river bed.	A severe flood: 40 residential and public building flooded (some destroyed). Damaged agriculture production, drown animals and psychological damages (high levels of stress among impacted residents).	4%
Baniska	Village, 1335 residents	2005	A rising river bed, forming a 5 meter high water column	A severe flood: destroyed residential buildings, personal vehicles dragged by water, streets and houses blocked with mud, drown animals, and psychological and health damages.	4%
Elin Pelin	Town, 6576 residents	2005	Heavy rainfalls and a rising river bed.	A heavy flood: 1000 people evacuated, residential houses and gardens flooded. The water level on streets reached 1 meter.	9%
Ihtiman	Town, 13458 residents	2005	Heavy rainfalls, a rising river bed and over-flooding of a dam.	A heavy flood: 2000 people evacuated, residential houses flooded, water level on streets reached 1,8 meter. 50% of the surveyed in town were affected by floods.	8%
Gorna Malina	Village, 1444 residents	2005	Heavy rainfalls and a rising river bed.	A severe flood: 700 house-cellars and first floors flooded, 7000 people affected and 160 evacuated, reports on psychological (stress, insomnia) and health damages.	4%
Ryahovo	Village, 1852 residents	2005	A rise in the level of the Danube river.	A medium flood: inundated agriculture lands, gardens, house-cellars and first floors. Citizens living in stress for a number of days, expecting the level of the river to rise.	5%
Kalugerovo	Village, 1414 residents	2005 2006	Over-flooding of a dam.	A heavy flood: House cellars and first floors inundated, reports on high levels of psychological damage (stress), including one death due to	5%

a shock.

Kostenets	Town, 7498 residents	2005 Heavy rainfalls and a 2006 rising river bed.	A heavy flood: 1000 houses flooded in 2005 (cellars, first floors and gardens). Material and health damages reported for both 2005 and 2006.	8%
Samokov	Town, 26419 residents		Not flooded	13%
Radomir	Town, 14419 residents		Not flooded	8%
Buhovo	Village, 2942 residents		Not flooded	5 %
Elshitsa	Village, 945 residents		Not flooded	5 %

4.3 Survey data and descriptive analysis

Data was gathered through a face-to-face survey administered in 2011 among 600 randomly selected individuals in 15 villages and towns. The sample reflects the age and gender structure of the respective municipal populations, located in the west and north regions of Bulgaria. We attempted to have about 50% of the observations coming from flood-affected areas. Eventually flood-affected respondents made up 58% of the sample, residing in 11 towns and villages; that is, respondents from four towns did not suffer floods but were included for comparison (control group). As addressed in Table 4.1, the floods have a varying degree of intensity (from severe to moderate) and have occurred in relatively small settlements (having less than 30 000 inhabitants). This explains the relatively low rejection rate of survey responses, (one in fifteen). The sample with the control group was drawn from towns and villages of comparable size, and located nearby, to allow for comparison (last four entries of Table 4.1).

The questionnaire used in the survey included sections on demographics, leisure, commuting, social relations, income, temperament, extreme events and awareness about climate change. Table 4.2 provides the descriptive statistics on key variables for the entire sample and relevant sub-samples. This allows for differentiation between the type of settlement (village or town), as well as between the respondents experiencing a flood and the control group (in the last column). Data was drawn just once, i.e. there are no observations available before and after the inundations, although we have responses on past income and happiness.

The section on subjective well-being includes questions on how often one feels happy and believes that the others feel happy, as well as on (past and present) satisfaction with life, work, income, family, free time and social life. We find a fairly high correlation between the scores on satisfaction with life and the percentage of time one reports to feel happy (about 50%). Furthermore, respondents tend to substantially underestimate the happiness of others. Whereas 65% of the respondents believe that others feel happy only $\frac{1}{4}$ of the time, only 30% of the surveyed report to be happy $\frac{1}{4}$ of the time. As shown in

Table 4.2, mean life satisfaction for the entire sample is 5,42. As a quick validity check of this result, the World Database on Happiness (WDH) provides an estimate of 5,81 for life satisfaction in 2007¹⁵ and the World Value Survey (WVS) of 5,2 in 2006, implying our estimation falls in between.

Table 4.2 Key descriptive statics

Variable	Entire sample	Villages	Towns	Experiencing flood(s)	Not experiencing flood/s
Life satisfaction 2011	5,42	5,10	5,60	4,87	6,21
% time one feels happy	46%	39%	49%	41%	52%
Age	48	52	46	53	42
Education	3,10	2,90	3,21	2,95	3,31
Income 2011 (BGN)	214	203	221	191	248
Working full-time	34%	31%	36%	29%	41%
Unemployed	17%	18%	17%	19%	15%
Pensioned	5%	6%	4%	5%	3%
Health problems	34%	41%	29%	39%	25%
Married	62%	63%	61%	66%	56%
Belief in mutual aid	52%	63%	46%	57%	46%
Distrust	80%	78%	81%	78%	82%
Informed about climate change	74%	74%	75%	70%	81%

Like in many post-socialist states reports on life satisfaction are relatively low (Hayo 2007). As Figure 4.1 indicates, subjective well-being in Bulgaria is substantially lower than in most countries with similar, and even lower, income per capita. In neighbouring Serbia, with whom Bulgaria has a lot in common in terms of language and culture, mean life satisfaction is 0,8 units higher (WVS 2006), although income per capita there is almost \$6000 less for the same year. Given that happiness is multidimensional, i.e. determined by a wide range of factors such as health, work, marital status, state of the environment, political freedom, social capital, and income inequality (van Praag and Ferrer-i-Carbonell 2004) an explanation for the extremely low levels of subjective well-being in Bulgaria should be sought beyond income per capita. One factor which may play a role is the pessimistic outlook and lack of trust embedded in the Bulgarian society. This partly comes out in the results: 80% of the respondents agree with the statement that “people will always take advantage of you if they had an opportunity” (a variable defined as “distrust” later on). Moreover, when asked to reflect on their life satisfaction in the past, respondents provide much higher values. Average reports on past life satisfaction (for 2010 and 2009) are 5.72 and 6.18, respectively, or much higher than present levels, despite the fact that

¹⁵ R. Veenhoven, World Database of Happiness, collection Happiness in Nations, Overview of happiness surveys using Measure type: 112D / 10-step numeral Happiness. This number refers to responding to the following question “Taking all things together on a scale of one to ten, how happy would you say you are?”

estimates for both years (as registered in WDH) have hardly risen above 5. Pessimism and the idealization of the past might be some of the factors which mediate (current) happiness in Bulgaria. Furthermore, when looking at the mean domain satisfactions, the lowest score is given to satisfaction with income (4.08), followed by satisfaction with work (4.57). Given the importance of social comparison for happiness (Clark and Oswald 1996, Blanchflower and Oswald 2004, McBride 2001; Luttmer 2005), another cause for the low subjective well-being in Bulgaria can be sought in the rise of reference income standards. If Bulgarians compare themselves with citizens of the older EU member states (rather than with their post-socialist Balkan neighbours), it is possible that the fast rise of reference income standards during the post EU-entrance years tempers life satisfaction in the country. Furthermore, mean life satisfaction of women is 0.28 points lower than for men. Here Bulgaria differs from post-socialist countries as well, since women there report higher levels of happiness on average.

Reviewing the descriptive statistics, the percentage of people with health problems in the sample is relatively high (34%). This is a result of the relatively older population in the surveyed villages which make 36% of the sample. Unemployment is slightly higher than the average for the country (17%). This is due to fact that employment rates tend to be higher in larger cities, which are not part of our sample. Regarding education 2,5% of the respondents do not have a basic-school education. People with secondary education represent the largest group, 49% of the sample, while the ones with a university degree account for only 12%. Monthly income for 2011 is 110 Euro, which is 10% and 9% lower than in 2010 and 2006, respectively. Regarding leisure, 90% of the respondents watch TV on a daily basis and 39% do gardening or domestic reparation every day, implying that a substantial part of the sample work in agriculture or in the household.

Concerning the variation between the categories in the columns of Table 4.2, income, employment and education levels are higher in towns and in the group which did not suffer a flood (comprising both towns and villages). One interesting finding is that belief in mutual help is highest in villages and the group which experienced floods. Distrust is generally high in all categories. The percentage of respondents informed about climate change is lowest in the group which experienced floods. Subjective well-being in villages is half a point lower than in towns, which is possibly due to the aging population, and the associated higher frequency of health problems.

One of the core results in Table 4.2 concerns the difference in the level of life satisfaction between the sample affected by floods and the control group. The average happiness of a flood-affected respondent is 1.34 points below that of an individual from the control group. The individuals affected by floods are on average older, less educated, with more health problems and more likely to be unemployed, which is expected to increase their vulnerability to extreme climatic events. Nevertheless, as we show later, this does not entirely explain the large variation in life satisfaction between the control group and the people who have experienced inundations.

4.4 Theoretical model

The approach to subjective well-being analysis adopted here is based on self-reporting. Individuals are asked to answer the question: "Taking all things together, how satisfied do you feel with your life at present?" Possible answers range from one to ten, where one corresponds to complete dissatisfaction and ten to complete satisfaction with life. The

reliability of this measure has been tested reasonably well and high correlations between satisfaction with life and various objective physiological and medical criteria have been found (Di Tella and MacCulloch 2006, Kahneman and Krueger 2006, Helliwell et al. 2012). Furthermore, reports on life satisfaction remain relatively stable and happen to reflect actual changes in life circumstances (Ehrhardt et al., 2000, Eid and Diner 2003).

The present modelling approach is based on the assumption that satisfaction with life is explained by variation in a number of observable characteristics. In the present analysis we adopt an Ordinary Least Squares (OLS) model:

$$LS_i = \beta_0 + \beta_1 X_{i1} + \dots + \beta_p X_{ip} + \varepsilon_n \quad (1)$$

Here LS is the measure of satisfaction with life, p is the number of characteristics which jointly determine happiness, i denotes the number of observations, and β is the strength of characteristic p . Estimates of β are derived by minimizing the sum of squared residuals.

Considering that the dependent variable is always a discrete number between 1 and 10, the alternative statistical approach commonly used is Ordered Probit (OP), as it assumes that answers are only ordinarily comparable. Ferrer-i-Carbonell and Frijters (2004) show that the two model specifications provide comparable results and are equally robust. In order to test possible divergences we estimated both models. Since the results were very similar in terms of the sign and significance of the coefficients, we present hereafter only the results of the OLS regressions.

Certain demographic variables, such as age, gender, education, marital and employment status, health, income, leisure and ethnicity are commonly considered key determinants of happiness. The set of factors which influence life satisfaction is, however, much larger. Regression analysis can also include personality traits, temperament, trust in others, social capital, commuting, freedom, state of the natural environment, security and particular life circumstances, such as experiencing extreme climate events. Evidently, not all happiness determinants can be captured and some usually remain hidden in the error term. The baseline equation we estimate is the following:

$$LS_i = \beta_0 + \beta_1 Z_i + \beta_2 C_i + \varepsilon_n \quad (2)$$

Here Z_i is vector of demographic and socio-economic variables (i.e gender, age, health, education, income, marriage and employment status, free time, social capital and temperament), and C_i is a vector of variables which indicate flood experiences and their intensity.

We are also interested in testing an extended version of the model including variables associated with changes in personal net income. The variable ΔY_{ji} in 3 reflects a change in income, where j is the reference year with respect to which the change has been calculated.

$$LS_i = \beta_0 + \beta_1 Z_i + \beta_2 C_i + \beta_3 \Delta Y_{ji} + \varepsilon_n \quad (3)$$

The income change parameter is introduced to correct for possible material gains and losses taking place after the extreme events so that the “pure” social and psychological effects of the flood can be isolated.

4.5 Empirical results and discussion

Equation (2) is first estimated in a baseline specification with a dummy variable which only reflects a flooding experience (denoted as OLS 1). Next we expand the model adding variables that reflect the scale of the damage and the timing of the flood to test for adaptation (denoted as OLS 2 and 3). Finally, variables on income change are added to test for specification (3), in OLS 4 and 5 respectively.

Results of all models are shown in Table 4.3 The only variable which is not significant in any of the happiness regressions is *female*. This is to be expected considering the lower average level of happiness among women in the sample. Next we find the typical U-shape for *age*, implying that subjective well-being gradually decreases over time until it reaches a critical minimum (at the age of 65 in our data) from where it picks up again. Experiencing a flood at an older age, is however associated with a persistent drop in happiness. This is seen in Figure 4.2 which shows median life satisfaction at each age. A steep descent in subjective well-being is observed at the ages of 65, 75 and 85 where individuals affected by floods are located.

Having serious *health* problems has the standard negative sign in all specifications. *Marriage* has the typical positive sign but the variable is significant only when introducing the time-lag of the experienced floods (in OLS 3, 4 and 5), implying that this model provides a better fit of the data. *Unemployment* is a significant source of disutility, and *income* has the expected positive sign. The coefficient of *education* is positive and significant, although mean happiness is lower for higher education levels.

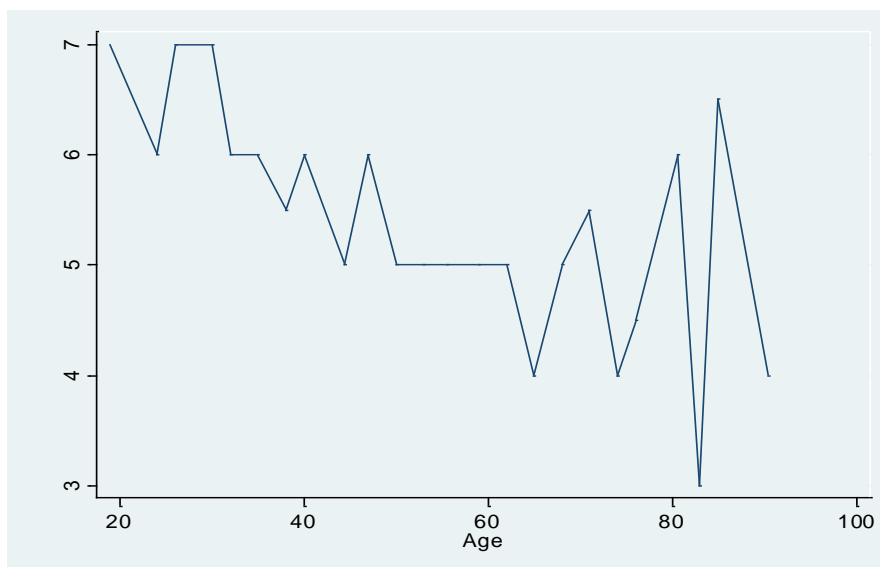


Figure 4.2 Median life satisfactions at each age category

The only significant variable among the ones related to free time, such as as doing sports, going out, watching TV, gardening, is *music*, capturing the frequency of dancing, singing or playing a musical instrument and possibly reflecting the importance of folklore. The variable is, however, significant only at 10% in OLS 1. Among the variables reflecting temperament which we tested only *worried* was significant (and not endogenous) and

having the expected negative sign. Next, *bonafide*, capturing the belief that people tend to help each other, contributes strongly and positively to subjective well-being.

Although mean happiness is lower in villages than in towns, living in a village, does not emerge as a determinant of life satisfaction. Likewise, the individuals of Roma ethnicity in the sample do not have a significantly different level of subjective well-being from the rest. The two variables (village and ethnicity) were not included in the table as they were not significant.

Among the variables related to extreme events experiencing a *flood* emerges as one of the strongest negative predictors of happiness, regardless of its scale and timing, (as seen in OLS 1). Having experienced a flood is associated with a direct reduction of life satisfaction by 0,7 points. The effect is larger than that of most other dummy variables, including unemployment. Introducing dummies which account for the type of flood intensity (in OLS 2 and 3) shows that impacts are more pronounced at higher damage levels. As shown in OLS 2, house destruction, or suffering physical or psychological damages as a result of the flood, captured by the coefficient of *severe damage*, leads to a permanent decrease in subjective well-being by almost one unit. Suffering a flood with substantial material damages, such as having water inside the house and deterioration of its interior and exterior, indicated by the coefficient of *heavy damage*, reduces life satisfaction by approximately half a point. While the two results suggest that happiness does not completely adapt after experiencing severe or heavy flood, there is some evidence that its negative impact decreases with time. As seen in OLS 3, *year_disaster*, indicating the number of years which have passed since the event took place, is negative and significant. Recent episodes of flooding have a more pronounced effect on life satisfaction, and happiness catches up with 0.09 points every year after the inundation. Furthermore, the variable reflecting a lack of self-perceived risk of natural disaster, indicated by the variable *no worry for extreme events*, is highly significant and positive. Alternatively, living with the perception of the risks, associated with extreme events, captured by the variable *worry for extreme events*, has a strong negative effect on happiness (OLS 3, 4 and 5).

Our results generally confirm the findings of Luechinger and Raschky (2009), which is the only happiness study on floods we are aware of. Nevertheless, two types of objections can be raised at this level. Firstly, the strong influence of floods on life satisfaction may be driven by large-scale material losses which have not been properly compensated. In order to check for this we ran a regression with past and present income level as dependent variable(s), determined by age, education, gender, marriage, employment status and flood experience. The variable reflecting a flood experience is significant and negative, implying that indeed part of the income decline experienced by the respondents is likely to be associated with an inundation. As an additional check, income decreases with respect to one, two and five years ago were separately introduced as independent variables in the initial happiness regressions (OLS 1, 2 and 3). The variable was specified as either a percentage change or a dummy. Either way, it did not appear to be significant. One could thus argue that part of the strong negative effect of floods on happiness is associated with material or income damages which have not been properly compensated, despite the small impact of past income loss on happiness.

Table 4.3 Regression results

Life satisfaction	OLS 1		OLS 2		OLS 3		OLS 4		OLS 5	
	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.	coef.	s.e.
Female	0,03	0,16	-0,03	0,16	-0,04	0,16	-0,07	0,16	-0,05	0,16
Age	-0,03***	0,01	-0,03***	0,01	-0,03***	0,01	-0,03***	0,01	-0,03***	0,01
Aged above 65	0,83***	0,28	0,83***	0,28	0,86***	0,28	0,81***	0,28	0,82***	0,28
Health problems	-0,41**	0,18	-0,39**	0,18	-0,40**	0,18	-0,44**	0,18	-0,40**	0,18
Education	0,26***	0,09	0,24***	0,09	0,21**	0,09	0,22**	0,09	0,22**	0,09
Married	0,24	0,17	0,26	0,17	0,29*	0,16	0,33**	0,16	0,30*	0,17
Unemployed	-0,58**	0,26	-0,60**	0,25	-0,58**	0,25	-0,52**	0,25	-0,56**	0,25
Log Income 2011	0,35***	0,11	0,32***	0,11	0,26**	0,11	0,20*	0,11	0,24**	0,12
Income_in-2 [3]							0,64***	0,21		
Income_in-5 [4]									0,15	0,17
Music	0,12*	0,07	0,11	0,07	0,10	0,07	0,09	0,07	0,09	0,07
Worried	-0,44***	0,07	-0,41***	0,07	-0,39***	0,07	-0,40***	0,07	-0,39***	0,07
Bonfide	0,41**	0,16	0,40**	0,16	0,38**	0,16	0,42***	0,16	0,38**	0,16
Heavy damage			-0,50**	0,2	-0,54**	0,2	-0,52**	0,2	-0,53***	0,2
Severe damage			-1,04***	0,34	-1,07***	0,34	-1,06***	0,33	-1,06***	0,34
No worry extr.events	0,62**	0,25	0,52**	0,24						
Worry extr.events					-0,47**	0,16	-0,47***	0,16	-0,47***	0,16
YearDisaster			-0,09***	0,03	-0,09**	0,03	-0,09***	0,03	-0,09***	0,03
Flood	-0,7***	0,17								
_cons	5,84	0,74	6,04	0,73	6,57	0,74	6,55	0,74	6,59	0,74
R-squared	0,32		0,34		0,34		0,35		0,34	
Adj R-squared	0,30		0,32		0,32		0,33		0,32	

Notes: [1] n =599, [2] * is significant at 10% level, ** at 5% *** at 1 %, [3] a dummy variable reflecting an income increase with respect to two years ago,[4] a dummy variable reflecting an income increase with respect to five years ago

Secondly, life satisfaction is lower among the individuals who are socially and economically disadvantaged, meaning living in risky areas (close to river banks), having lower income and poor health or housing. At the same time this group is more heavily affected by floods. To test for the differential impact of floods on various social groups we restrict the sample to the richest individuals, or those in the highest four income quintiles of the sample and ran the OLS 1, 2 and 3. The variable *flood* remains equally significant and similar in effect for both poor and rich individuals. Although our data does not have observations on the level of subjective well-being before the inundation, this result indicates that the material and emotional impacts of floods have a comparable (negative)effect on well-being of relatively rich and poor households.

Finally, the extended version of the model (3) is estimated and presented in OLS 4 and 5 of Table 4.3. The variable *income change* (in absolute terms, as a percentage change, as logarithmic change and as a dummy) is introduced in the regression analysis to control for the effect of potential material gains and losses after the flood. The last two columns of Table 4.3 present the model estimations with a dummy variable indicating an income increase occurring with respect to two and five years ago. An income increase with respect to two years ago emerges as a positive and significant factor for life satisfaction (although

only the dummy specification of the income increase was significant). Increases in income which occur five years ago, however, do not have an effect on the present level of happiness. This finding is consistent with the literature on adaptation to income increase (Diener and Diener 2002, Easterlin 2003). Testing various specifications of a variable reflecting *income decreases* occurring two and five years ago did not result in significant coefficients and was therefore not included in the final results.

4.6 Conclusions

In this study we tested the effect of various degrees of flooding on happiness. Floods considered ranged from inundations associated with physical and psychological harm and house demolition, to ones that caused high water levels in gardens and cellars. Eleven cases of floods that occurred in various regions of Bulgaria, between one and seven years ago, were studied.

The regression results indicate that experiencing a flood and living with the perception of the risks associated with extreme events is associated with a considerable decrease in life satisfaction for all income and age groups. This impact is stronger for more severe floods. Furthermore, while the negative effect of inundations on happiness wears off with time, it does not completely disappear. The individuals affected by floods tend to be older, less educated, having more health problems and less employment opportunities. Yet, the generally disadvantaged position of the individuals affected by floods does not explain the profound (negative) impacts of the studied inundations on the well-being of individuals in the sample.

The present study further reveals particular features of the Bulgarian context, notably a generally low level of trust in society. Moreover, recent income increases are found to have a positive impact on subjective well-being, while a rise in earnings occurring five years ago does not have a substantial effect.

Floods represent extreme (climatic) events that are both widely distributed and associated with significant economic and social damages. If the type of events we have selected can serve as a proxy of the natural disasters that climate change is expected to bring about, we should expect a persisting and possibly irreversible reduction in well-being. This implies that climate change may be costlier than what is commonly estimated in economic studies, especially for the domains of human health, social conditions and security. Stated differently, while happiness seems to adapt to changes in income over time, it might not adapt to extreme climate events. This finding deserves more attention in climate policy.

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Chapter 5.

Drivers and challenges of sharing in the context of climate change mitigation

5.1 Introduction

In a recent survey on attitudes towards sharing, commissioned for various regions of the UK, 81% of the respondents state that sharing makes them feel happy and 75% declare to feel better when sharing their time and possessions with others (Griffiths 2011). Sharing has a positive connotation, one of cooperation, togetherness, and sociality. The term is wide in meanings, among which: to apportion, to budget, to cut, to set aside, to slice, to give and to allot. The definition of sharing adopted here is however confined to the collective use of physical resources and goods in a consecutive or simultaneous manner.

Writings on sharing treat its conceptual differences with gift, reciprocity and barter. For anthropologist John Price (1975) sharing is the most universal form of human economic behaviour, which ensures that the “intimate” (i.e. small-scale and personal) economic system effectively distributes resources in a non-reciprocal manner. Belk (2007, p.127) sees sharing as “the act and process of distributing what is ours to others for their use”. In a literature review in the field he notes that sharing tends to be overlooked, and confused with commodity exchange and gift (Belk 2010). Benkler (2005) also positions sharing as based on social-relations which are not necessarily reciprocal. He believes that sharing represents a modality of production, which is widespread, while undervalued in many advanced economies.

A review of more than 300 academic papers with the word “sharing” in the title shows that the term is most frequently studied in the context of managing digital information, or distributing costs, risks and various “bads”. Less research has been dedicated to sharing in the sense of joint use and management of objects. This type of sharing is interesting for several reasons. On the one hand, it can contribute to mitigating pressing environmental problems (e.g. climate change). It is a solution to regulating consumption without sacrificing access to many life-essentials. This is especially relevant considering that increasing the use-efficiency of goods, understood as the highest number of people using a particular item throughout its life-cycle, is not an objective meticulously pursued by public policy. On the other hand, sharing might be too easy of an answer. Sharing can also backfire and result in an increased use of resources. This is an important consideration given the rise of collaborative consumption practices¹⁶, defined as systems of organized bartering, lending, trading, renting, gifting, and swapping where sharing plays a prominent role (Albinsson and Perera 2012, Bollier and Helfrich 2012, Lietaert 2010).

Sharing can be studied as a private and as a socially-optimal decision, implying its drivers differ in each of the the two cases. Here a schematic cost-benefit model is used to derive the conditions under which sharing is beneficial for a rational individual and for society at large. One of the model highlights is the consideration of potential rebound and educational effects of sharing. It further considers the interplay between sharing and

¹⁶ <http://www.collaborativeconsumption.com/the-movement/snapshot-of-examples.php>

rivalry-based, or conspicuous, consumption. Drawing on original data from metropolitan Barcelona (Spain) and rural Bulgaria several common types of sharing are identified and their psychological, social and cultural determinants sought in series of regressions, using an Ordered Probit model.

This chapter is structured as follows. Section 2 surveys different formats and manifestations of sharing. Section 3 develops a schematic cost-benefit model presenting the trade-offs between the gains and losses of sharing for an individual and for society. Section 4 provides an empirical study on the determinants of sharing cars, housing, electro-domestic appliances and tools, based on data from Bulgaria and Spain. Section 5 discusses the results and Section 6 concludes.

5.2 Types of sharing

The first differentiation in the domain of sharing one can make is with regards to its organization. Sharing can be done commercially (i.e. purchasing a laundry service) or non-for-profit (using a washing machine among friends). The first type of sharing is discussed in the literature on product service systems, and the second - in anthropological studies and in writings on collaborative lifestyles. A number of sharing practices, such as markets where goods are given away, swapped or sold, however fall in the grey area between the two (Botsman and Rogers, 2010).

Commercial solutions to sharing abound. Mont (2004), for example, looks at product service systems as an alternative to ownership. Reviewing schemes for tool rental and laundry services in Sweden, she finds that washing machines have a higher success at sharing. Users of public washing-machines are generally satisfied with the equipment quality and availability. Tool rental by private persons is, however, relatively low. Only between 5% and 10% of the available commercial renting services are rendered to private persons. Mont concludes that commercial sharing is more likely to happen for goods which are relatively expensive, infrequently used and having high insurance and maintenance costs. Prettenhaler and Steininger (1999) also find that the switch from ownership to service-purchasing would be easier for durable high-value goods, whose total flow of services does not extend beyond one's lifetime. Observing schemes for commercial sharing, Lamberton and Rose (2012) find that the propensity to share is defined by consumers' perceived risk of product scarcity even when cost, utility, substitutability, and knowledge are accounted for. Approaches to sharing as a prosperous business model appear in a book by Gransk (2010), titled "Why the future of business is sharing". There the author argues that making money and building communities of sharing can go together. In her words companies can flourish by renting goods at the moment when these are needed, 'relieving' customers the burden and expenses of ownership. The intention here is to maximize profits on sales of services, rather than on sales of goods¹⁷.

¹⁷ This vision of the sharing economy, however, does not go without a criticism. Paul Davis, editor of the Shareable Magazine, comments that: "Focusing on the profit motive reduces the scope of the sharing economy, from a transformative cultural movement to an easy way to make a quick buck. Sharing isn't just a way to make startups profit ...—it's a cultural movement that has the power to build community, engagement and a new, more sustainable peer-to-peer economy, transforming how we define our interpersonal relationships in the process" in Davis, P.M. 2011. Collaborative consumption: It's not about the Money. www.shareable.net

The literature on sharing as an informal, non-for-profit or collaborative practice is less rich (Botsman and Rogers 2010). Non-commercial sharing is more complex and varies with the locus of ownership. Shared goods can either be individually or communally owned. The use rights and responsibilities associated with these two types of ownership differ. Sharing goods with a community-based ownership can be related to the work of Elinor Ostrom, demonstrating how resources can be sustainably and collectively managed outside market and state institutions (Ostrom 2003, 2010). Studying the motivation of people using communally owned goods, such as library toys, Ozanne and Ballantine (2010) find that sharing is often chosen as a way to reduce consumption and a form of market resistance. Another recent publication, by Albinsson and Perera (2012) looks at sharing in grass-root marketplaces, organized by consumers for consumers. The authors find that participation is often non-reciprocal and driven by the desire and need to foster social collaboration and strengthen communities.

One practice which falls in between the commercial and non-for-profit domains, is mobile phone-sharing in Africa. James (2011) finds that mobile phones can be shared by up to ten people, either within a family or commercially in a number of African countries. If phone-sharing, rather than ownership, is considered, he estimates that mobile-phone use in Africa is almost as high as in Europe. In poor countries, he notes, the benefits from use are more heavily derived by the sharing of a particular technology, rather than from its ownership.

Sharing further differs with goods' design and function. Public goods with high fixed costs (such as hospitals, schools, public transport, parks, museums, libraries) and some private ones (restaurants, bars and music clubs) are generally designed for sharing. Much of the transport, energy, communication and entertainment infrastructure is meant, built and existing for a shared use. We also share small-size goods, such as newspapers in trains, books in libraries, bicycles in public transport schemes, and dining tables in restaurants. Other categories of goods we tend to share less. Private goods (like houses, cars, swimming pools) are commonly shared within a close group of friends or relatives. Often the sharing of these goods is asymmetric, implying that one individual, or family, has the property and priority use-rights. Furthermore, while having one stationary telephone, one music player, one car and one computer per household was common in rich countries about ten years ago, now the number of these items per household is growing proportionate to the number of members. Some goods are now especially tailored for individual use. Examples are small-size laptops, I-pods, and mobile phones. Non-durable small-sized goods, which are not easy to repair are costly to share as they easily break down and are relatively expensive to fix. The trend towards reduced sharing of various appliances and tools is thus driven, among the rest, by a goods' design.

Still, few of the goods we use are strictly individual. Unless we live alone, we share the larger part of everything in the household or office with others. A large number of these goods are "lumpy" according to Benkler (2005), meaning that they can only be provided in certain discrete bundles, offering discontinuous amounts of functionality or capacity. The author gives examples with computer processors, books, cars, and toys. Since only the owners of these goods use the capacity generated by them, a large pool of idle and excess capacity is generated in many small "drops" while remaining unused. Unlike Mont (2004), Benkler finds that sharing smaller and not too dear objects is relatively easy to achieve because individuals are not interested in buying excess capacity.

Nonetheless the most common examples of sharing studied in the literature concern pricy and bulky items like housing and cars. These are reviewed in turn.

Co-housing projects are broadly understood as neighbourhood developments where various facilities are combined to respond to the social and the practical needs of urban citizens. Lietaert (2010) shows that cohousing projects started 30 years ago in Denmark, and quickly spread to the Netherlands and Sweden, where the model was institutionalized in 1980. Eventually these type of projects appeared in the USA, the UK, Australia, New-Zealand, Canada, Japan and more recently in Italy, France, Belgium and Spain (McCament and Durrett, 1993). While the concept of co-housing dates from pre-industrialised times, implementing it in the context of post-industrial societies, where people rarely work where they live, is meant to recreate social links and share daily amenities (Lietaert 2010). Heath (2004) finds that the nature of the relationships and proximity that arise and exist between household members are crucial for house-sharing¹⁸. People self-select for the type of house-sharing, be it peer or family-based. In an older study of the US housing market Schreter (1986) writes that most people who share their homes do so consciously and voluntarily, rather than due to considerations of age, debility or income disadvantages. Schreter further notes that living with others, either family or friends, is reported to be more psychologically rewarding. Based on a data-set of 1,018 individuals in the UK, Griffiths (2011) shows that 72% of the respondents prefer sharing their homes rather than living on their own. Mulder et al. (2006) further find that communities using shared housing are likely to have a higher and more sustainable quality of life and lower rates of consumption than the average, which is relevant for the analysis in the upcoming section). For this a balanced contribution from built, human, social and natural capital, as well as proper community design are crucial.

Cars are the other category of goods most commonly studied in the literature on sharing. The UK survey on the attitudes to sharing quoted earlier reports that 63% of the population would like to share their journeys to work. One of the largest car-sharing companies in the US has about 360,000 members and roughly 6,000 cars, implying up to 60 users per car¹⁹. The forms of car-sharing are further diversifying. Shaheen et al. (2012) find that peer-to-peer vehicle sharing is growing, especially in the cases when trust among the auto-owners and renters is enforced. Mont (2004) notes that car-sharing is usually chosen for the associated capital and maintenance costs savings, availability and flexibility of use, and an environmentally sound image. Prettenthaler and Steininger (1999) further analyse the main services rendered by cars among car-owners in Europe to find that 69% of the surveyed households would benefit from car-sharing if it is the yearly mileage that motivates the ownership of their vehicle. When the service of having a car always at disposal makes an important motive for its ownership, 22% of the surveyed households would benefit from car-sharing.

Furthermore, Mont (2004) estimates that car-sharing may reduce the number of cars on the roads by 44%²⁰ and the distances driven by 30- 60%. Steininger et al. (1996) study drivers' behaviour before and after joining a car-sharing organization in Austria and find a 46.8% reduction of total private vehicle mileage. They find that participants do not

¹⁸ House-sharing is understood here as a group of people residing in a common flat, or a house.

¹⁹ Car and Bike Sharing Capture Urbanites' Eyes. *Electricity Journal*, 2010. Vol. 23, Issue 5, p.3

²⁰ Result are derived by Meijkamp (2000) and Sperling et al. (2000).

regard car-sharing as more difficult than private car use. Fellows and Pitfield (2003) also show that car-sharing can produce high net benefits to society. Yet, car-sharing need not always reduce the number of cars on the road. Seik (1999), for example, shows that the introduction of car-sharing schemes in Singapore made people switch from public transport to cars, and served to satisfy citizens' aspiration for using personal vehicles. Similarly, Steininger et al. report that individuals who had owned a car before joining car-sharing initiatives reduced their car mileage by 62%, while individuals who had never owned one, increased their car-mileage by 118%. Vehicle-sharing can thus lead to a reduction in the total amount of kilometres of car-travel as long as these schemes reduce car-dependency and do not lure users of public transport to switch to cars (an illustration of the rebound effect). For this reason Huwer (2003) suggests that car-sharing is promoted as a form of combined mobility jointly with public transport. The author argues that the basic orientation towards public transport can be maintained if car-sharing is pursued as an option for specific activities or days within a mix of available transport modes.

5.3 The costs and benefits of sharing

The models presented here allow for analysing the logic of sharing as a private decision, involving a consideration of the gains and losses on individual level, and as a socially optimal solution, implying an estimation of the associated gains and losses at a societal level.

5.3.1 Private decision model

Economic theory teaches that a rational, self-interested individual would share when the associated net benefits of sharing outweigh those of private ownership (of not sharing), or when:

$$B_{ps} - C_{es} - C_{ps} > B_{pp} - C_{ep} - C_{pp}, \quad (1)$$

where B_{ps} (B_{pp}) stand for the psychological benefits of sharing (non-sharing), while C_{es} (C_{ep}) and C_{ps} (C_{pp}) are the respectively the economic and psychological costs of sharing (non-sharing/private use).

The economic cost of sharing C_{es} represents the financial and time-related resources of purchasing, using and maintaining a particular good in a shared way. C_{es} increases with the amount of time required for coordination and decreases with the cooperation efforts exerted by all users.

Feeling part of a community and belonging to a social network are some of the psychological benefits of sharing. The psychological benefits of non-sharing reflect the importance, social status and self-perceived sense of security that individuals assign to the ownership of particular goods. The psychological costs of sharing are then associated with facing uncooperative behavioural, free riding, conflict and having a lower degree of privacy, comfort and freedom. The psychological and economic costs of non-sharing are then related to the feeling of rivalry and conspicuous behaviour. Equation 1 generally says that a rational individual would share when one, or more, of the following hold(s):

- the sum of the monetary savings, net of time, is positive. This envisions sharing as a way to afford pricy, high-quality tools or housing, for example. If the amount of

extra effort (time) needed for sharing is not excessive, its economic cost is normally lower than the one of private ownership one ($C_{ep} < C_{es}$).

- the psychological gains of communal use outweigh these of non-sharing, and the psychological costs of sharing are not excessively high. This depends on the presence and development of social capital, conceptualized as a mixture of interpersonal trust, norms of reciprocity, mutual aid and social involvement (Verhaeghe and Tampubolon 2012) in a community.

The individual decision to share will thus be a result of a trade-off between the economic gains and psychological constraints of sharing (i.e. distrust, uncooperative behaviour and the importance and status assigned to individual ownership). For example, an individual would share a car if the interaction efforts and time required for agreeing on its use schedule and maintenance are smaller than the preference of having it always at disposal.

5.3.2 Social decision model

Expression (1), however, does not consider the fact that people do not necessarily calculate the gains and losses of all their actions and can decide to share when societal benefits are high. These could be savings on pollution, erosion, landscape damage and natural resource use and more generally, the mitigation of environmental problems like climate change, biodiversity and landscape loss. If the environmental costs of sharing a particular good are denoted by C_{evs} and the ones associated with using it privately by C_{evp} , in many cases $C_{evp} - C_{evs} > 0$.

Two effects can further influence the potential environmental gains of sharing. One is associated with the rebound effect and the other with its educational spill-overs. Firstly, sharing can be seen as a type of efficiency producing a maximum output for a given amount of resources. It is however well established in the literature that efficiency in product design and use does not necessarily lead to a consumption reduction due to behavioural or other systemic responses. The underlying phenomena here are the rebound effect and Jevons paradox (Polimeni 2008). As consumption aspirations tend to adapt upwards, efficiency savings are often redirected toward new consumption (Herring and Sorrell 2008, Alcott 2008). Energy and material efficiency alone can thus bring environmental gains only when rebound effects are minimized. The same holds for sharing. If sharing is promoted as a way to tap new market niches, like in product service systems for example, making certain goods cheaper and fashionable, it might rebound and result in an amplified resource use and pollution. In her book on commercial sharing Gransk (2010) suggests that customers should be encouraged to buy less and use more. Applying this recipe to cars-sharing implies that easing access to vehicles can help customers redirect the savings made on car-ownership to car-use and thus travel more (by car). Furthermore, car-sharing can either accustom oneself to using this transport mode and eventually inspire a purchase of an individual vehicle, or it can have an 'unlearning' effect. Alternatively, while sharing luxurious holiday apartments can bring down demand for new vacation housing, it can also make the use of secondary housing cheap and accessible, encouraging unsustainable life-style practices (i.e. high level of international travel) which are quickly learnt, adopted and replicated.

If sharing rebounds, its environmental costs are likely to be multiplied. If α is the multiplier associated with the rebound effect (taking values between zero and one), when

$\alpha=0$ no rebound effect takes place, and when $\alpha>0$ environmental costs increase with sharing.

Secondly, the process of sharing can be associated with lifestyle changes and have educational effects. The direction of these is often uncertain. Lietaert (2010) finds that house-sharing can lead to behavioural shifts from an individual to more collective action. He argues that members of cohousing communities often adopt more environmentally sustainable habits after joining, thanks to the stimuli and coordination inside the community (i.e. within co-housing communities sharing systems for small items such as tools for gardening, maintenance, cleaning and cooking are often created, and the sharing of cars, freezers, and washing machines is well-organized). Thus, on the benefits side, sharing can embed certain new sustainable choices and practices on the use of goods, resources and space. It can trigger cooperation and environmental sustainability in lifestyles and habits through (mutual) learning. This effect would scale up, or multiply, the environmental gains of sharing. At the same time, sharing can also discourage environmentally sustainable practices. Negative experiences with co-housing, for example, can evoke a dislike for sharing space and objects and increase demand for individual housing.

The educational effect of sharing is denoted here as β , and takes values between zero and (minus) one. When $\beta>0$ ($\beta<0$) there are additional benefits (losses) of sharing associated with learning environmentally (un)sustainable habits through sharing. For $\beta=0$ educational effects are zero. From a society-wide perspective the environmental gains of sharing would then arise when:

$$\sum C_{evp} - \sum (1+\alpha)(1-\beta)C_{evs} > 0, \quad (2)$$

or when the rebound effect of sharing (α) is minimized and additional environmentally sustainable habits are adopted ($\beta>0$).

Apart from its environmental benefits, sharing has wider social implications. For example, it can contribute to the reduction of the inequalities in the access of goods and services, and thus contribute to higher well-being in society (Verme 2010). Sharing can further be studied in the context of social comparison and rivalry. More than 20% of the personal expenditures in the US are attributed to conspicuous consumption²¹ (Heffetz 2007). If sharing improves access to conspicuous goods, it can make their possession less important for status. Stated differently, the pleasure and social status obtained from the ownership of a conspicuous good (e.g. a sports car) might diminish with the notion that many others have access to the same good. For example, only 9% of the people who possess a car for status reasons would like to share their vehicle (Prettenhaler and Steininger 1999). More generally, increasing the possibilities of sharing might calm rivalry and the desire for goods ownership as a medium for identity-building. Given the negative impact of conspicuous consumption on subjective well-being, reducing status-based consumption can translate in higher well-being in society (Frank 1999). Certainly, reducing status-based consumption is not equivalent to reducing status-seeking, which is

²¹ Consumption defined as “conspicuous” is aimed at demonstrating social status, and the goods most frequently included in the conspicuous basket are cars, housing, clothes, jewelry, furniture and modern electronic appliances.

inherent to society. With more sharing, status-seeking can only be moved to other, hopefully less environmentally burdensome areas. This said, possession of conspicuous goods which are only made accessible to a small circle of peers can still be a source of social status (i.e. the ownership of a castle). Asymmetric sharing, where one individual has the property and priority use-rights over a conspicuous good, might reinforce status-seeking and wasteful consumption.

The change in rivalry and conspicuous consumption associated with sharing can act as a multiplier (γ) of the individual psycho-social benefits of sharing (B_{ss}). If γ is ranges between zero and one, when sharing is associated with a decrease in conspicuous consumption $\gamma > 0$, otherwise $\gamma \leq 0$.

Putting (1) and (2) together results that sharing is socially beneficial if:

$$\sum(1+\gamma)B_{ps} - \sum C_{es} - \sum C_{ps} - \sum(1+\alpha)(1-\beta)C_{evs} > \sum B_{pp} - \sum C_{ep} - \sum C_{pp} - \sum C_{evp} \quad (3)$$

or when one (or more) of the following hold(s):

- trust, cooperation and social capital $\sum(1+\gamma)B_{ss}$ improve with sharing, while rivalry and conspicuous consumption decrease with it ($\gamma > 0$),
- the aggregate monetary savings net of coordination time $\sum C_{ep} > \sum C_{es}$ are positive,
- uncooperative behavior $\sum C_{ps}$ is not a limiting factor,
- rebound (α) is minimal and additional environmentally sustainable habits are adopted ($\beta > 0$), or environmental costs ($\sum C_{evs}$) are smaller than these of private ownership ($\sum C_{evp}$).

5.4 Sharing in urban Spain and rural Bulgaria

5.4.1 Data

Building on the models from the previous section, the determinants of sharing for Barcelona (Spain) and Bulgaria can be empirically tested. The analysis in this section is based on original surveys administered in 2011, using an identical questionnaire for Spain and Bulgaria. The data-sets include 840 observations from Barcelona and 600 from Bulgaria, and both are representative in terms of age and gender. The survey included questions on demographics (age, gender, education, income, marital and employment status), subjective well-being, free time, social life, sharing and social capital.

The major part of the Barcelona data was collected via face-to-face interviews in randomly selected houses in all city districts²². On the question *Would you like to continue sharing what you already do (share)* 61% of the respondents (in Barcelona) give an affirmative answer, 24% state they would like to share more and 15% would rather avoid sharing. When asked to identify the items they normally share, the majority of the respondents in Barcelona mention books, clothes, space, furniture, and computers. Moreover some 34% understand sharing as a socializing event, such as spending time (or a having a meal) with the others, or as an exchange of information and knowledge. Although a few respondents state they prefer to share within a family context, sharing is most often understood as a non-commercial, non-market activity, done outside the family circle.

²² Sixty respondents filled in the questionnaire on the Internet.

With regards to the categories of shared goods, 26% of the respondents in Barcelona share a car. This should be interpreted in a context of relatively low car-use, as 52% of the sample do not normally commute by car. Exactly half of the sample share housing and only 34% of them do it with a partner. As regards to the other two categories of goods, 55% share tools and 39% - a washing machine, fridge or a TV with others. Much of the electro-domestic appliances and tools are shared in the context of a shared house, as 70% of the people who share electro-domestic appliances and tools also share a house. However, only 33% of the people who share cars live with others in the house.

The Bulgarian data consists of survey responses conducted in 15 villages and towns in north/north-west part of the country. Exactly one third of the respondents declare that they would like to continue sharing (the items they already share), and 21% state they would like to do it more. The remaining 45% prefer not to share. When asked to list the items they normally share, the majority of the respondents mention money, and a few refer to food, services, seeds and clothes. Sharing in this sample is generally understood as a form of reciprocal mutual support, often monetary, done outside the family circle. By categories, 18% of the respondents share a car, 30% a garden, and only 9% a house, electro-domestic utilities and tools. In the Bulgarian sample cars are shared more than houses, although in absolute terms people tend to share more of both items in Spain. Car-use in rural Bulgaria is, however, relatively higher than in Barcelona, as only 43% of respondents do not normally commute by car.

One of the reasons for the difference in the levels of sharing between Bulgaria and Barcelona can probably be sought in the responses on the social capital section of the survey. While 58% of the Barcelona respondents state that people can be trusted, only 31% of the Bulgarians subscribe to this vision. Furthermore whole 79% of the Bulgarian respondents consider that people normally misuse each other, while 46% do so in the Barcelona sample. On the other hand belief in mutual aid is relatively higher in Bulgaria (52%), as in comparison with Barcelona (39%).

5.4.2 Regression model

The hypothesis of the private decision model from section 3.1 states that sharing is jointly determined by economic factors (such as income and time availability) and psychological ones (such as the need to be part of a community versus the social status and self-perceived sense of security assigned to the ownership of particular goods). Should we test the social decision model from 3.2, variables related to environmental awareness can be included.

The datasets allow for testing variables in all three categories, as well as age, education and marital status. Given that the dependent variable is a dummy, taking values between 1 or 0, and responses are only ordinarily comparable, Ordered Probit (OP) model suits best the purpose of the analysis. OP explains the act of sharing by the probability that an individual decides to share, given a number of conditions. This can be formalized as:

$$P_i(x) = F(\mu_i, x, \beta)$$

where F is the probability distribution of sharing, i is the number of the observation, x is an independent predictor of sharing, and β reflects its strength and size. The threshold parameter μ is then equal to zero or one. Assuming that $F(.)$ is normal, with a variance 1

and expected parameters $\beta_1x_1+\dots\beta_px_p$, probability P can be defined as a function of a latent utility as follows:

$$P_i(x)=N(\mu_i - \beta`x;0,1), \text{ where } \beta`x = \beta_1x_{1n}+ \dots\beta_px_{pn},$$

Here p is the number of characteristics which jointly determine sharing and n is the number of observations. In the OP regressions presented in Tables 5.1 and 5.2, the dependent variables are respectively answers to the following questions: Would you like to continue sharing (what you already do)? Do you share a house? Do you share electro-domestic appliances? Do you share a car? Do you share tools?

5.4.3 Empirical results for Barcelona

Table 5.1 presents the regression models estimated only with the Barcelona data-set. The dependent variable in Model 1 is a self-report on the willingness to continue sharing. Results indicate that people tend to share less with *age* and the number of *working hours*. Figure 5.1 shows that people with the highest willingness to share are in their thirties and forties. As shown in Table 5.1 (Model 1), individuals who are *single* are less willing to share, while *generosity* (defined as the frequency of lending objects to others), *volunteering* and *higher incomes* have a positive effect on sharing. The dependent variable here is contingent upon respondents' subjective interpretation of sharing, implying that regressions per type of sharing (Models 2-5) provide some further detail.

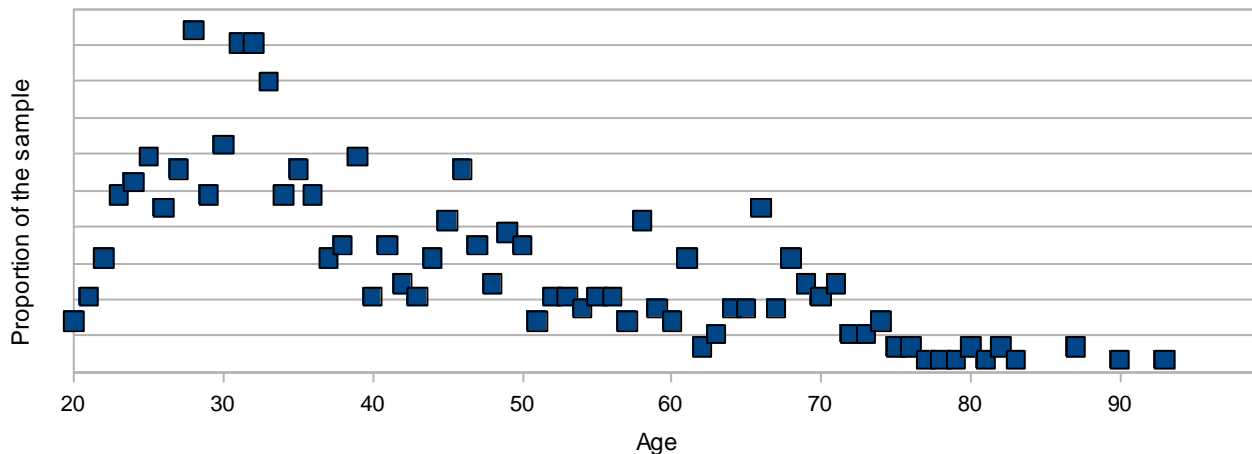


Figure 5.1 Willing to share in Barcelona for different ages

House-sharing

Practised by 50% of people in the sample, house-sharing decreases with *age*, being *married* and the number of *working hours* (Model 2). The sharing of housing is more likely to occur among individuals who are generous, or used to lend their items to others. The level of *education* and, surprisingly, *income*, do not have an influence on the decision to live in a shared house, while *environmental awareness* is highly significant.

Sharing electro-domestic appliances

The regression results with *sharing electro-domestic appliances* (such as a TV, a washing mashing, and a fridge) as the dependent variable (Model 3) resemble the ones of house-sharing. The parameters which fit the data best are similar, and so are their signs: *age*,

Table 5.1 Regression results. Sharing in Barcelona

Model 1			Model 2		
Share	coef.	s.e.	Sharing house	coef.	s.e.
Age	-0,01**	0,00	Age	-0,02***	0,00
Single	-0,36***	0,12	Education	-0,03	0,05
Working hours	-0,01**	0,00	Married	-0,31***	0,10
LogY2011	0,21***	0,07	Working hours	-0,01**	0,00
Generosity	0,33***	0,05	LogY2011	-0,04	0,07
Volunteering	0,26**	0,12	Generosity	0,24***	0,04
			Env.awareness	0,22***	0,11
<i>Number of obs</i>		818	<i>Number of obs</i>		812
<i>Pseudo R2</i>		0,084	<i>Pseudo R2</i>		0,1083
Model 3			Model 4		
Sharing electro-domestic utilities	coef.	s. e.	Sharing a car	coef.	s.e.
Age	-0,01***	0,00	Age	0,00	0,00
Education	0,03	0,05	Education	0,12**	0,05
Married	-0,46***	0,10	Single	-0,30***	0,13
Working hours	-0,01**	0,00	Full-time work	-0,44***	0,12
LogY2011	-0,15**	0,07	LogY2011	0,04	0,08
Generosity	0,19***	0,05	Generosity	0,23***	0,05
Friends	0,02*	0,01	Car hours	0,28***	0,04
			Public transport	-0,10**	0,04
			Env.awareness	0,22*	0,11
<i>Number of obs</i>		768	<i>Number of obs</i>		825
<i>Pseudo R2</i>		0,1317	<i>Pseudo R2</i>		0,115
Model 5					
Share tools	coef.	s.e.			
Age	-0,01*	0,00			
Education	0,11**	0,05			
Full-time work	-0,27**	0,11			
LogY2011	-0,01	0,07			
Generosity	0,24***	0,05			
Friends	0,02*	0,01			
Number of obs		775			
Pseudo R2		0,0776			

Note: * is significant at 10% level, ** at 5%, and *** at 1 % level.

working-hours and being *married* decrease the probability of sharing electro-domestic utilities, while *education* is not significant. *Income* in this model, is significant and negative, implying that higher earnings tend to discourage the communal use of TVs, washing machines, computers or other utilities. The variable (number of) *friends* is significant here and has the expected positive sign. As inverse causality cannot be completely dismissed with this variable, a test for endogeneity was conducted, which turned negative.

Car-sharing

The factors which determine car-sharing (Model 4) are somewhat different from the former three models. While age does not influence car-sharing, education is positive and significant. Being *single*, using frequently *public transport* and working *full-time* are all significant and negative. The income level does not influence car-sharing but the need, or frequency, of using a car do, as demonstrated by the significant and positive sign of *car hours*, defined as the number of hours spent in a car per week. The variable *environmental awareness* is positive and significant.

Sharing tools

In Model 5 the variables *age*, *full-time work*, *generosity* and *friends* feature the same signs and significance as in the regressions on sharing housing and electro-domestic appliances. The endogeneity test with *friends* is also negative here. *Education* is positive and significant, while *income* is not significant, as in the case with house-sharing.

One highlight of these results is the generally negative contribution of *full-time work* and *working hours*, indicating that goods-sharing is generally a subject to time constraints. Furthermore, the little significance of *income* implies that sharing is not induced only by lower earnings. Age is the other variable which is negative and significant in almost all models, implying that sharing is associated with a particular life-stage.

5.4.4 Empirical results for Bulgaria

In the Bulgarian data set the number of individuals who share housing, electro-domestic appliances and tools is fairly low. Sufficiently high number of observations for running regressions was only available for testing two models: one with the *willingness to continue sharing* and another with *car-sharing* as dependent variables (Table 5.2).

In the Bulgarian sample, as is the case with the Spanish one, the *willingness to share* decreases with *age* and *marriage*, and increases in *income* (Model 6). The positive contribution of *income* might, however, indicate that people with higher incomes have more to give, and more to share. Given that the Bulgarian sample was drawn in fifteen towns and villages, it was possible to differentiate between the types of urban areas. As expected, people living in villages have a considerably higher willingness to share than town-dwellers, illustrated by the significance and sign of the *village* coefficient. Interestingly, the variable reflecting emotional status is significant in both models. Frequent episodes of *anger* are associated with a lower willingness to share. Indeed, 26% of the respondents in the Bulgarian sample report to frequently feel angry, while this is the case for only 3,7% of the Barcelona respondents. The other two predictors of *the*

willingness to share in the Bulgarian sample are *watching TV* daily and *distrust* in the good intentions of others, which are both highly significant and negative.

Table 5.2 Regression results. Sharing in Bulgaria

Model 6			Model 7		
Share	coef.	s. e.	Share car	coef.	s. e.
Age	-0,01***	0,00	Female	-0,55***	0,14
Married	-0,35***	0,11	Age	-0,03***	0,00
LY2011	0,15**	0,06	Education	0,21***	0,08
Distrust	-0,36***	0,14	LY2011	0,22***	0,08
Watching TV	-0,23***	0,08	Watching TV	-0,24**	0,09
Village	0,32***	0,11	Public transport	-0,23***	0,07
Angry	-0,08*	0,04	Self-interest	-0,45**	0,19
			Angry	-0,1*	0,05
<i>Number of obs</i>		599	<i>Number of obs</i>		599
<i>Pseudo R2</i>		0,0645	<i>Pseudo R2</i>		0,221

Note: * is significant at 10% level, ** at 5%, and *** at 1 % level.

Car-sharing

In the model with car-sharing, the parameters *age*, *education* and use of public transport are all significant and having the same signs as in the Barcelona data set. *Income* here is significant and positive, unlike in the Catalan case, although causality cannot be conferred from this result for reasons earlier mentioned (higher income implies a higher probability of car-ownership). The highly significant variables here are *female* and the belief that people are mainly *self-interested*, both of which emerge as negative determinants of car-sharing. The sign of *female* can, however, be explained by the relatively lower percentage of car-use among women: 63% of the individuals spending more than one hour commuting by car per week are men and their percentage drastically increases for higher number of hours per week spent on car travel.

5.5 Discussion

In both data-sets individuals' life-stages emerge as major determinants of sharing, as seen in the sign and significance of the parameters *age*, and *married/single*. The regression results further indicate that sharing is strongly influenced by time constraints (hence by the variables *working hours* and *full-time work*). The propensity to share washing machines, televisions and other electro-domestic appliances decrease with income, which does not hold for sharing cars, housing, and tools. It was argued earlier that sharing is more likely to happen when certain affiliation between the members of a community has been established. This is demonstrated by the variables *friends*, *volunteering* and *generosity* which appear as strong positive determinants of sharing. The negative signs of *distrust* and the belief that people are *self-interested* further indicate that the lack of trust in society increases the psychological costs of sharing. The same holds for negative affect, or the frequency of feeling *anger*, which is another strong disincentive for sharing in the

Bulgarian sample. Geographical proximity between community members (i.e. living in a village) increases the willingness to share in the Bulgarian case.

Generally the regression results give credit to the private decision model from Section 3.1. Finding evidence for the social decision model is, however, more complex. The environmental gains associated with the sharing of housing, cars, and electro-domestic appliances can be easily demonstrated by roughly looking at their carbon intensity. Following Jackson et al. (2007) space heating, private transport fuels and the emissions associated with the demand for transport are some of the most carbon-intensive categories of goods. Tukker et al. (2005) also find that building occupancy, (including heating and electricity) is a category with the highest level of carbon emissions (35.3%), followed by personal cars (17%), goods transport (9.9%), and electronic equipment (9.1%)²³. Nemry et al. (2002) further estimate that construction and buildings-occupancy contribute respectively 11% and 39% to CO₂ emission levels, followed by passenger transport with 32.76%. Hence cars (production and use), buildings (construction, heating and furnishing), and electronic appliances emerge as the categories where a reduction of use rates, via sharing, will bring high benefits for society from a climate change mitigation perspective. Energy use for cooking in collaborative houses, for example, is lower than in single households (Carlsson-Kanyama 2004). Curiously, it is exactly with these two categories of goods sharing where environmental awareness emerges as a significant and positive determinant of sharing.

The (regression) results on house-sharing provide some relevant insights as regards to the rest of the elements from the social decision model. In both samples house-sharing correlates highly and positively with the sharing of electro-domestic appliances (0,66). This fact, combined with the similarity between the results of Model 2 and 3 point to the possible learning, or spill-over, effects of house-sharing. Furthermore, when house-sharing is introduced as an independent variable in Models 3, 4 and 5, it stands out as the most important (positive) predictor of car-, electro-domestic appliances and tool-sharing²⁴. This result does not indicate that the sharing of electro-domestic appliances and tools happens only in the household. By sharing within the house, one learns to share with those outside the household. Co-housing can thus “create” sharing in other domains, or have educational effects such as adopting environmentally sustainable practices (Mulder et al. 2006, Lietaert 2010).

One of the hypotheses of the social decision model was that rivalry and conspicuous consumption come in conflict with sharing. *Watching TV* on a daily basis is a relatively good proxy for the importance given to conspicuous consumption. By watching television one is likely to assimilate, and strive to reproduce certain (high-income) lifestyles, (presented in popular film series, for example), as a viable social norm. This is also found by Bruni and Stanca (2008), who show that watching TV crowds-out relationality and increases material aspirations. As watching television is positively related to the

²³ Nijdam and Wilting (2003) confirm the high top rank of personal transport in terms of carbon dioxide emissions allocating it 17%, followed by animal food, heating and electricity, clothes and furniture. Weidema et al (2005) show that household heating, car construction and use, personal hygiene and meat purchase are the most carbon intensive categories in the consumption patterns of Denmark.

²⁴ House-sharing was not introduced in the final regression models because it interferes the rest of the variables.

importance of individual possession for social status, its negative contribution to sharing in the regressions with the Bulgarian data provides some grounds for the social decision model.

Furthermore, as discussed earlier, the decision to own a particular good (versus to share it) is affected by its design and social function. Verhoef and van Wee (2000) show that cars are often valued more for the associated status effect than use value, which makes their personalization essential. Luxury car-sharing, for example, could imperil the social prestige derived from their ownership. This can be one reason why cars are shared least (among all the goods tested) in the Barcelona sample. When a particular good is perceived as personalized, it is not likely to be extensively shared. This can probably also explain why the sharing of electro-domestic appliances decreases with income.

The preceding discussion raises the question on the type of advocacy which sharing requires. Firstly, sharing need not be promoted for its own sake, that is, we need to share the right goods. Certain types of highly polluting and carbon intensive infrastructure, or harmful objects (such as arms), need neither be increasingly used, nor increasingly shared. Secondly, sharing might not always be associated with environmental and social benefits. As discussed earlier, the promotion of car-sharing can shift passengers away from public transport. In the Barcelona sample individuals who spend many hours commuting by car per day are more likely to share a motorized vehicle. Establishing the right tax on car-ownership, use and maintenance might not be sufficiently powerful stimuli to avoid rebound, as indicated by the lack of significance of *income* in the car-sharing model. The inclusion of car-sharing in public transport schemes and infrastructure adjustments which convert public transport into an easier and faster mode of transportation than personal car, for example, can be more efficient in avoiding rebound. Finally, while in the imagination of the individuals who desire more privacy and space for a nuclear family, house-sharing is not equivalent to a good and comfortable life, those who voluntarily opt for it can benefit from certain institutional support. House-sharing can be promoted by fiscal measures (tax-reductions for houses with a high rate of occupation per square meter), as well as by increased tax on the ownership of secondary houses. As an illustration, over the last twenty years the number of secondary homes throughout the Spanish coast increased several folds, pointing to the availability of an excess housing capacity (Gallent et al. 2005). A cap on the construction of new (vacation) housing can encourage the better utilization of the existing stock. Another, more controversial, though pragmatic, measure is the legalization of the right to squat empty buildings. More generally, sharing can be triggered by providing the right (product) design and infrastructure for the specific social and geographical context.

5.6 Conclusions

It was argued here that sharing, defined as the collective use of resources and space in a simultaneous or consecutive manner, can have wide environmental and social repercussions which are not immediately visible. Located between the market and non-market domains, sharing can be conceived as a challenge to the perception of goods as strictly personalized. Although goods design can certainly influence sharing, it is argued here that few goods are strictly individual.

The social cost-benefit model of sharing presented here indicates that the associated environmental gains of sharing cars, housing and electro-domestic appliances

can be substantial if rebound effects are considered, or when the savings on optimization are not directed towards increasing consumption. One of the model hypotheses is that sharing can brake conspicuous consumption and embed environmentally sustainable lifestyle habits.

The empirical analysis of sharing is based on two separate data sets based on the same survey conducted in Barcelona and Bulgaria. Although quite distinct from each other in terms of demographic indicators, both data sets confirm several of the model claims. Results indicate that sharing is strongly influenced by time constraints and availability (i.e. *working hours, full-time work*), and partially by income. The sharing of electro-domestic appliances is shown to decrease with income, while car-sharing is not strongly influenced by the level of earnings.

Next, sharing is likely to take place when social bonds and affiliation (i.e. friendships, generosity) between the members of a community have been established and the level of *distrust* is not an impediment. Results indicate that sharing flourishes with the presence of social capital, although this relation can also work in the other direction: sharing can contribute to the building of social capital in the long run, as found by Albinsson and Perera (2012). Results further show that environmental awareness relates positively to house- and car-sharing. The importance of psychological factors for sharing is manifested in the significance of the emotional status variables (such as *anger*). Geographical proximity and one's life-stage are other important drivers. Younger generations and individuals who are not married are more inclined to share. Sharing further decreases with the amount of time dedicated to watching television (in Bulgaria), and increases with the time dedicated to volunteer activities (in Catalonia). If watching TV is taken as a proxy for the tendency to indulge in conspicuous consumption, it is demonstrated that the latter is a disincentive for sharing.

One of the policy-relevant insights of this chapter is that increased house-sharing, understood as a higher level of person-occupation per square meter, can be a socially attractive meta. It is the most common type of sharing, generating substantial environmental benefits and a number of positive environmental spill-overs by incentivizing sharing in other domains. Generally, sharing has the potentials to generate savings on environmental deterioration and mediate conspicuous consumption, and thus increase human well-being in the long run. It however requires a minimum level of trust in society to kick off and be commonly adopted.

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Chapter 6.

Conclusions

The basic idea that underpins this thesis is that a happiness perspective contributes to a better understanding of the socio-economic impacts of climate change and an adequate formulation of policy solutions. Climate change economics and happiness research were allied here in two ways: first by assessing the impact of extreme climate events on happiness, second and by looking at climate change policies which can be simultaneously effective and having a non-negative, or minimum, impact on well-being.

Concerning the first issue, it was argued that climate change is expected to put pressure on some of the major domains of happiness where adaptation is shown to be incomplete. These include human health, environmental and social conditions. The argument that climate change might lead to a permanent reduction in happiness was empirically supported by findings in Chapter 4. Regression results based on data from flood-impacted urban settlements in Bulgaria indicate that experiencing a flood, and worrying about floods in general, is associated with a considerable decrease in life satisfaction for all income and age groups. This impact is stronger for higher intensity floods, and while diminishing, it does not completely wear off with time. The data indicates that many individuals who have experienced an inundation are socially unprivileged, or having lower incomes, education level, employment opportunities and poor health. Yet social and economic vulnerability does not completely explain the magnitude of the differences in reported well-being between the control group and the individuals experiencing a flood in the sample. Statistical tests show that flood experiences mark equally harsh the happiness of individuals who are relatively richer, younger and healthier. An additional finding which reflects the importance of extreme climate events for happiness is provided in Chapter 3, where experiencing a forest fire is shown to have a lasting negative effect on subjective well-being. This result should, however be interpreted with care, given the small fraction of the Barcelona sample who experienced forest fires.

Floods and forest fires represent extreme (climate) events that are widely distributed while having significant social and economic impacts. If the studied cases provide good proxies of the natural disasters that climate change could bring about, they are expected to cause a lasting reduction in well-being. One should realize that next to irreversibility associated with surpassing climate thresholds there may be irreversibility in happiness changes. This is illustrated by the fact that in the case studies individuals do not regain their initial level of happiness many years after having experienced a natural disaster. This suggests that climate change might have a higher social cost than what is commonly estimated by economic CBA studies.

The second set of research questions addressed in this thesis is on the intersection of climate policy and well-being. It was argued in Chapter 2 that the income and consumption effects of policy measures which effectively limit greenhouse gas emissions will have a zero or small and transitory effect on well-being, especially in comparison with the permanent stress on happiness incurred by extreme climate events. This can be seen when looking at particular policy instruments. More progressive income taxation that

corrects for rivalry and habituation to higher income can be considered an element of a climate policy. On the one hand, the reduction in income standards and moderation of rivalry which these taxes aim at could off-set the negative happiness effect of limiting the consumption of CO₂-intensive goods, achieved by carbon pricing or other policies. The particular mechanism here at play is narrowing the income distribution, and thus reducing inequality. On the other hand, the suggested set of income taxes will have a negative effect on the consumption of CO₂-intensive goods.

Empirical evidence for the second set of research questions can be found in the study on Barcelona in Chapter 3. The econometric test of the relation between happiness and income change during a period of economic crisis indicated that decreases in individual income were not associated with losses in life satisfaction in the short term. Curiously, the variable indicating a lower level of income than last year is positive and significant. This result is supported by models with various specifications of the income decrease parameters and might suggest that a recent decrease in incomes can have a positive impact on happiness. An explanation might be that the respective individuals have more free time and autonomy. Another explanation is the adjustment, or fall, of reference income standards as a result of the economic crisis. The empirical relation between income decrease and happiness is, however, more nuanced. Regression results also indicate that individuals who have a lower income at present than five years ago are less satisfied with their lives. This result is, however, not highly conclusive as it appears in a limited number of model specifications and has a low significance level. In the regression analysis of the Bulgarian data none of the variables capturing a decrease in income from one to five years ago appeared as significant.

While the income increase parameters do not influence the level of happiness of individuals in Barcelona, some of them are significant in the Bulgarian case. Having higher levels of income than two years ago exhibits a positive relation with happiness for Barcelona. However, individuals with higher earnings at present than in comparison with five years ago are not more satisfied with their lives than the rest of the sample. This can be interpreted as an indication of happiness habituation to higher material standards, which is often found in the literature.

The lack of a significant negative relation between income reduction and subjective well-being found in both samples is surprising as the income reductions which took place in the case of Barcelona were widespread, but equitably distributed. This result suggests that a climate policy which reduces income and consumption does not necessarily reduce overall happiness if it simultaneously affects reference income standards. Moreover, the proposed income tax is certainly expected to produce a 'better' welfare effect than the economic crisis in Spain as it corrects for inequality and rivalry.

For the Barcelona sample it was further found that the variables reflecting status-based consumption, such as the purchase of cars and furniture, contribute positively to happiness. In particular, the results indicate that the frequency of changing cars and pieces of furniture matters more than the use of these goods as such. In fact, the happiness effects of the new purchase are short-lasting: once people get accustomed to their current car, changing it might be a strategy to maintain or regain social prestige and satisfaction. The importance of status-based consumption for life satisfaction indicated by this result implies that climate policy which does not take conspicuous consumption and unequal access to status goods into account, might have a negative effect on happiness. This

justifies the need for policy tools which correct for rivalry and adaptation to an increasing use (and purchase) of CO₂-intensive goods.

A third line of research in this thesis concerns the happiness effects of a particular climate mitigation strategy, namely sharing CO₂-intensive goods. This can be seen as a community-based practice in which individuals in a community simultaneously or sequentially make use of the same goods, which can result in reductions of greenhouse gas emissions. Studies on CO₂ emitting energy embodied in various types of goods indicate that cars, buildings and electronic appliances represent the most CO₂-intensive categories of goods. The happiness regressions based on the Barcelona sample presented in Chapter 3 illustrate that the willingness to share has a lasting positive effect on well-being. This suggests that if a sharing strategy to reducing greenhouse gas emissions were voluntarily and widely undertaken, it would have the potential to generate happiness gains for society.

Empirical tests on the determinants of sharing cars, housing, electro-domestic appliances and tools undertaken separately for the Bulgarian and Barcelona data, indicate that these practices are strongly influenced by age and the existence of time constraints, and less by the level of personal income. As predicted by the theoretical model from Chapter 5, sharing is more likely to take place in a context of trust, generosity and established social bonds. One notable result from the Bulgarian case is that the frequency of watching television discourages sharing. This can partly be contributed to the fact that watching television crowds out relationality (Bruni and Stanca 2008) and increases material aspirations, which favors the ownership of positional goods as a strategy to build social status. Furthermore, although the results for Bulgaria indicate that sharing in cities is less common, it is more likely to happen in metropolitan Catalonia than in rural Bulgaria. In Barcelona, 50% of the respondents share a house and 39% a washing machine, fridge and a TV with others. All these items are shared by only 9% of respondents in the Bulgarian sample. As discussed, sharing might rebound and thus not always lead to reductions in resource use. Yet, if rebound is avoided, sharing could contribute to the reduction in carbon dioxide emissions while stimulating the development of social capital and thus an upswing of well-being.


The present study also provided modest sociological and psychological insights allowing for a reflection on the reports of happiness and its determinants for two south-European countries. For example, reports on past happiness indicate that while self-reported subjective well-being is rising in Spain, it is falling in Bulgaria. So despite the economic crisis, Barcelona respondents indicate to be happier now than they were one and two years ago, while Bulgarians declare that their life satisfaction in the past was much higher. The pessimistic valuation of the present by the Bulgarian respondents is one probable reason for the considerably low level of life satisfaction there. The results also indicate that neither the absolute, nor the relative, levels of income provide an explanation for this phenomenon. The determinants of happiness in Bulgaria are, however, likely to be more complex so that additional research on this issue is useful.

The present work aimed to show some of the advantages of placing happiness in the domain of climate change. The same approach can be applied to other environmental problems, such as biodiversity loss and desertification. The weak relation between growth in income and subjective well-being over time points to the limited possibility of trading-off changes in non-pecuniary domains of happiness with income. This challenges the

capacity of monetary units to reliably indicate the scale of the environmental, health and social costs of climate change. Monetary valuation places a (too) high weight on the financial losses of climate policy (as expressed in GDP decline), suggesting a higher welfare cost than indicated by a happiness analysis of climate change and policy. While the health, social and environmental impacts of climate change zoom out, when expressed as a loss in happiness, the cost of a safe climate policy appear quite small in terms of well-being. This implies that such a climate policy is likely to have a net positive impact on real welfare.

Appendix 1. Questionnaire on happiness and extreme climate events conducted in Barcelona and Bulgaria

Climate change Barcelona



UAB
Universitat Autònoma de Barcelona

Dear responder, we would like to ask you to answer the following list of questions. Your responses will be very useful for the research on climate change policy in Barcelona which we are currently undertaking at the Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona. Thank you very much for your time and inputs!

For questions and remarks, please write to Filka Sekuleva at Filka.Sekuleva [at] uab.cat

1. How satisfied do you nowadays feel with the following?
1 = completely unsatisfied, 10 = completely satisfied

	1	2	3	4	5	6	7	8	9	10
Your living place	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The state of the environment in general	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your free time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your sexual life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your personal income	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your family life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your social life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Please indicate how frequently you have experienced the feelings from the list below during the last year

	very rarely	rarely	occasionally	often	very often
Angry?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worried?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Happy?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sad?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Climate change Barcelona

3. Now we would like to ask you how you feel about sharing. Do you regularly share any of the following items with friends or strangers:

- A car
- A house
- A washing machine, a fridge, a television
- A garden
- Tools (for repairing, cooking, gardening)
- A computer

Anything else? (please list)

4. Regarding the item(s) above, would you like to:

- Continue sharing them?
- Start sharing more?
- Stop sharing them as soon as you have the opportunity?

Depending on your answer, please name the items you would like to continue, start or stop sharing

5. What is your employment status?

- I am unemployed
- I do unpaid care work
- I work full time
- I work part-time
- I am irregularly employed / without contract
- I am retired
- I am a student

Other (please name)

Climate change Barcelona

6. Has there been a change in your work over the last 2 years?

- There has not been a change
- I changed my job
- I got unemployed
- I started working part time
- I started working fulltime
- I retired
- I started working irregular hours
- My job transformed

7. How many hours do you work in a typical work-week?

I work the following number of hours:

8. How many hours do you normally travel by car per WEEK?

- I don't travel by car
- Between 0 and 2 hours
- Between 2 and 5 hours
- Between 5 and 10 hours
- Between 10 and 20 hours
- More than 20 hours

9. How many hours do you normally use the public transport per WEEK?

- I don't travel by public transport
- Between 0 and 2 hours
- Between 2 and 5 hours
- Between 5 and 10 hours
- Between 10 and 20 hours
- More than 20 hours

10. Have you visited a doctor over the last year? (Please choose 0 for no trips)

I had the following number of visits:

Climate change Barcelona

11. Have you suffered severe health problem over the past 2 years?

Yes

No

12. In the table below, can you please indicate the level of your personal monthly NET earnings now and in the past (in EURO).

Please mind that his information will be kept confidential and that your response is anonymous.

	Now	1 year ago	2 years ago	5 years ago
< 400	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 400 and 630	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 630 and 850	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 850 and 1000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 1 000 and 1 500	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 1 500 and 2 000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 2 500 and 3 500	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 3 500 and 4 500	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Between 4 500 and 6 000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
> 6 000	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate here if you have changed your country of residence over the last 5 years

13. Can you please notify whether you:

- Take part in a civil society organization or group?
- Tend to make the bigger part of your purchases in big supermarkets
- Normally buy local products
- Normally buy organic products
- Have bought a secondary house
- Consume little or no meat

Climate change Barcelona

14. Now we would like to ask some questions about your free time. Please indicate how often you:

	daily	biweekly	once a month	once a month	once a year	never
Go out (to the cinema, clubs, bars, concerts, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Go hiking/walking in nature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visit to religious or spiritual events	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Watch TV/Videos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use your PC and Internet outside work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Play music, do arts, or dance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do domestic repairs or gardening	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do sports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Go skiing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. Can you please specify how frequently you:

	biweekly	once a month	once in 6 months	once a year	once in 2 years	once in 5 years	once in 10 years	never
Buy furniture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Buy electronic equipment (a P.C.s, a mobile, a fridge, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Change your car	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Take a plane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. Can you please specify:

how much (approximately) you pay for water, gas, electricity (altogether) per month (in Euro)?

17. Can you please specify:

how many square meters is your house/flat?

18. Can you please specify:

How many people live in your house/flat in total?

19. Do you think that production and consumption in the developed (western or Northern) countries should continue increasing?

- Yes
- I do not have an opinion
- No

Climate change Barcelona

20. Are you informed about climate change and its potential impacts?

- Yes
- No
- Yes, but I do not trust the current projections about climate change

21. Are you willing to pay more for certain goods and services (such as electricity, meat, cars) which contribute a lot to climate change?

- Yes
- No

Other (please comment):

22. Are you willing to sacrifice part of your income to lower the risk of extreme events, such as floods, droughts, hurricanes and forest fires, which occur as a result of climate change?

- Yes, I am willing to sacrifice between 0.1% and 1% of my income
- Yes, I am willing to sacrifice between 1% and 5% of my income
- Yes, I am willing to sacrifice between 5% and 10% of my income
- Yes, I am willing to sacrifice more than 10% of my income
- No

23. Can you now try to imagine how you would possibly react to extreme events such as floods, droughts, hurricanes or forest fires which occur at higher frequency and intensity in your region?

- I would be very worried and feel helpless to do anything
- I would not care too much
- I would immediately try to secure better my house and property
- I would migrate to another, safer location

Other (please specify):

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24. Have you ever been affected by a large natural disaster like:

- A drought?
- A flood?
- A heat wave?
- A forest fire?
- I never experienced a natural disaster

Please specify how many years ago the natural disaster took place. Please tell us also whether you have lived through a natural disaster which is not on the list.

25. Did you or your household suffer any sort of damage from this disaster? (If you never experienced a natural disaster, please skip this question.)

- No
- I suffered material damages (on my house, my car, etc.)
- I had health problems
- I had psychological problems
- I had other type of problems.

Please specify the type of material, health, psychological or other damage that you suffered

26. Do you agree with the following:

	Yes	No
People normally attempt to help each other?	<input type="radio"/>	<input type="radio"/>
People act only in their own interest?	<input type="radio"/>	<input type="radio"/>

27. Do you believe that the majority of the people:

	Yes	No
Are likely to take advantage of you if they had an opportunity?	<input type="radio"/>	<input type="radio"/>
Are likely to be fair towards you?	<input type="radio"/>	<input type="radio"/>

28. How often does it happen that

	Very often	Often	Sometimes	Seldom	Never
You lend your personal belongings?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
You lend money?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Climate change Barcelona

29. We would now like to ask you about your satisfaction with life in general.

1 = "completely dissatisfied", 10 = "completely satisfied"

	1	2	3	4	5	6	7	8	9	10
Taken all things together, how satisfied with your life do you feel at present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can you state how satisfied with your life you were last year?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
And what about two years ago?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

30. What part of the time would you consider yourself happy?

- Almost never
- About ¼ of the time
- About half of the time
- About ¾ of the time
- Almost always

31. How many close friends do you have?

Approximately:

32. What part of the people in your country do you think are happy most of the time?

- None
- About ¼ of the people
- About half of the people
- About ¾ of the people
- The majority of the people

33. What type of education do you have? (Please choose the highest level attained)

- No education
- Primary
- Secondary
- College/university and higher
- Vocational

34. Can you please state your gender

- F
- M

Climate change Barcelona

35. Can you please state:

Your year of birth

Your nationality

36. What is your relationship/marital status?

- Single
- Divorced/Separated
- Widowed
- I have a stable relationship/ I am married, and live separate from my partner/spouse
- I have a stable relationship/ I am married, and live together with my partner/spouse
- I have an unstable relationship

Other (please specify)

37. Do you have children?

- Yes
- No

How many children do you have (if so) ?

38. Has there been a change in your family/relationship situation over the last 2 years?

- I separated from my partner/spouse
- I got together with my current partner/spouse
- I lost a close relative
- I got a child
- No, there has been no change

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39. Can you please specify the district of Barcelona where you live at present?

- Ciutat Vella
- Eixample
- Sant-Mentjuliç
- Les Corts
- Sant-Marc de Sant Gervasi
- Gràcia
- Horta-Guinardó
- Nou Barris
- Sant Andreu
- Sant Martí

Can you please mention the name of your barri