Weather as a transient influence on survey-reported satisfaction with life

C. P. Barrington-Leigh*

FIRST DRAFT: 15 August 2008; THIS DRAFT: October 2008

Abstract

A large and growing literature in economics now makes use of subjective response data as a dependent variable in regression models. In particular, inferences about the determinants of experienced well-being rely on self-reports of overall life satisfaction as proxies for utility. This measure of utility is widely used in reduced form equations to estimate its dependence on various life circumstances, and it has provided remarkable and consistent relationships which give insight into life domains where measures of revealed preference are not available. However, worthy econometric reservations have been raised about the use of subjective reports as dependent variables. Moreover, it is often the case that some of the "causative" regressors are also subjective reports, making the problem particularly grave since the coefficients on those subjective variables have also been taken seriously. This leads to a possibly large endogeneity problem in which unmeasured subjective factors, such as emotions, may bias estimates on all variables. In this study we look for such a bias resulting from transient affective influences on subjective response data by using the weather as a perturbation on respondents' mood in a large national survey. The date and location of survey interviews are combined with weather and climate records to construct the random component of weather conditions experienced by respondents on the day of their interview. We find significant effects of the weather on both right- and left-hand-side variables, yet standard inferences about the determinants of life satisfaction remain robust after taking into account this source of affective bias.

---

*Department of Economics, University of British Columbia. Please look for an up to date draft online (GRAD.ECON.UBC.CA/CPBL/). I am grateful for helpful discussions with John F. Helliwell and for support from the Canadian Institute for Advanced Research (CIFAR) and from Statistics Canada through UBC's Interuniversity Research Data Centre. This research forms part of the CIFAR Program on Social Interactions, Identity and Well-Being.

Contents

List of Tables

1 Introduction

Behind the compelling and growing modern evidence about what determines human well-being lie several qualitative claims concerning survey measures of satisfaction with life (SWL). These are that (1) the meaning of standard SWL questions does not vary greatly between respondents from different languages and cultures, that (2) self-reported SWL measures something objective about a person's mental experience which reflects objective circumstances rather than solely individuals' fixed personality types, and that (3) SWL gets at a more lasting or long-term assessment of life quality than just an individual's current mood and its short-term influences. Generally speaking, these claims all have good support (for a brief review, see e.g. Diener, 2000) and there are a number of studies showing how the single-question SWL measure compares with other measures of well-being such as positive affect, low levels of negative affect, multi-question indices of life satisfaction and affect, experience sampling methods, and a number of physiological measurements.

Nevertheless, the reliability of life satisfaction data has often been held in low regard by economists on the general grounds that subjective responses may generate large statistical biases. The majority of the studies assessing the reliability and susceptibility to affective influence of reported life satisfaction are based on experiments with relatively low sample sizes. In order to test the robustness of statistical inference concerning the socioeconomic determinants of SWL, it is desirable to have access in a large survey to some random factor which can be expected to affect mood and thus any self-reported values affected by mood. Of primary interest in this regard are the measures of health, trust, and other major established determinants of SWL, as well as SWL itself. If transient influences on mood do not result in large correlated effects between SWL and its ostensible determinants, well-being researchers may rest assured that they are capturing meaningful relationships in ubiquitous econometric models.

Data from two Canada-wide surveys described below include not only the location of each respondent's home but also the precise day of each survey interview, which was conducted by telephone. Canadian weather archives from the several months during which the surveys were conducted in 2002, 2003, and 2005 are used to determine the local weather conditions experienced by each respondent on the day of their interview. I find that these local weather conditions do indeed serve as a transient influence on both SWL and some of its self-reported determinants, yet I show that the correlations from this influence do not result in a significant bias of estimates for canoncial models of SWL.

The remainder of this section provides an overview of previous investigations into the psychological influences on subjective well-being assessments, the role of climate and weather in well-being and judgement, and the problem of accounting for geographical amenities in cross-sectional studies. Section 2 describes the surveys used and the linking of weather data to respondents. Section 3 presents the main findings and Section 4 concludes.

1.1 Reliability: does SWL vary too much?

Bertrand and Mullainathan (2001) discuss and test the reliability and statistical usefulness of survey subjective evaluations.[1] They conclude that subjective responses are unreliable as dependent variables in statistical models because a number of situational and psychological factors are likely to affect both the dependent and independent variables and may therefore cause arbitrarily large biases. Although Bertrand and Mullainathan (2001) describe the unwillingness of economists to use subjective data as an "important divide between economists and other social scientists," the role of SWL in economics as a measure of well-being has persisted and grown because regularities of relationships in modeled SWL seem unlikely to be explainable in terms of bias alone. The use in the present work of weather events as an exogenous situational influence makes possible a test for effects on the "right-hand side" variables in typical models for life satisfaction.

Turning more specifically to the central subjective measure of the present study, a considerable literature addresses the degree to which asking people about their SWL elicits meaningful and reproducible responses that are distinct from transient affect. Krueger and Schkade (2008) report that the SWL question has a lower consistency amongst individuals re-surveyed after two weeks than do either narrower domain satisfaction questions or measures of net affect.[2] Even though the major known determinants of life satisfaction are circumstances that can be expected not to change much on short time scales, the authors point out that the cognitive process invoked in evaluating SWL is naturally less systematic than and less well circumscribed than those of the more narrowly defined questions. Thus, while SWL may get at the ultimate outcome measure, it necessarily does so noisily. Despite this susceptibility to context dependence, Krueger and Schkade (2008) conclude that the consistency in life satisfaction responses is high enough to justify the typical statistical inferences being made in current research.

The open-endedness of the life satisfaction question means that the cognitive assessment which it elicits is susceptible to variation in focus based on any factor which makes a particular piece of evidence more or less salient, prominent, or subject to immediate attention. In comparison, introspection about mood or about domain satisfaction is a relatively well circumscribed task.

(Schwarz and Strack, 1991, p. 37) and others since have shown that making a mood-affecting factor such as weather more explicitly salient reduces its impact on self-reported satisfaction. Their interpretation is that current mood is one piece of evidence used to assess one's own longer-term well-being, but if transient influences on mood are identified or attention is drawn to them, their bias on perceived satisfaction can be cognitively corrected for.

For instance, when phone interviews were conducted on sunny or rainy days, the weather affected reported life satisfaction only when weather was not mentioned either in passing or as a context for the study (Schwarz and Clore, 1983). More generally,

[1] While providing evidence that subjective evaluations *do* have useful explanatory power in predicting outcomes like wage and job turnover, Bertrand and Mullainathan (2001) provide only hypothetical problems rather than any statistical evidence for the kind of correlation which they conclude could invalidate the use of subjective measures as dependent variables.

[2] They define net affect as a duration-weighted difference between a composite measure of positive emotions — encompassing happy, affectionate/friendly and calm/relaxed — and one of negative emotions, encompassing tense/stressed, depressed/blue and angry/hostile.

when the relevance of momentary affect is drawn into question, subjects cease to let it inform their assessment of their life satisfaction (Schwarz and Clore, 1983).

On the other hand Schkade and Kahneman (1998) demonstrate how a *focusing illusion* can increase an individual's estimate of the salience of a given factor for SWL when that factor is mentioned or emphasized.[3] In their study, respondents overestimated the importance of climate in determining their life satisfaction when climate was the basis for a comparison with another region. In the present work, weather and climate are not discussed in the survey questions nor did they relate to the original or stated motivation for the surveys.

1.2 Meaningfulness: does SWL not vary enough?

Another strand of historical skepticism about subjective well-being studies relates to the opposite concern — that reported SWL does not vary sufficiently in relation to experienced circumstances because it is determined largely by personality. The two strands of objection correspond to two traditions in psychologists' understanding of reported satisfaction with life. These are judgement theories, which look at the momentary influences on the cognitive process of evaluating one's life, and personality theories, which focus on the influence of stable personality type in determining life satisfaction. Schimmack et al. (2002) offer an attempt to integrate the two traditions. They provide evidence that, at least amongst their rather uniform sample of students, life satisfaction judgements are made through a deliberate and consciously accessible process. This would help to explain the ability of respondents to discount factors which have been deemed uninformative (Schwarz and Clore, 1983; Schwarz and Strack, 1991). More generally, Schimmack et al. (2002) suggest that while people use readily available introspective evidence in making a life satisfaction assessment, consistency over time comes from the natural fact that accessible sources of information reflect important and repeatably salient aspects of people's lives.

An influence of culture and personality on reported SWL is mediated through the same channel: the perceived importance of different circumstances and domains of success and the strength of memories of emotional experiences reflect the priorities that define an individual's identity. In this sense, the meaning of an open-ended SWL question may not vary between people and cultures as much as the values which inform the answer.

The survey statistical approach typically used by economists studying life satisfaction naturally accounts for influences from both personality and socioeconomic circumstances, where such variables are available. Modern concensus is that reported life satisfaction has both meaningful variation over time and significant reproducibility and consistency over time. In accordance with the description and empirical evidence of Schimmack et al. (2002), the latter consistency reflects the information to which a respondent appeals when forming satisfaction assessments. Transient influences such as weather can be thought of as complications to those salient factors, when they are not cognitively compensated for or excluded, and it may be expected that more specific

[3] Bertrand and Mullainathan (2001) give a brief review of this and other possible kinds of biases in subjective responses.

questions than SWL will suffer less from interference simply because the cognitive calculation and relevant pool of introspective information is simpler.

1.3 Stock markets and behaviour

The imperfect self-awareness that characterises cognitive assessments has also come up in evidence regarding economic decision making. Influences on mood affect judgement and behaviour through the misattribution of feelings to the wrong source. In this way, for example, mood-enhancing weather may mistakenly become confused with an optimistic assessment of future stock returns, in part by increasing the preceived salience of positive information. There is a small industry of studies on weather, moon phase, and stock returns (Loughran and Schultz, 2004; Cao and Wei, 2005; Krämer and Runde, 1997; Yuan et al., 2006).

For instance, Hirshleifer and Shumway (2003) find a highly statistically significant relationship between morning sunshine and stock market performance amongst 26 countries, with cloudiness dominating precipitation as a measure of influence. As mentioned above, drawing attention to a particular influence on mood or explicitly highlighting it as a possible source of bias is likely to diminish the effect of misattribution. A related, preliminary study by Guven (2009) analyses the influence of weather, through mood, on household investment and consumption choices. He finds weather to be an appropriate instrument for mood and reports a number of quantifiable behavioural influences which indicate that positive mood has a significant effect on household economic decision making.

1.4 Sunlight and depression

Turning now to the specific effects of weather and daylight on well-being, the largest set of evidence relates to seasonality in depressive episodes, which has been recognised for millennia. In modern terminology, seasonal affect disorder (SAD) refers to psychopathologies with distinct seasonal variation for which the patient feels worst in winter (Magnusson, 2000, for a review). Because SAD is thought to be caused primarily by a lack of sunlight, its incidence was expected to vary strongly with latitude as well as with other determinants of sunlight exposure, such as cloudiness. Many studies have addressed this question, however, and found mixed results. Mersch et al. (1999) survey the literature and find overall no correlation between latitude and the prevalence of SAD, indicating that seasonality in sunlight may not be the primary factor involved. They suggest that other factors like climate and social-cultural context are instead dominant determinants. They also cite studies suggesting that temperature or even precipitation may be significant factors in explaining differences in SAD incidence between different regions of the world and even the existence of "summer-SAD" in some places.

Furthermore, the incidence of suicide is generally peaked in the summer, when sunlight exposure is at its maximum. This, in conjunction with the relatively high prevalence of suicide in Scandinavia, has led to the proposition that increased sunlight might be associated with suicide risk. As with the contrary hypothesis concerning

SAD, the evidence has not painted a simple picture. Helliwell (2007) surveys the relevant research and discusses the relationship between suicide and SAD. He then finds limited empirical evidence of a role for latitude in predicting suicide rates. Once again, social-cultural factors appear to be as successful as long or short duration daylight in explaining any correlation between latitude and psychological health.

1.5 Climate, geography, and well-being

While the link between long-term sunshine and measures of severely compromised well-being appears to be weak, a related question is how the more central well-being measure of SWL is affected by persistent aspects of climate, physical geography, and other environmental factors. Physical amenities and climate constitute an increasingly significant and marketable factor in migration between cities in the U.S.A. (Rappaport, 2007) and the looming task of mitigating the effects of climate change will require an understanding of the welfare implications of climatic factors.

Frijters and Van Praag (1998) construct an estimate of the direct climate costs of global warming using Russian reported satisfaction with life and satisfaction with income. Using geographic variation in mean annual climate, they find that households tend strongly to dislike cold, windy winters and hot, humid summers and that they benefit from higher annual hours of sunlight.

Rehdanz and Maddison (2005) use instead a cross-country comparison of overall happiness in 67 countries to anticipate the direct importance of climate change to the geographic distribution of well-being. Using several national control variables and climate parameters for temperature and precipitation, they find that more moderate temperatures — lower peaks and higher minima — are significantly preferred.

Brereton et al. (2008) use a similar approach to that of Frijters and Van Praag (1998) but for a small sample in Ireland and find that windiness and mean annual minimum and maximum temperatures are significant in explaining the geographic variation in SWL. They also find a slightly negative relationship between annual hours of sunshine and SWL but they explain this by appealing to other, unmeasured aspects of geography. In the approach I pursue below, unmeasured geographic variation should not bias results because geographic fixed effects are carefully controlled for. I am also able to compare the magnitude of the influence on SWL from essentially stochastic daily weather events with that due to long-term climatic differences, assuming people have not become strongly geogaphically sorted according to their preferences.

In any attempt to accomplish the just-described task of estimating the effect of regional variation in climate — rather than short-term weather — on SWL, one is confronted with the confounding effect of variation in other geographic amenities. There is a considerable literature treating such "hedonic geography." In addition to the climate studies already discussed, estimates based on SWL have been conducted for aircraft noise near an airport (van Praag and Baarsma, 2005), NO_2 air pollution (Welsch, 2006), and proximity to the workplace as measured by commuting time (Stutzer and Frey, 2008). Moro et al. (2008) use a model of geographic amenities to construct a geographic estimate of SWL by weighting the environmental endowments of each Irish county by the marginal rate of substitution between income and the amenity. They find that this estimate provides a similar ranking to others based more directly on actual reported SWL in each county. In their related work, Brereton et al. (2008) conclude that incorporating various geographic factors across Ireland generates a marked increase in the proportion of explained variance in SWL.

Numerous other studies use market outcomes such as house prices rather than SWL to evaluate the well-being contribution of geographic amenities. This hedonic price approach is, however, predicated on a frictionless market in which there are insignificant costs to moving (Gyourko et al., 1999, for a discussion). Given that in the U.S.A., 57%-79% of Americans reside near where they were born (Bayer and McMillan, 2005), this assumption is a poor one. In the opposite case when markets for location are highly frictional and migration is small, correlations between geographic amenities and SWL are more likely to reflect a causal relationship.

2 Data and Method

Two surveys in Canada are suited to the current task. The second wave of the Equality, Security, and Community survey (ESC2)[4] includes 5600 respondents interviewed between December 2002 and July 2003. Rather than being uniformly distributed over time, the sampling was strongly peaked in April to May. Data for Cycle 19 of the General Social Survey (GSS19) were collected in 11 monthly samples from January to November 2005 with data collection for the November sample extending until mid-December. The sampling was evenly distributed over the 11 months.

Both surveys asked respondents to rate their overall life satisfaction on a ten point scale with bipolar verbal descriptions. ESC2 asked:

> On a scale of 1-10 where ONE means dissatisfied and TEN means satisfied, all things considered how satisfied are you with your life as a whole these days?

while in GSS19 the question was phrased:

> Please rate your feelings about them, using a scale of 1 to 10 where 1 means "Very dissatisfied" and 10 means "Very satisfied". ... Using the same scale, how do you feel about your life as a whole right now?

Numerous other questions relevant to social interactions and socioeconomic and cultural backgrounds were posed in these surveys. Of the nearly 20,000 respondents surveyed in GSS19, all were asked the SWL question but just less than half were asked to evaluate their level of trust in neighbours, an important metric for local social capital. Also, nearly 5000 respondents declined to provide an income, half of whom chose “don’t know”. In regressions below where these measures are used, the sample size is accordingly smaller. Household survey weights are available for GSS19 and are used in all estimates.

[4] ESC2 is described by Soroka et al. (2007) and online at http://grad.econ.ubc.ca/cpbl/esc2.

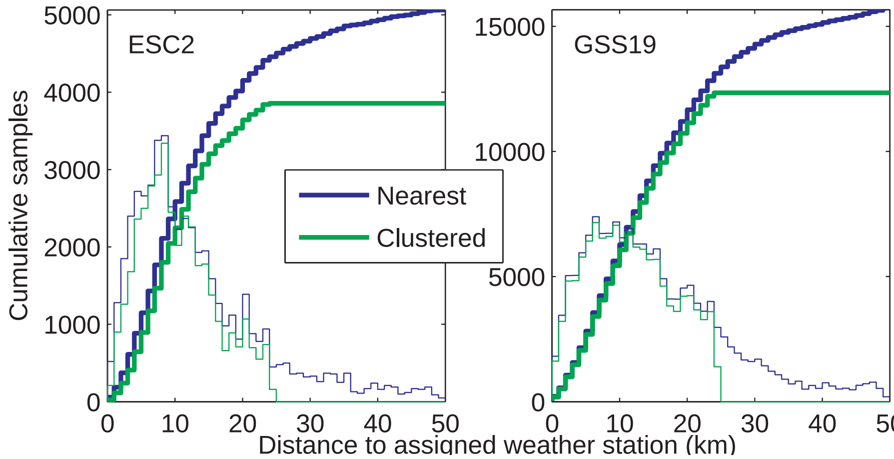

Figure 1: Comparison of the "nearest" and "clustered" algorithms for assigning weather stations to respondents. *Plots show incremental and cumulative distributions of distance from the assigned station for each of the two surveys, ESC2 and GSS19.*

2.1 Assignment of weather stations

Environment Canada offers several kinds of historical weather and climate data via the Internet. Of 2108 weather stations across Canada, a subset recorded daily weather summaries for the years 2002-2005 and a smaller set offer hourly information on sky conditions. These include the cloud fraction and facilitate the calculation of the sunniness of daytime weather for each day.[5] In addition, monthly climatic averages and daily "almanac" averages are available for some stations.

There is no single optimal algorithm for assigning a weather station to each survey respondent. For statistical models which do not include fixed effects for each weather station, the closest suitable station can be used for each respondent irrespective of the number of neighbours assigned to the same station. In some cases, more than one station is used per respondent, such as when the nearest station providing hourly cloud cover data is different from the nearest station providing daily precipitation levels.

On the other hand, for models which involve a constant term for each weather station, there is a tradeoff between minimising the total number of stations used and minimising the distance between each respondent and her assigned weather station. For the latter purpose, a multi-step process involving successive reassignment was used to achieve a balance between the two objectives. In each stage, the least populous stations are dropped and respondents are assigned to the nearest station in the remaining set. Respondents who live beyond 20 km from one of the most popular stations are eventually dropped from the analysis. In addition, stations with fewer than ten respondents assigned to them are not included in the regressions to follow.

Altogether, half the GSS19 sample, or ∼10,000 respondents, survive this pro-

[5]Verbal descriptions of fractional cloud cover were coded numerically and averaged over 12 daytime hours.

cess when the "clustered" station algorithm is used while ~12,500 respondents are matched using the "nearest" station algorithm. Of these, only ~5200 have cloud cover data available from the clustered station algorithm and 5900 from the nearest station method. Figure 1 on page 9 shows the coverage of respondents by nearby weather stations for the ESC2 and GSS19 surveys and under the two assignment algorithms. In all cases, approximately half of the respondents are within 10 km of their assigned weather station. Estimates resulting from these two different assignment methods do not differ significantly, and the "cluster"-assigned data are used preferentially in all the results below.

3 Evidence and discussion

In this section the main findings are summarised in the form of regression coefficient tables. Because the estimates are primarily made for models of SWL, a proxy for utility itself, there is no structural equation framework motivating the analysis. Reduced form equations estimate the marginal effect of different circumstances on the outcome of interest. Rather than pooling data from two surveys which use different sampling methods, each equation is estimated separately for ESC2 and GSS19. In some tables, mean values of coefficients from the two surveys are reported.

3.1 Weather and well-being

Tables 1–6 report results from an investigation of the influence of weather on responses to several survey questions, including subjective measures of well-being.[6] For discrete dependent variables such as SWL and subjective assessments of trust and health, estimates from a logit or an ordered logit model are reported.[7] The model specifications focus on the average cloudiness over the week prior to the interview as an explanatory variable and show that once this and the same-day cloudiness are controlled for, the temperature and precipitation do not significantly affect outcomes.

Column 1 of Table 1 on page 12 shows a significant negative relationship between SWL and the seven-day cloudiness prior to the day of interview for GSS19 respondents when several sociodemographic variables, not including income or self-reported health, are controlled for. These controls encompass the essentially objective measures of sex, a quadratic in age, five dummies for marriage status, and five dummies for workforce status, along with two more subjective measures of religiosity. This set of controls is included[8] in every model throughout the paper but for compactness is generally not shown.

Even after including these important determinants of SWL, the remaining geographic variation in SWL may be correlated with recent weather. Since a sunny climate

[6] The appendix and online supplement contain more complete versions of tables shown in the text.

[7] Raw coefficients are shown in the table. Logit and ordered logit models estimate the marginal change in probability, held uniform across different possible outcome values, of finding a higher dependent variable value for a given marginal change in an explanatory variable. To calculate the probability ratio between successive outcome possibilities, simply exponentiate the raw coefficient shown in the table.

[8] Not all variables are available in both surveys.

is likely to serve as a geographic amenity, one might expect to find higher incomes in sunnier locations, given a residential market with high mobility. One might also expect that objective health or at least subjectively reported health would be affected by climate or weather and thus account for some of the correlation between cloudiness and satisfaction with life. In columns 3 and 5, household income and self-reported health along with a subjective measure of trust in neighbours are included in the regression and result in no significant change in coefficients on cloudiness.

Corresponding results for the ESC2 survey, shown in columns 2, 4, and 6, are consistent with those for GSS19 but are based on a much smaller sample and are less significant. Taken together, the two surveys produce a significant negative coefficient for cloudiness, as shown in the greyed columns following each pair. These report weighted mean coefficients for the two surveys, using the reciprocal squared standard errors as weights.

The final two columns in Table 1 confirm that the additional same-day weather effects of temperature, precipitation, and cloudiness are insignificant. Further tests of these findings are shown in the Appendix.

In order to control for any seasonal variation in life satisfaction due to length of daylight or other annual cycles, monthly fixed effects were included and the findings are reported in Table 2. Adding these controls uniformly strengthens the estimated influence of recent cloudiness, possibliy indicating the importance of expectations in moderating the effect of weather on satisfaction with life. This possibility is revisited further on but the present interest is in isolating the effect of short term weather.

In Table 4 the estimated models include a dummy variable for each of 22 (for ESC2) or 49 (for GSS19) weather stations used in matching weather data to respondents with a minimal set of locations, i.e. via the "clustered" method. These stations are the ones with ten or more respondents nearby. Controlling for weather station fixed effects removes the confounding influence of most geographic variations in climate as well as other geographical amenities and local contextual effects. The coefficient estimated for cloudiness is only slightly diminished in this case and as an interesting side note, the effects of health and own trust in neighbours remain unchanged in this specification. The calculation of standard errors is performed with clustering at the same level as the fixed effect controls.

An account of the effect of short-term weather on SWL is only credible when the influence of climatic norms, which vary over both season and geography, is fully controlled for. Accordingly, the central result is presented in Table 4 which includes fixed effects for every possible combination of calendar month and weather station. Such clusters containing less than ten respondents are again dropped, diminishing the sample size somewhat. By including this generous set of controls, all aspects of the climate are accounted for and the seven-day cloudiness measure represents a highly exogenous event determined through the fully randomized algorithm of the survey sampling method, which for GSS19 was stratified by month and by geographic region. The estimates indicate a strong effect of recent cloudiness on SWL that is consistent between the two surveys, marginally significant for ESC2, and strongly significant within the larger sample of GSS19. The probability ratio corresponding to the recent cloudiness coefficient in column ⟨61–62⟩ of Table 4 is 0.53, indicating that a run of completely sunny weather increases the chance of an individual reporting an extra point higher on

	SWL (1)	SWL (2)	SWL ⟨1-2⟩	SWL (3)	SWL (4)	SWL ⟨3-4⟩	SWL (5)	SWL (6)	SWL ⟨5-6⟩	SWL (7)	SWL (8)	SWL ⟨7-8⟩
clouds										−.19	−.12	−.17
										(.15)	(.22)	(.12)
clouds (7 days)	−.77	−.43	−.68	−.94	−.52	−.81	−.78	−.49	−.70	−.81	−.58	−.74
	(.22)	(.36)	(.19)	(.24)	(.38)	(.20)	(.24)	(.38)	(.20)	(.26)	(.39)	(.21)
T_{high} (°C)										.002	−6e-05	.001
										(.009)	(.011)	(.007)
T_{low} (°C)										−.0006	.007	.002
										(.009)	(.012)	(.007)
rain (mm)										.001	−.007	−.0001
										(.004)	(.010)	(.004)
snow (cm)										−.008	−.003	−.006
										(.016)	(.024)	(.013)
log(HH inc)				.64	.47	.59	.36	.34	.35	.42	.40	.41
				(.11)	(.16)	(.091)	(.11)	(.15)	(.091)	(.12)	(.15)	(.094)
health							2.81	1.66	2.55	2.85	1.70	2.58
							(.15)	(.28)	(.13)	(.16)	(.28)	(.14)
trust-N							.51	.42	.46			
							(.17)	(.14)	(.11)			
controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
survey	G19	E2	⟨2⟩	G19	E2	⟨2⟩	G19	E2	⟨2⟩	G19	E2	⟨2⟩
obs.	6359	1632	7991	5167	1496	6663	5161	1495	6656	4956	1495	6451
pseudo-R^2	.014	.031		.018	.033		.056	.043		.055	.042	

Table 1: Weather and satisfaction with life, without geographic controls. *Raw ordered logit coefficients and standard errors are shown. A number of other demographic, individual, and household controls are included but not shown; see Table 11 on page 30 for detailed results behind this and the following five tables. Significance: 1% 5% 10%*

[tab:clouds-nofe-subset] [/home/cpbl/research/thesis/final/rdc/cloudsClusb1-withMeans-SWL-nofe-subset]

the ten-point SWL scale by over 20%, as compared with a completely overcast week.[9]

[9] Odds of reporting a higher score are even under sunny weather (i.e. with cloudiness=0) and the odds ratio is $\exp(-0.64) \approx 0.53$ under cloudy weather, meaning the odds of a higher SWL score are only half those of a lower SWL score — ie $\frac{1}{3}$ and $\frac{2}{3}$, respectively.

	SWL (19)	SWL (20)	SWL ⟨19-20⟩	SWL (21)	SWL (22)	SWL ⟨21-22⟩	SWL (23)	SWL (24)	SWL ⟨23-24⟩	SWL (25)	SWL (26)	SWL ⟨25-26⟩
clouds										−.23	−.17	−.20
										(.21)	(.22)	(.15)
clouds (7 days)	−.83	−.57	−.75	−.99	−.69	−.89	−.91	−.68	−.84	−.87	−.69	−.82
	(.31)	(.47)	(.26)	(.29)	(.40)	(.23)	(.26)	(.39)	(.22)	(.27)	(.44)	(.23)
T_{high} (°C)										−.004	.0006	−.003
										(.007)	(.012)	(.006)
T_{low} (°C)										−.009	.001	−.005
										(.007)	(.009)	(.006)
rain (mm)										.0002	−.008	−.0008
										(.003)	(.008)	(.003)
snow (cm)										−.010	−.003	−.009
										(.012)	(.030)	(.011)
log(HH inc)				.64	.47	.54	.36	.33	.34	.42	.38	.40
				(.15)	(.12)	(.094)	(.14)	(.13)	(.094)	(.13)	(.14)	(.096)
health							2.81	1.66	2.56	2.84	1.70	2.58
							(.14)	(.26)	(.12)	(.14)	(.25)	(.12)
trust-N							.51	.44	.46			
							(.19)	(.12)	(.098)			
controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
mnth f.e.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
clustering	mnth	mnth	mnth	mnth	mnth	mnth	mnth	mnth	mnth	mnth	mnth	mnth
survey	G19	E2	⟨2⟩	G19	E2	⟨2⟩	G19	E2	⟨2⟩	G19	E2	⟨2⟩
obs.	6359	1632	7991	5167	1496	6663	5161	1495	6656	4956	1495	6451
pseudo-R^2	.015	.033		.020	.035		.057	.045		.057	.044	
$N_{clusters}$	12	8		12	8		12	8		12	8	

Table 2: Weather and satisfaction with life, allowing for monthly fixed effects. *Significance: 1% 5% 10%*

[tab:clouds-monthfe-subset] [/home/cpbl/research/thesis/final/rdc/cloudsClusb1-withMeans-SWL-mnth-subset]

	SWL	SWL	SWL	SWL	SWL	SWL	SWL	SWL	SWL	SWL	SWL	SWL
	(37)	(38)	⟨37-38⟩	(39)	(40)	⟨39-40⟩	(41)	(42)	⟨41-42⟩	(43)	(44)	⟨43-44⟩
clouds										−.14	−.013	−.12
										(.10)	(.22)	(.094)
clouds (7 days)	−.71	−.23	−.50	−.84	−.18	−.58	−.65	−.20	−.42	−.68	−.25	−.49
	(.26)	(.30)	(.20)	(.26)	(.32)	(.20)	(.31)	(.31)	(.22)	(.28)	(.32)	(.21)
T_{high} (°C)										−.003	−.007	−.004
										(.009)	(.013)	(.007)
T_{low} (°C)										.007	.015	.009
										(.008)	(.013)	(.007)
rain (mm)										.0006	−.010	−.0006
										(.004)	(.011)	(.004)
snow (cm)										−.012	−.003	−.008
										(.020)	(.024)	(.015)
log(HH inc)				.67	.51	.61	.39	.38	.38	.45	.41	.44
				(.13)	(.17)	(.10)	(.12)	(.15)	(.092)	(.13)	(.17)	(.10)
health							2.84	1.74	2.64	2.89	1.76	2.70
							(.12)	(.26)	(.11)	(.12)	(.26)	(.10)
trust-N							.50	.38	.44			
							(.16)	(.17)	(.12)			
controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
stn f.e.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
clustering	stn	stn	stn	stn	stn	stn	stn	stn	stn	stn	stn	stn
survey	G19	E2	⟨2⟩	G19	E2	⟨2⟩	G19	E2	⟨2⟩	G19	E2	⟨2⟩
obs.	6334	1594	7928	5147	1461	6608	5141	1460	6601	4928	1460	6388
pseudo-R^2	.020	.036		.025	.039		.062	.049		.063	.048	
$N_{clusters}$	50	22		50	22		50	22		49	22	

Table 3: Weather and satisfaction with life, allowing for local fixed effects. *Significance: 1% 5% 10%*

[tab:clouds-stnfe-subset] [/home/cpbl/research/thesis/final/rdc/cloudsClusb1-withMeans-SWL-stn-subset]

	SWL (55)	SWL (56)	SWL ⟨55-56⟩	SWL (57)	SWL (58)	SWL ⟨57-58⟩	SWL (59)	SWL (60)	SWL ⟨59-60⟩	SWL (61)	SWL (62)	SWL ⟨61-62⟩
clouds										−.23	−.35	−.29
										(.19)	(.22)	(.14)
clouds (7 days)	−.47	−.65	−.52	−.71	−.56	−.67	−.67	−.58	−.64	−.67	−.58	−.64
	(.34)	(.54)	(.29)	(.35)	(.52)	(.29)	(.37)	(.55)	(.31)	(.38)	(.53)	(.31)
T_{high} (°C)										−.004	−.006	−.005
										(.012)	(.014)	(.009)
T_{low} (°C)										−.011	.009	−.001
										(.013)	(.013)	(.009)
rain (mm)										.004	−.011	3e-05
										(.006)	(.010)	(.005)
snow (cm)										−.010	−.037	−.021
										(.035)	(.041)	(.027)
log(HH inc)				.67	.72	.68	.35	.56	.41	.42	.61	.47
				(.13)	(.20)	(.11)	(.12)	(.20)	(.10)	(.13)	(.21)	(.11)
health							2.95	1.53	2.44	2.99	1.58	2.47
							(.17)	(.23)	(.13)	(.17)	(.23)	(.14)
trust-N							.62	.48	.56			
							(.20)	(.23)	(.15)			
controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
mnthStn f.e.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
clustering	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn
survey	G19	E2	⟨2⟩	G19	E2	⟨2⟩	G19	E2	⟨2⟩	G19	E2	⟨2⟩
obs.	5144	1245	6389	4040	1122	5162	4017	1122	5139	3833	1122	4955
pseudo-R^2	.027	.033		.033	.036		.073	.045		.074	.044	
$N_{clusters}$	169	44		152	42		150	42		143	42	

Table 4: Weather and satisfaction with life, controlling for local climate. *Significance: 1% 5% 10%*

[tab:clouds-monthstnfe-subset] [/home/cpbl/research/thesis/final/rdc/cloudsClusb1-withMeans-SWL-mnthstn-subset]

3.2 Weather and other determinants of well-being

Ascertaining a large effect of purely exogenous weather shocks on SWL does not directly elucidate the mechanism of influence. Two possible channels are (1) a sun-associated shift towards optimism when conducting the life satisfaction assessment and (2) a weather-mediated effect on time use over the week preceeding the interview. For instance, sunny weather may be conducive to socialising with family, friends, or community out of the home or pursuing other rewarding activities, in particular those that are outdoors or require outdoor travel. Recent enjoyment of such weather-modulated activities may promote the salience of the respondent's social connectedness or access to chosen leisure activities.

The subsequent two tables may shed some preliminary light on these possibilities. Firstly, the first four columns of Table 6 contain the surprising result that when a conventional measure of affect, or mood, is substituted in place of the more cognitive and reflective SWL, the influence from weather nearly disappears. The coefficients come from the GSS19 survey which asked the question "Presently, would you describe yourself as: very happy, somewhat happy, somewhat unhappy, or very unhappy?" to all respondents (stating "no opinion" was also an option). ESC2 had no similar question about mood. When complete controls for climate and other geographic effects are included,[10] the estimated effect of recent and current cloudiness on self-reported happiness is not statistically distinguishible from zero. There is the weak suggestion that cooler nighttime temperatures promote higher happiness, and it is also worthy of note that self-reported health is almost as strongly related to short-term happiness as to the longer-term report of SWL.

The compressed, four-point scale of the happiness question can be expected to elicit numerically smaller marginal effects than the ten-point SWL question, simply on the basis of its coarser resolution. Thus, comparable effects from recent cloudiness cannot be altogether statistically ruled out by the results of Table 6, but they nevertheless strongly suggest that the first postulated channel described above, in which cloudiness affects mood which in turn affects the calculation of SWL, is not a good description. One way to check this implication is to convert SWL into a comparable four-point scale to see whether the reduced resolution itself is to blame for the insignificant coefficients. This is carried out in Table 5. The ten-point responses given in GSS19 for SWL are mapped into four points in order to match as closely as possible the distribution of the happiness response. The result is clearly no decrease in the significance of the effect, confirming the surprising result that the SWL question is more sensitive than happiness to the influence of transient weather.

While self-reported health is a strong predictor of both SWL and happiness, like happiness it does not appear to be significantly driven by the degree of recent cloudiness nor by daily temperatures. Columns (5) – (8) of Table 6 show means of coefficients from both surveys with health as the dependent variable and with local climate fixed effects fully accounted for. These are extracted from the more detailed set of estimates which include regressions without the fixed effects.

Corresponding findings for weather effects on two measures of trust and on self-reported household income are also summarised in Table 6. Because income is a

[10] Once again, the more complete set of tests carried out can be seen in Table 11 on page 30.

continuous variable, an ordinary least-squares (OLS) model is used in the final three columns. Only weighted averages from the two surveys are displayed in the table. The appendix shows that in general the effect of precipitation is not consistent between the two surveys, while those of temperature and cloudiness are. Trust in neighbours is negatively but marginally dependent on recent cloudiness while reported income is negatively — but more significantly for GSS19 than for ESC2 — associated with snowfall. Because only half of the GSS19 respondents were asked trust questions, the sample sizes are smaller for these than for other questions.

The possibility that some of the major self-reported covariates of life satisfaction are also strongly affected by weather conditions is important. If spurious influences on mood can be shown simultaneously to affect both satisfaction with life and the "right hand side" variables typically portrayed as causative, the consistency of estimates in individual level regressions for life satisfaction could be put gravely in doubt. Correlations between SWL and trust and even between SWL and self-reported income that are due to separate but simultaneous influence from transient factors like weather may be indistinguishable from correlations that are due to a causal channel running only through more long-term effects. This amounts to the central critique made by Bertrand and Mullainathan (2001) and is also the classic endogeneity problem.

To lay out some possibilities explicitly for the three-way relationship between weather, SWL, and other subjective measures like trust, consider the following causal relationships corresponding to the case of spurious correlation:

$$\begin{array}{ccccc} & & & & \text{trust} \\ & & & \nearrow & \\ \text{weather} & \longrightarrow & \text{mood, judgement} & & \\ & & & \searrow & \\ & & & & \text{life satisfaction} \end{array}$$

There need be no effect at all of trust on life satisfaction in order to observe a statistical correlation between the two. In this case weather conditions influence an individual's assessment of others' trustworthiness through some affective bias in judgement. For instance, sunny weather may generate a good mood and good moods may tend to promote the salience of positive rather than negative attributes of remembered experience. Parallel biases may then influence responses to the trust question and the SWL question.

Another possibility is that the relationship between trust and life satisfaction is more or less causal in the way generally portrayed in the social capital and well-being literature, and that weather is correlated with SWL largely through its influence on the measured and well-recognized principal determinants of SWL, such as trust:

$$\begin{array}{ccccccc} & & \text{mood, judgement} & \longrightarrow & \text{trust} & & \\ & \nearrow & & & & \searrow & \\ \text{weather} & & & & & & \text{life satisfaction} \\ & \searrow & & & & \nearrow & \\ & & \text{activities, encounters} & \longrightarrow & \text{trust} & & \end{array}$$

Two examples are shown of how this influence on trust could come about. The top one works through the same judgement bias channel discussed above, while the bottom

	SWL (4-point)	SWL (4-point)	SWL (4-point)	SWL (4-point)
	(1)	(2)	(3)	(4)
clouds				−.52
				(.26)
clouds (7 days)	−.91	−1.25	−1.22	−1.22
	(.39)	(.39)	(.44)	(.46)
T_{high} (°C)				−.002
				(.017)
T_{low} (°C)				−.026
				(.020)
rain (mm)				.003
				(.008)
snow (cm)				−.046
				(.038)
log(HH inc)		.59	.28	.28
		(.16)	(.15)	(.16)
health			2.97	2.96
			(.22)	(.22)
trust-N			.47	
			(.22)	
controls	✓	✓	✓	✓
mnthStn f.e.	✓	✓	✓	✓
clustering	mnthStn	mnthStn	mnthStn	mnthStn
survey	G19	G19	G19	G19
obs.	5144	4040	4017	3833
pseudo-R^2	.055	.065	.124	.126
$N_{clusters}$	169	152	150	143

Table 5: Weather and a compressed measure of life satisfaction. *The dependent variable is the 10-point satisfaction with life response compressed into four categories for better comparability with happiness in GSS19. Significance:* *1%* *5%* *10%*

[tab:SWL4] [/home/cpbl/research/thesis/final/rdc/cloudsClusc1-hidecontrols-swl4-subset]

	happy	happy	happy	happy	health	health	health	health	trust-N	trust-N	trust-N	trust-N	trust-G	trust-G	trust-G	trust-G	log(HH inc)	log(HH inc)	log(HH inc)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
clouds				−.11				.013				.15				.068			−.049
				(.17)				(.15)				(.18)				(.25)			(.027)
clouds (7 days)	−.28	−.31	−.27	−.15	−.16	−.095	−.088	−.015	−.73	−.35	−.42	−.66	.24	.62	.74	.72	−.082	−.074	−.087
	(.38)	(.43)	(.43)	(.48)	(.26)	(.28)	(.28)	(.31)	(.34)	(.38)	(.39)	(.41)	(.48)	(.50)	(.52)	(.56)	(.047)	(.047)	(.049)
T_{high} (°C)				.016				−.005				.013				−.020			.002
				(.015)				(.009)				(.012)				(.016)			(.001)
T_{low} (°C)				−.040				−.005				−.009				−.009			−.001
				(.020)				(.011)				(.013)				(.018)			(.001)
rain (mm)				.005				.006				−.005				−.014			−.0008
				(.007)				(.004)				(.006)				(.008)			(.0009)
snow (cm)				−.041				.053				.045				−.017			−.010
				(.029)				(.014)				(.030)				(.034)			(.003)
log(HH inc)		.63	.35	.31		.78	.75	.82		.76	.71	.75		1.02	.75	.98			
		(.14)	(.14)	(.16)		(.10)	(.10)	(.11)		(.15)	(.15)	(.14)		(.15)	(.16)	(.16)			
health			2.63	2.67							.78	.77			.90	1.20		.17	.19
			(.19)	(.19)							(.18)	(.18)			(.23)	(.25)		(.023)	(.023)
trust-N			.37				.49								1.70			.11	
			(.23)				(.11)								(.17)			(.019)	
controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
mnthStn f.e./clust	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
survey	G19	G19	G19	G19	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩
obs.	5169	4052	4029	3846	6447	5195	5195	5009	3390	2683	2682	2603	3753	3067	3059	2967	5350	5335	5141

Table 6: Weather and other covariates of satisfaction with life. *Mean coefficients, calculated as weighted averages over estimates carried out separately for each available survey, are shown. Significance: 1% 5% 10%*

[tab:weatherAndOtherCovariates] [/home/cpbl/research/thesis/final/rdc/cloudsClusb1-onlyMeans-subset]

is that described previously in which recent activities that are influenced by weather may change the salience or freshness of memories, in this case relating specifically to the familiarity and trustworthiness of neighbours or others. In each of these two interpretations, short-term weather conditions act like a natural experiment in which the independent variable, trust, is modulated randomly around its longer average without directly affecting SWL. Under this assumption the importance of trust in determining SWL could be correctly estimated by using the projection of reported trust onto current weather conditions in a two-stage regression for SWL. The randomness of recent weather, controlling for climatic norms, would eliminate other endogenous factors linking trust and SWL. However, given that weather is highly correlated with SWL even after trust and other subjective responses are controlled for suggests that weather is not a reasonable instrument for trust when predicting SWL.

The lack of an effect of weather on happiness may be an argument against the mood-mediated channels, while the significant coefficient on weather in explaining SWL even when trust, health, and income are controlled for (column ⟨59-60⟩ in Table 4) suggests that the introspective judgement leading to SWL responses is being affected by weather in some other way.

In order to test for the validity of standard inferences about the subjective (health and trust) and ostensibly objective (income) determinants of SWL in the presence of an influence on mood and judgement, Table 7 compares regression results with and without controls for weather. Columns 1, 4, 7, and 10 control for current weather conditions. The subsequent columns to each of these — 2, 5, 8, and 11 — estimate a version of the equation which is naïve to weather but uses precisely the same sample as the first specification. The remaining columns estimate the naïve equation using the entire available sample — that is, including samples which are missing one of the weather condition variables and therefore excluded in the earlier estimates. In all cases, fixed effects are included for every combination of month and geography.

Reassuringly, despite the significant influence already shown of weather on both SWL and some of its explanatory variables, the inclusion and exclusion of weather conditions result in indistinguishible coefficients on each of those explanatory variables.

3.3 Climate and well-being

The foregoing analysis addresses the question of how much is missing when a transient influence like weather is absent from an empirical model for SWL. I now turn to the analogous question regarding climate. When geographic or seasonal differences in climate are ignored across a sample population, one might expect significant variation in SWL to go unexplained due to this missing variable. In sections 3.1 and 3.2 these differences have been controlled for using fixed effects for month, location, or the combination of the two in order to focus on the relatively unexpected, short-term component of weather. In place of these all-encompassing climate fixed effects, I now use some measures of long-term climate averages available from Environment Canada to investigate climate as an amenity. Such efforts have also been made for Russia and Ireland by Frijters and Van Praag (1998) and Brereton et al. (2008).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
clouds	−.28			−.31			−.25			−.30		
	(.14)			(.13)			(.13)			(.14)		
clouds (7 days)	−.64	−.68		−.45	−.47		−.44	−.46		−.61	−.64	
	(.30)	(.29)		(.29)	(.29)		(.29)	(.29)		(.31)	(.31)	
T_{high} (°C)	−.005			−.007			−.007			−.005		
	(.009)			(.008)			(.008)			(.009)		
T_{low} (°C)	−.003			−.003			−.001			−.0005		
	(.009)			(.009)			(.009)			(.009)		
rain (mm)	.003			−.0004			−.002			−.002		
	(.004)			(.004)			(.005)			(.005)		
snow (cm)	−.022			−.040			−.035			−.024		
	(.025)			(.022)			(.021)			(.026)		
log(HH inc)	.71	.72	.72							.43	.41	.44
	(.11)	(.11)	(.11)							(.11)	(.10)	(.11)
trust-N				.80	.76	.79				.61	.56	.59
				(.13)	(.13)	(.13)				(.15)	(.15)	(.15)
health							2.62	2.64	2.63	2.43	2.44	2.42
							(.13)	(.12)	(.13)	(.14)	(.13)	(.14)
controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
clustering	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn
survey	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩
obs.	4978	4978	4978	6160	6389	6160	6146	6375	6146	4955	5139	4955

Significance: 1% 5% 10%

Table 7: Comparison between naïve and weather-aware models of SWL. *Raw ordered logit coefficients and standard errors are shown. The complete results are presented in Table 13 on page 37.*

[tab:cloudsCompareNaive] [/home/cpbl/research/thesis/final/rdc/cloudsCompareNaiveClusb1-onlyMeans-hidecontrols]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
YEAR: $\langle T_{max} \rangle$ (°C)	.068	.052	.085	.063	.070	.069							
	(.036)	(.044)	(.041)	(.032)	(.040)	(.035)							
YEAR: $\langle T_{min} \rangle$ (°C)	−.011	−.019	−.011	−.011	−.021	−.008							
	(.012)	(.016)	(.018)	(.010)	(.016)	(.018)							
YEAR: days sun	−.004	−.002	−.002	−.004	−.003	−.004							
	(.002)	(.003)	(.004)	(.003)	(.003)	(.004)							
MONTH: days sun		.053			.075		−.020		−.007				
		(.11)			(.094)		(.032)		(.026)				
MONTH: sun fraction		−.010			−.017		.003		.007				
		(.026)			(.023)		(.010)		(.008)				
MONTH: $\langle T \rangle$ (°C)		.029			.031		−.002		−.010				
		(.029)			(.027)		(.012)		(.012)				
MONTH: rain>5mm		.033			.030		.032		.029				
		(.051)			(.047)		(.033)		(.029)				
MONTH: snow>5cm		−.059			.010		−.038		−.018				
		(.10)			(.091)		(.055)		(.046)				
DAY: precipitation			.013			.012		.003		.0002	−.005	.007	−.030
			(.005)			(.004)		(.003)		(.003)	(.009)	(.007)	(.014)
DAY: $\langle T_{max} \rangle$ (°C)			.060			.046		−.061		−.045	−.27	−.26	−.41
			(.046)			(.048)		(.021)		(.020)	(.12)	(.095)	(.13)
DAY: $\langle T_{min} \rangle$ (°C)			−.004			−.014		.069		.053	.31	.31	.47
			(.048)			(.052)		(.024)		(.022)	(.13)	(.11)	(.15)
clouds (7 days)													−.56
													(.29)
log(HH inc)	.57	.59	.57				.54	.59			.70		.69
	(.14)	(.14)	(.14)				(.100)	(.074)			(.086)		(.11)
controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
f.e./clustering	mnth	mnth	mnth	mnth	mnth	mnth	stn	stn	stn	stn	mnthStn	mnthStn	mnthStn
survey	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩	⟨2⟩
obs.	2285	2285	2285	2774	2774	2774	4538	12216	5453	14753	8090	10252	5162

Table 8: Climate and satisfaction with life. *Covariates include local climatic expectations in the form of probabilities and means for each station's overall climate (*YEAR*) and for its averages for the month (*MONTH*) and day (*DAY*) of the interview. Standard errors are calculated with clustering at the level of the fixed effects (f.e.) indicated. Results in this table are all weighted averages of coefficients determined separately for each of the two surveys; see Table 12 on page 34 for details. Significance: 1% 5% 10%*

[tab:cloudsandclimatechecks] [/home/cpbl/research/thesis/final/rdc/cloudsandclimatechecksb1-onlyMeans-hideControls-subset]

Table 8 summarises the results, presented in more detail in the Appendix.[11] Climate parameters are grouped into three categories: those that describe annual, monthly, and daily averages at each weather station. The first column of the table shows an ordered logit estimate for SWL which includes month fixed effects, the standard suite of socioeconomic controls along with household income, and three measures of annual average climate. These are the average maximum temperature of the warmest month, the average minimum of the coldest month, and the average number of days of sunshine per year. The second and third columns bring in local monthly averages and local daily averages for each station, including the probability of receiving more than 5 mm of precipitation and the average amount of precipitation received. Because these climate measures are not available for all stations, sample sizes are relatively small.

Generally, the climatic variables do not appear to have a significant effect on SWL once the season and demographic controls are accounted for.[12] The next three columns show the same specifications with the omission of household income, in order to test for the possibility that people with greater financial means of choosing their location are more likely to experience a favourable climate. This turns out not to be the case. Columns (7) to (10) repeat the specifications allowing for a fixed effect for each weather station rather than for each month. Thus the month-level climate averages now represent climate features that are special for the interview month at a given location rather than those that are special to the location for a given month.

The estimates shown in the remaining three columns of Table 8 include the detailed set of controls for local and seasonal climate. Once again, expectations for the day's weather do not appear to play significantly into SWL responses yet — as shown in the final column — the actual cloudiness experienced has a very significant impact on SWL.

3.4 Cyclic temporal effects

The date of the interview itself represents another possible contextual effect that is usually ignored in large survey analysis. Csikszentmihalyi and Hunter (2003) use an experience sampling method to investigate the correlates of reported momentary happiness. For their sample of teenagers, significant though slight differences in happiness were found as a function of time of day and the day of the week, with times free of school constraints being favoured. To check whether the social structure of time also affects life satisfaction reported by adults, I estimate the standard SWL equation with fixed effects for the days of the week and for the months of the year. To provide more constrained alternatives, a weekend dummy variable and an annual-cycle sinusoid peaking on summer solstice are also tested.

Tables 9 and 10 summarise the results. There is no significant pattern throughout the week, but there is a significant seasonal variation, with a sharp mid winter or holiday peak in SWL. Because the ESC2 survey did not span an entire year, it is not possible to corroborate the pattern properly between surveys.

[11] See Table 12 on page 34.

[12] The significant coefficients on precipitation-related variables only occur when collinear variables are present.

	(9)	(10)	⟨9-10⟩	(11)	(12)	⟨11-12⟩
Monday	−.075	.095	−.012			
	(.11)	(.15)	(.090)			
Tuesday	.038	.082	.050			
	(.096)	(.15)	(.081)			
Wednesday	−.15	−.009	−.095			
	(.10)	(.14)	(.083)			
Thursday	−.084	−.055	−.074			
	(.10)	(.14)	(.082)			
Friday	−.25	.31	−.12			
	(.12)	(.22)	(.11)			
Saturday	−.035	−.049	−.040			
	(.13)	(.17)	(.10)			
weekend				.082	−.074	.019
				(.077)	(.094)	(.060)
log(HH inc)	.71	.52	.65	.71	.52	.65
	(.10)	(.16)	(.087)	(.10)	(.16)	(.086)
trust-N	.86	.59	.73	.87	.58	.73
	(.15)	(.15)	(.11)	(.15)	(.15)	(.10)
controls	✓	✓	✓	✓	✓	✓
mnthStn f.e.	✓	✓	✓	✓	✓	✓
clustering	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn	mnthStn
survey	G19	E2	⟨2⟩	G19	E2	⟨2⟩
obs.	6309	1780	8089	6309	1780	8089
pseudo-R^2	.037	.033		.036	.032	
$N_{clusters}$	254	62		254	62	

Table 9: Days of the week and satisfaction with life. *Significance:* *1%* *5%* *10%*

[tab:Timea22-dow] [/home/cpbl/research/thesis/final/rdc/Timea22-withMeans-dow-hideControls]

	(5)	(6)	⟨5-6⟩	(7)	(8)	⟨7-8⟩
February	−.37	−.45	−.41			
	(.20)	(.21)	(.15)			
March	−.34	−.48	−.38			
	(.17)	(.24)	(.14)			
April	−.43	−.39	−.41			
	(.21)	(.25)	(.16)			
May	−.34	−.44	−.37			
	(.18)	(.24)	(.14)			
June	−.53	−.31	−.47			
	(.15)	(.27)	(.13)			
July	−.36	−.30	−.34			
	(.18)	(.32)	(.16)			
August	−.20	−.15	−.19			
	(.17)	(.30)	(.15)			
September	−.45		−.45			
	(.17)		(.17)			
October	−.38		−.38			
	(.17)		(.17)			
November	−.24		−.24			
	(.17)		(.17)			
December	−.28		−.28			
	(.20)		(.20)			
sun cycle				−.048	.052	−.037
				(.028)	(.081)	(.026)
log(HH inc)	.59	.47	.55	.59	.47	.55
	(.090)	(.12)	(.072)	(.089)	(.12)	(.071)
trust-N	.84	.57	.71	.84	.57	.72
	(.12)	(.13)	(.089)	(.12)	(.13)	(.088)
controls	✓	✓	✓	✓	✓	✓
stn f.e.	✓	✓	✓	✓	✓	✓
clustering	stn	stn	stn	stn	stn	stn
survey	G19	E2	⟨2⟩	G19	E2	⟨2⟩
obs.	9710	2561	12271	9710	2561	12271
pseudo-R^2	.028	.037		.027	.037	
$N_{clusters}$	137	49		137	49	

Table 10: Calendar months and satisfaction with life. *Significance:* *1%* *5%* *10%*

[tab:Timea22-months] [/home/cpbl/research/thesis/final/rdc/Timea22-withMeans-months-hideControls]

4 Conclusions

The perspective underpinning this work is to recognise subjective responses as the result of a cognitive evaluation that is likely to be imperfect yet which contains useful information. In principle there is no alternative to reliance on subjective assessments to evaluate a population's well-being or at least to learn or elucidate the importance of various factors in promoting this ultimate social goal. Since SWL data are characterised by a high degree of variability, both between individuals and for a given individual over time, understanding what influences and biases lie in this variation is an ongoing task. Given the importance of large survey data for modern inference about subjective well-being and its judgement-based explanatory factors, for instance measures of trust that proxy for social capital, being able to quantify or put constraints on psychological bias in survey responses remains an important component of analysis.

I find that after controlling for local climate expectations, an average of recent cloud cover levels has a large and significant effect on SWL responses. The magnitude of the modeled effect of a change in weather circumstances from half-cloudy to completely sunny is comparable to that associated with more than a factor of ten increase in household income, more than a full-spectrum shift in perceived trust in neighbours, and nearly twice the entire benefit of being married as compared with being single. In addition, there is an effect of weather on responses to some of the questions typically used in explaining variation in SWL. In particular, trust in neighbours shows a large effect significant at the 5% level and self-reported income may also be subject to a bias related to current weather conditions.

Nevertheless, the findings in this work do not support the hypothesis that the impact of weather on respondents' reported SWL acts through a broad affective bias which would cause correlated mistakes in explanatory and explained variables. There is no evidence of a strong weather effect on reported happiness, the best available measure of affective state at the time of interview, nor is there any evidence that weather causes a spurious correlation between SWL and standard explanatory variables. Statistical estimates which are not informed about the state of weather produce the same inferences regarding the determinants of SWL as those which take weather's influence into account.

To the extent that this work can be taken to be an applied test of the concerns laid out by Bertrand and Mullainathan (2001), their objections appear to be pessimistic in that they do not gain support in the expected way. At least for the case of weather and SWL, it appears that the effects of transient influences can be significant yet not overwhelm the underlying relationships evident through large statistical inferences.

The lack of a strong correlation between reported happiness and the aspects of weather which influence SWL and other subjective variables is surprising and remains mysterious. On the other hand there is a plausible explanation for the positive effect of sunniness on SWL and trust in neighbours. The influence could come as a result of modified behaviour, for instance the promotion of outdoor activity or social gathering, rather than directly from sunlight. Tests of this hypothesis will be carried out in future work.

References

Bayer, Patrick, and Robert McMillan (2005) 'Racial sorting and neighborhood quality.' Working Paper 11813, National Bureau of Economic Research, December 8

Bertrand, M., and S. Mullainathan (2001) 'Do People Mean What They Say? Implications for Subjective Survey Data.' *The American Economic Review* 91(2), 67–72 3, 4, 5, 17, 26

Brereton, F., J.P. Clinch, and S. Ferreira (2008) 'Happiness, geography and the environment.' *Ecological Economics* 65(2), 386–396 7, 8, 20

Cao, M., and J. Wei (2005) 'Stock market returns: A note on temperature anomaly.' *Journal of Banking and Finance* 29(6), 1559–1573 6

Csikszentmihalyi, M., and J. Hunter (2003) 'Happiness in Everyday Life: The Uses of Experience Sampling.' *Journal of Happiness Studies* 4(2), 185–199 23

Diener, E. (2000) 'Subjective well-being. The science of happiness and a proposal for a national index.' *Am Psychol* 55(1), 34–43 3

Frijters, P., and BMS Van Praag (1998) 'The Effects of Climate on Welfare and Well-Being in Russia.' *Climatic Change* 39(1), 61–81 7, 20

Guven, Cahit (2009) 'Reversing the Question: Does Happiness Affect Consumption and Savings Behavior?' *SSRN eLibrary* 6

Gyourko, Joseph, Matthew Kahn, and Joseph Tracy (1999) 'Quality of life and environmental comparisons.' In *Handbook of Regional and Urban Economics,* ed. P. C. Cheshire and E. S. Mills, vol. 3 of *Handbook of Regional and Urban Economics* (Elsevier) chapter 37, pp. 1413–1454 8

Helliwell, J.F. (2007) 'Well-Being and Social Capital: Does Suicide Pose a Puzzle?' *Social Indicators Research* 81(3), 455–496 7

Hirshleifer, D., and T. Shumway (2003) 'Good Day Sunshine: Stock Returns and the Weather.' *Journal of Finance* 6

Krämer, W., and R. Runde (1997) 'Stocks and the weather: An exercise in data mining or yet another capital market anomaly?' *Empirical Economics* 22(4), 637–641 6

Krueger, Alan B., and David A. Schkade (2008) 'The reliability of subjective well-being measures.' *Journal of Public Economics* 92(8-9), 1833–1845 4

Loughran, T., and P. Schultz (2004) 'Weather, stock returns, and the impact of localized trading behavior.' *Journal of Financial and Quantitative Analysis* 39(2), 343–64 6

Magnusson, A. (2000) 'An overview of epidemiological studies on seasonal affective disorder.' *Acta Psychiatrica Scandinavica* 101(3), 176–184 6

Mersch, PP, HM Middendorp, AL Bouhuys, DG Beersma, and RH van den Hoofdakker (1999) ‘Seasonal affective disorder and latitude: a review of the literature.’ *J Affect Disord* 53(1), 35–48 6

Moro, Mirko, Finbarr Brereton, Susana Ferreira, and J. P. Clinch (2008) ‘Ranking quality of life using subjective well-being data.’ *Ecological Economics,* 65(3), 448–460 7

Rappaport, Jordan (2007) ‘Title moving to high quality of life.’ *CEA 41st Annual Meetings* 7

Rehdanz, K., and D. Maddison (2005) ‘Climate and happiness.’ *Ecological Economics* 52(1), 111–125 7

Schimmack, U., E. Diener, and S. Oishi (2002) ‘Life-satisfaction is a momentary judgment and a stable personality characteristic: The use of chronically accessible and stable sources.’ *Journal of personality* 70(3), 345–384 5

Schkade, D., and D. Kahneman (1998) ‘Does living in california make people happy?: A focusing illusion in judgments of life satisfaction.’ *Psychological Science* 9(5), 340–46 5

Schwarz, N., and F. Strack (1991) ‘Evaluating one’s life: a judgment model of subjective well-being.’ In *Subjective well-being: an interdisciplinary perspective,* ed. F. Strack, M. Argyle, and N. Schwarz (Pergamon Press, Oxford [England]; New York) 4, 5

Schwarz, N., and GL Clore (1983) ‘Mood, misattribution, and judgments of well-being: informative and directive functions of affective states.’ *Journal of personality and social psychology* 45(3), 513–523 4, 5

Soroka, Stuart, Richard Johnston, and John F Helliwell (2007) ‘Measuring and modelling interpersonal trust.’ In *Diversity, Social Capital and the Welfare State,* ed. Fiona Kay and Richard Johnston (UBC Press) 8

Stutzer, A., and B.S. Frey (2008) ‘Stress that Doesn’t Pay: The Commuting Paradox.’ *Scandinavian Journal of Economics* 110(2), 339–366 7

van Praag, B.M.S., and B.E. Baarsma (2005) ‘Using Happiness Surveys to Value Intangibles: The Case of Airport Noise*.’ *The Economic Journal* 115(500), 224–246 7

Welsch, Heinz (2006) ‘Environmental welfare analysis: A life satisfaction approach.’ *Ecological Economics* 7

Yuan, K., L. Zheng, and Q. Zhu (2006) ‘Are investors moonstruck? Lunar phases and stock returns.’ *Journal of Empirical Finance* 13(1), 1–23 6

A Detailed Tables

Below are more detailed versions of estimation results presented in the main body of the paper. For space reasons, tables exclude coefficients of the set of demographic, individual, and household controls used for all models. The complete table is available from the author.

Table 11: Complete regression results for weather effects on survey-reported SWL, happiness, health, trust, and income. *Trust-G is the general social trust question, while trust-N is the stated trust in neighbours. The dependent variable is indicated at the left end of each row. All coefficients are raw ordered logit coefficients, except for the regressions for income, in which case OLS coefficients with robust standard errors are shown.*

Significance: 1% 5% 10%

[tab:clouds-subset-appendix] [/home/cpbl/research/thesis/final/rdc/cloudsClusb1-withMeans-hidecontrols-subset-transposed]

		clouds	clouds (7 days)	T_{high} (°C)	T_{low} (°C)	rain (mm)	snow (cm)	log(HH inc)	health	trust-N	constant	controls	mnth f.e.	stn f.e.	mnthStn f.e.	clustering	survey	obs.	pseudo-R^2	$N_{clusters}$	R^2(adj)
(1)	SWL		−.77									✓					G19	6359	.014		
			(.22)																		
(2)	SWL		−.43									✓					E2	1632	.031		
			(.36)																		
⟨1-2⟩	SWL		−.68									✓					⟨2⟩	7991			
			(.19)																		
(3)	SWL		−.94					.64				✓					G19	5167	.018		
			(.24)					(.11)													
(4)	SWL		−.52					.47				✓					E2	1496	.033		
			(.38)					(.16)													
⟨3-4⟩	SWL		−.81					.59				✓					⟨2⟩	6663			
			(.20)					(.091)													
(5)	SWL		−.78					.36	2.81	.51		✓					G19	5161	.056		
			(.24)					(.11)	(.15)	(.17)											
(6)	SWL		−.49					.34	1.66	.42		✓					E2	1495	.043		
			(.38)					(.15)	(.28)	(.14)											
⟨5-6⟩	SWL		−.70					.35	2.55	.46		✓					⟨2⟩	6656			
			(.20)					(.091)	(.13)	(.11)											
(7)	SWL	−.19	−.81	.002	−.0006	.001	−.008	.42	2.85			✓					G19	4956	.055		
		(.15)	(.26)	(.009)	(.009)	(.004)	(.016)	(.12)	(.16)												
(8)	SWL	−.12	−.58	−6e-05	.007	−.007	−.003	.40	1.70			✓					E2	1495	.042		
		(.22)	(.39)	(.011)	(.012)	(.010)	(.024)	(.15)	(.28)												
⟨7-8⟩	SWL	−.17	−.74	.001	.002	−.0001	−.006	.41	2.58			✓					⟨2⟩	6451			
		(.12)	(.21)	(.007)	(.007)	(.004)	(.013)	(.094)	(.14)												
(19)	SWL		−.83									✓	✓			mnth	G19	6359	.015	12	
			(.31)																		
(20)	SWL		−.57									✓	✓			mnth	E2	1632	.033	8	
			(.47)																		
⟨19-20⟩	SWL		−.75									✓	✓			mnth	⟨2⟩	7991			
			(.26)																		
(21)	SWL		−.99					.64				✓	✓			mnth	G19	5167	.020	12	
			(.29)					(.15)													
(22)	SWL		−.69					.47				✓	✓			mnth	E2	1496	.035	8	
			(.40)					(.12)													
⟨21-22⟩	SWL		−.89					.54				✓	✓			mnth	⟨2⟩	6663			
			(.23)					(.094)													
(23)	SWL		−.91					.36	2.81	.51		✓	✓			mnth	G19	5161	.057	12	
			(.26)					(.14)	(.14)	(.19)											
(24)	SWL		−.68					.33	1.66	.44		✓	✓			mnth	E2	1495	.045	8	
			(.39)					(.13)	(.26)	(.12)											
⟨23-24⟩	SWL		−.84					.34	2.56	.46		✓	✓			mnth	⟨2⟩	6656			
			(.22)					(.094)	(.12)	(.098)											
(25)	SWL	−.23	−.87	−.004	−.009	.0002	−.010	.42	2.84			✓	✓			mnth	G19	4956	.057	12	
		(.21)	(.27)	(.007)	(.007)	(.003)	(.012)	(.13)	(.14)												
(26)	SWL	−.17	−.69	.0006	.001	−.008	−.003	.38	1.70			✓	✓			mnth	E2	1495	.044	8	
		(.22)	(.44)	(.012)	(.009)	(.008)	(.030)	(.14)	(.25)												
⟨25-26⟩	SWL	−.20	−.82	−.003	−.005	−.0008	−.009	.40	2.58			✓	✓			mnth	⟨2⟩	6451			
		(.15)	(.23)	(.006)	(.006)	(.003)	(.011)	(.096)	(.12)												
(37)	SWL		−.71									✓		✓		stn	G19	6334	.020	50	
			(.26)																		
(38)	SWL		−.23									✓		✓		stn	E2	1594	.036	22	

Continued on next page

		clouds	clouds (7 days)	T_{high} (°C)	T_{low} (°C)	rain (mm)	snow (cm)	log(HH inc)	health	trust-N	constant	controls	mnth f.e.	stn f.e.	mnthStn f.e.	clustering	survey	obs.	pseudo-R^2	$N_{clusters}$	R^2(adj)
			(.30)																		
⟨37-38⟩	SWL		−.50									✓		✓		stn	⟨2⟩	7928			
			(.20)																		
(39)	SWL		−.84					.67				✓		✓		stn	G19	5147	.025	50	
			(.26)					(.13)													
(40)	SWL		−.18					.51				✓		✓		stn	E2	1461	.039	22	
			(.32)					(.17)													
⟨39-40⟩	SWL		−.58					.61				✓		✓		stn	⟨2⟩	6608			
			(.20)					(.10)													
(41)	SWL		−.65					.39	2.84	.50		✓		✓		stn	G19	5141	.062	50	
			(.31)					(.12)	(.12)	(.16)											
(42)	SWL		−.20					.38	1.74	.38		✓		✓		stn	E2	1460	.049	22	
			(.31)					(.15)	(.26)	(.17)											
⟨41-42⟩	SWL		−.42					.38	2.64	.44		✓		✓		stn	⟨2⟩	6601			
			(.22)					(.092)	(.11)	(.12)											
(43)	SWL	−.14	−.68	−.003	.007	.0006	−.012	.45	2.89			✓		✓		stn	G19	4928	.063	49	
		(.10)	(.28)	(.009)	(.008)	(.004)	(.020)	(.13)	(.12)												
(44)	SWL	−.013	−.25	−.007	.015	−.010	−.003	.41	1.76			✓		✓		stn	E2	1460	.048	22	
		(.22)	(.32)	(.013)	(.013)	(.011)	(.024)	(.17)	(.26)												
⟨43-44⟩	SWL	−.12	−.49	−.004	.009	−.0006	−.008	.44	2.70			✓		✓		stn	⟨2⟩	6388			
		(.094)	(.21)	(.007)	(.007)	(.004)	(.015)	(.10)	(.10)												
(55)	SWL		−.47									✓			✓	mnthStn	G19	5144	.027	169	
			(.34)																		
(56)	SWL		−.65									✓			✓	mnthStn	E2	1245	.033	44	
			(.54)																		
⟨55-56⟩	SWL		−.52									✓			✓	mnthStn	⟨2⟩	6389			
			(.29)																		
(57)	SWL		−.71					.67				✓			✓	mnthStn	G19	4040	.033	152	
			(.35)					(.13)													
(58)	SWL		−.56					.72				✓			✓	mnthStn	E2	1122	.036	42	
			(.52)					(.20)													
⟨57-58⟩	SWL		−.67					.68				✓			✓	mnthStn	⟨2⟩	5162			
			(.29)					(.11)													
(59)	SWL		−.67					.35	2.95	.62		✓			✓	mnthStn	G19	4017	.073	150	
			(.37)					(.12)	(.17)	(.20)											
(60)	SWL		−.58					.56	1.53	.48		✓			✓	mnthStn	E2	1122	.045	42	
			(.55)					(.20)	(.23)	(.23)											
⟨59-60⟩	SWL		−.64					.41	2.44	.56		✓			✓	mnthStn	⟨2⟩	5139			
			(.31)					(.10)	(.13)	(.15)											
(61)	SWL	−.23	−.67	−.004	−.011	.004	−.010	.42	2.99			✓			✓	mnthStn	G19	3833	.074	143	
		(.19)	(.38)	(.012)	(.013)	(.006)	(.035)	(.13)	(.17)												
(62)	SWL	−.35	−.58	−.006	.009	−.011	−.037	.61	1.58			✓			✓	mnthStn	E2	1122	.044	42	
		(.22)	(.53)	(.014)	(.013)	(.010)	(.041)	(.21)	(.23)												
⟨61-62⟩	SWL	−.29	−.64	−.005	−.001	3e-05	−.021	.47	2.47			✓			✓	mnthStn	⟨2⟩	4955			
		(.14)	(.31)	(.009)	(.009)	(.005)	(.027)	(.11)	(.14)												
(100)	happy		−.28									✓			✓	mnthStn	G19	5169	.048	169	
			(.38)																		
(101)	happy		−.31					.63				✓			✓	mnthStn	G19	4052	.057	152	
			(.43)					(.14)													
(102)	happy		−.27					.35	2.63	.37		✓			✓	mnthStn	G19	4029	.107	150	
			(.43)					(.14)	(.19)	(.23)											
(103)	happy	−.11	−.15	.016	−.040	.005	−.041	.31	2.67			✓			✓	mnthStn	G19	3846	.108	143	
		(.17)	(.48)	(.015)	(.020)	(.007)	(.029)	(.16)	(.19)												
(163)	health		−.33									✓			✓	mnthStn	G19	5200	.030	169	
			(.30)																		
(164)	health		.29									✓			✓	mnthStn	E2	1247	.024	44	
			(.50)																		
⟨163-164⟩	health		−.16									✓			✓	mnthStn	⟨2⟩	6447			
			(.26)																		
(165)	health		−.30					.90				✓			✓	mnthStn	G19	4071	.037	152	
			(.33)					(.14)													
(166)	health		.50					.60				✓			✓	mnthStn	E2	1124	.032	42	

Continued on next page

		clouds	clouds (7 days)	T_{high} (°C)	T_{low} (°C)	rain (mm)	snow (cm)	log(HH inc)	health	trust-N	constant	controls	mnth f.e.	stn f.e.	mnthStn f.e.	clustering	survey	obs.	pseudo-R^2	$N_{clusters}$	R^2(adj)
			(.56)					(.17)													
⟨165-166⟩	health		−.095					.78				✓			✓	mnthStn	⟨2⟩	5195			
			(.28)					(.10)													
(167)	health		−.30					.86		.87		✓			✓	mnthStn	G19	4071	.041	152	
			(.33)					(.13)		(.18)											
(168)	health		.52					.56		.24		✓			✓	mnthStn	E2	1124	.033	42	
			(.56)					(.17)		(.14)											
⟨167-168⟩	health		−.088					.75		.49		✓			✓	mnthStn	⟨2⟩	5195			
			(.28)					(.10)		(.11)											
(169)	health	.006	−.26	−.004	−.001	.006	−.017	.95				✓			✓	mnthStn	G19	3885	.039	145	
		(.19)	(.37)	(.012)	(.015)	(.004)	(.026)	(.14)													
(170)	health	.022	.53	−.006	−.010	−.002	.080	.62				✓			✓	mnthStn	E2	1124	.037	42	
		(.23)	(.56)	(.015)	(.016)	(.019)	(.016)	(.17)													
⟨169-170⟩	health	.013	−.015	−.005	−.005	.006	.053	.82				✓			✓	mnthStn	⟨2⟩	5009			
		(.15)	(.31)	(.009)	(.011)	(.004)	(.014)	(.11)													
(235)	trust-N		−.86									✓			✓	mnthStn	G19	2140	.035	100	
			(.53)																		
(236)	trust-N		−.64									✓			✓	mnthStn	E2	1250	.072	44	
			(.44)																		
⟨235-236⟩	trust-N		−.73									✓			✓	mnthStn	⟨2⟩	3390			
			(.34)																		
(237)	trust-N		−.19					.59				✓			✓	mnthStn	G19	1558	.038	82	
			(.61)					(.25)													
(238)	trust-N		−.46					.86				✓			✓	mnthStn	E2	1125	.086	42	
			(.48)					(.18)													
⟨237-238⟩	trust-N		−.35					.76				✓			✓	mnthStn	⟨2⟩	2683			
			(.38)					(.15)													
(239)	trust-N		−.31					.49	1.06			✓			✓	mnthStn	G19	1558	.044	82	
			(.62)					(.25)	(.24)												
(240)	trust-N		−.48					.83	.45			✓			✓	mnthStn	E2	1124	.087	42	
			(.49)					(.18)	(.26)												
⟨239-240⟩	trust-N		−.42					.71	.78			✓			✓	mnthStn	⟨2⟩	2682			
			(.39)					(.15)	(.18)												
(241)	trust-N	.13	−.43	.006	.017	−.016	.013	.46	1.12			✓			✓	mnthStn	G19	1479	.045	77	
		(.26)	(.71)	(.018)	(.024)	(.007)	(.042)	(.26)	(.26)												
(242)	trust-N	.18	−.77	.018	−.019	.039	.077	.88	.42			✓			✓	mnthStn	E2	1124	.092	42	
		(.24)	(.51)	(.015)	(.015)	(.014)	(.042)	(.17)	(.26)												
⟨241-242⟩	trust-N	.15	−.66	.013	−.009	−.005	.045	.75	.77			✓			✓	mnthStn	⟨2⟩	2603			
		(.18)	(.41)	(.012)	(.013)	(.006)	(.030)	(.14)	(.18)												
(307)	trust-G		.67								−1.65	✓			✓	mnthStn	G19	2534	.093	166	
			(.72)								(.52)										
(308)	trust-G		−.11								.24	✓			✓	mnthStn	E2	1219	.079	44	
			(.65)								(.26)										
⟨307-308⟩	trust-G		.24								−.14	✓			✓	mnthStn	⟨2⟩	3753			
			(.48)								(.23)										
(309)	trust-G		1.16					.61			−4.18	✓			✓	mnthStn	G19	1964	.112	148	
			(.77)					(.23)			(1.14)										
(310)	trust-G		.22					1.31			−6.29	✓			✓	mnthStn	E2	1103	.109	42	
			(.67)					(.19)			(1.00)										
⟨309-310⟩	trust-G		.62					1.02			−5.38	✓			✓	mnthStn	⟨2⟩	3067			
			(.50)					(.15)			(.75)										
(311)	trust-G		1.50					.33	.75	2.85	−4.92	✓			✓	mnthStn	G19	1957	.203	146	
			(.84)					(.23)	(.29)	(.31)	(1.21)										
(312)	trust-G		.26					1.11	1.17	1.23	−7.24	✓			✓	mnthStn	E2	1102	.142	42	
			(.67)					(.21)	(.39)	(.20)	(1.01)										
⟨311-312⟩	trust-G		.74					.75	.90	1.70	−6.29	✓			✓	mnthStn	⟨2⟩	3059			
			(.52)					(.16)	(.23)	(.17)	(.78)										
(313)	trust-G	−.23	1.51	.012	−.040	−.022	−.011	.53	1.17		−4.31	✓			✓	mnthStn	G19	1865	.128	139	
		(.34)	(.92)	(.026)	(.030)	(.009)	(.057)	(.24)	(.30)		(1.22)										
(314)	trust-G	.45	.26	−.041	.008	.025	−.020	1.28	1.25		−6.85	✓			✓	mnthStn	E2	1102	.126	42	
		(.38)	(.70)	(.021)	(.022)	(.020)	(.042)	(.20)	(.42)		(.96)										
⟨313-314⟩	trust-G	.068	.72	−.020	−.009	−.014	−.017	.98	1.20		−5.87	✓			✓	mnthStn	⟨2⟩	2967			

Continued on next page

		clouds	clouds (7 days)	T_{high} (°C)	T_{low} (°C)	rain (mm)	snow (cm)	log(HH inc)	health	trust-N	constant	controls	mnth f.e.	stn f.e.	mnthStn f.e.	clustering	survey	obs.	pseudo-R^2	$N_{clusters}$	R^2(adj)
		(.25)	(.56)	(.016)	(.018)	(.008)	(.034)	(.16)	(.25)		(.76)										
(381)	log(HH inc)		−.048								4.36	✓			✓	mnthStn	G19	4209		169	.237
			(.065)								(.11)										
(382)	log(HH inc)		−.12								4.77	✓			✓	mnthStn	E2	1141		44	.222
			(.069)								(.029)										
⟨381-382⟩	log(HH inc)		−.082								4.74	✓			✓	mnthStn	⟨2⟩	5350			
			(.047)								(.028)										
(383)	log(HH inc)		−.039						.19	.12	3.98	✓			✓	mnthStn	G19	4195		168	.258
			(.063)						(.029)	(.034)	(.10)										
(384)	log(HH inc)		−.12						.14	.11	4.59	✓			✓	mnthStn	E2	1140		44	.240
			(.069)						(.037)	(.023)	(.045)										
⟨383-384⟩	log(HH inc)		−.074						.17	.11	4.49	✓			✓	mnthStn	⟨2⟩	5335			
			(.047)						(.023)	(.019)	(.041)										
(385)	log(HH inc)	−.041	−.054	.002	5e-06	−.0006	−.008		.20		4.07	✓			✓	mnthStn	G19	4001		160	.256
		(.033)	(.072)	(.002)	(.002)	(.001)	(.005)		(.030)		(.11)										
(386)	log(HH inc)	−.066	−.12	.002	−.003	−.003	−.012		.16		4.65	✓			✓	mnthStn	E2	1140		44	.232
		(.049)	(.068)	(.002)	(.002)	(.003)	(.004)		(.037)		(.068)										
⟨385-386⟩	log(HH inc)	−.049	−.087	.002	−.001	−.0008	−.010		.19		4.49	✓			✓	mnthStn	⟨2⟩	5141			
		(.027)	(.049)	(.001)	(.001)	(.0009)	(.003)		(.023)		(.058)										

Table 12: Climate and satisfaction with life. *Covariates include local climatic expectations in the form of probabilities and means for each station's overall climate (YEAR) and for its averages for the month (MONTH) and day (DAY) of the interview. Standard errors are calculated with clustering at the level of the fixed effects (f.e.) indicated. Results in this table are summarised in Table 8 on page 22. Significance: 1% 5% 10%*

[tab:cloudsandclimatechecks-appendix] [/home/cpbl/research/thesis/final/rdc/cloudsandclimatechecksb1-withMeans-hideControls-subset-transposed]

	YEAR: $\langle T_{max} \rangle$ (°C)	YEAR: $\langle T_{min} \rangle$ (°C)	YEAR: days sun	MONTH: days sun	MONTH: sun fraction	MONTH: $\langle T \rangle$ (°C)	MONTH: rain>5mm	MONTH: snow>5cm	DAY: precipitation	DAY: $\langle T_{max} \rangle$ (°C)	DAY: $\langle T_{min} \rangle$ (°C)	clouds (7 days)	log(HH inc)	controls	f.e./clustering	survey	obs.
(1)	.013	−.010	−.003										.59	✓	mnth	G19	1930
	(.042)	(.013)	(.002)										(.17)				
(2)	.23	−.013	−.008										.52	✓	mnth	E2	355
	(.071)	(.026)	(.005)										(.26)				
⟨1-2⟩	.068	−.011	−.004										.57	✓	mnth	⟨2⟩	2285
	(.036)	(.012)	(.002)										(.14)				
(3)	.013	−.014	.0002	.060	−.024	.001	.025	.003					.59	✓	mnth	G19	1930
	(.048)	(.017)	(.003)	(.13)	(.030)	(.035)	(.055)	(.15)					(.17)				
(4)	.24	−.059	−.019	.038	.037	.088	.078	−.12					.58	✓	mnth	E2	355
	(.10)	(.046)	(.008)	(.18)	(.056)	(.051)	(.13)	(.14)					(.24)				
⟨3-4⟩	.052	−.019	−.002	.053	−.010	.029	.033	−.059					.59	✓	mnth	⟨2⟩	2285
	(.044)	(.016)	(.003)	(.11)	(.026)	(.029)	(.051)	(.10)					(.14)				
(5)	.037	−.002	.002						.015	−.012	−.008		.60	✓	mnth	G19	1930
	(.048)	(.020)	(.005)						(.005)	(.082)	(.075)		(.17)				
(6)	.21	−.050	−.017						−.011	.094	−.002		.51	✓	mnth	E2	355
	(.078)	(.043)	(.010)						(.018)	(.056)	(.062)		(.24)				
⟨5-6⟩	.085	−.011	−.002						.013	.060	−.004		.57	✓	mnth	⟨2⟩	2285
	(.041)	(.018)	(.004)						(.005)	(.046)	(.048)		(.14)				
(7)	.034	−.013	−.003											✓	mnth	G19	2388
	(.035)	(.012)	(.003)														
(8)	.20	−.004	−.006											✓	mnth	E2	386
	(.075)	(.021)	(.006)														
⟨7-8⟩	.063	−.011	−.004											✓	mnth	⟨2⟩	2774
	(.032)	(.010)	(.003)														
(9)	.034	−.013	−.002	.090	−.022	−.001	.032	.059						✓	mnth	G19	2388
	(.046)	(.018)	(.003)	(.11)	(.025)	(.033)	(.049)	(.12)									

Continued on next page

	YEAR: ⟨T_{max}⟩ (°C)	YEAR: ⟨T_{min}⟩ (°C)	YEAR: days sun	MONTH: days sun	MONTH: sun fraction	MONTH: ⟨T⟩ (°C)	MONTH: rain>5mm	MONTH: snow>5cm	DAY: precipitation	DAY: ⟨T_{max}⟩ (°C)	DAY: ⟨T_{min}⟩ (°C)	clouds (7 days)	log(HH inc)	controls	f.e./clustering	survey	obs.
(10)	.19 (.085)	−.054 (.037)	−.016 (.009)	.020 (.20)	.015 (.066)	.10 (.049)	.006 (.15)	−.064 (.14)						✓	mnth	E2	386
⟨9-10⟩	.070 (.040)	−.021 (.016)	−.003 (.003)	.075 (.094)	−.017 (.023)	.031 (.027)	.030 (.047)	.010 (.091)						✓	mnth	⟨2⟩	2774
(11)	.039 (.039)	.002 (.020)	−.003 (.004)						.013 (.004)	.044 (.075)	−.064 (.074)			✓	mnth	G19	2388
(12)	.20 (.080)	−.044 (.039)	−.012 (.009)						−.006 (.017)	.048 (.062)	.035 (.073)			✓	mnth	E2	386
⟨11-12⟩	.069 (.035)	−.008 (.018)	−.004 (.004)						.012 (.004)	.046 (.048)	−.014 (.052)			✓	mnth	⟨2⟩	2774
(15)				−.016 (.044)	.004 (.011)	−.010 (.015)	.026 (.036)	−.11 (.083)					.60 (.12)	✓	stn	G19	3631
(16)				−.024 (.048)	−.004 (.024)	.010 (.018)	.066 (.087)	.020 (.074)					.42 (.18)	✓	stn	E2	907
⟨15-16⟩				−.020 (.032)	.003 (.010)	−.002 (.012)	.032 (.033)	−.038 (.055)					.54 (.100)	✓	stn	⟨2⟩	4538
(17)									−.004 (.004)	−.070 (.024)	.075 (.027)		.62 (.092)	✓	stn	G19	9654
(18)									.015 (.005)	−.028 (.045)	.047 (.050)		.52 (.12)	✓	stn	E2	2562
⟨17-18⟩									.003 (.003)	−.061 (.021)	.069 (.024)		.59 (.074)	✓	stn	⟨2⟩	12216
(21)				−.006 (.033)	.008 (.009)	−.016 (.014)	.025 (.031)	−.12 (.072)						✓	stn	G19	4457
(22)				−.010 (.044)	−.003 (.024)	.005 (.021)	.068 (.093)	.053 (.060)						✓	stn	E2	996
⟨21-22⟩				−.007 (.026)	.007 (.008)	−.010 (.012)	.029 (.029)	−.018 (.046)						✓	stn	⟨2⟩	5453
(23)									−.004 (.003)	−.051 (.023)	.056 (.026)			✓	stn	G19	11924
(24)									.012 (.005)	−.027 (.039)	.045 (.043)			✓	stn	E2	2829
⟨23-24⟩									.0002 (.003)	−.045 (.020)	.053 (.022)			✓	stn	⟨2⟩	14753

Continued on next page

	YEAR: $\langle T_{max} \rangle$ (°C)	YEAR: $\langle T_{min} \rangle$ (°C)	YEAR: days sun	MONTH: days sun	MONTH: sun fraction	MONTH: $\langle T \rangle$ (°C)	MONTH: rain>5mm	MONTH: snow>5cm	DAY: precipitation	DAY: $\langle T_{max} \rangle$ (°C)	DAY: $\langle T_{min} \rangle$ (°C)	clouds (7 days)	log(HH inc)	controls	f.e./clustering	survey	obs.
(29)									−.013	−.30	.32		.75	✓	mnthStn	G19	6309
									(.013)	(.14)	(.16)		(.10)				
(30)									.002	−.22	.29		.57	✓	mnthStn	E2	1781
									(.013)	(.21)	(.24)		(.16)				
⟨29-30⟩									−.005	−.27	.31		.70	✓	mnthStn	⟨2⟩	8090
									(.009)	(.12)	(.13)		(.086)				
(39)									−.002	−.28	.31			✓	mnthStn	G19	8207
									(.008)	(.11)	(.13)						
(40)									.038	−.23	.30			✓	mnthStn	E2	2045
									(.015)	(.18)	(.21)						
⟨39-40⟩									.007	−.26	.31			✓	mnthStn	⟨2⟩	10252
									(.007)	(.095)	(.11)						
(41)									−.027	−.46	.52	−.53	.68	✓	mnthStn	G19	4040
									(.016)	(.17)	(.18)	(.34)	(.13)				
(42)									−.040	−.31	.38	−.62	.71	✓	mnthStn	E2	1122
									(.032)	(.21)	(.24)	(.57)	(.20)				
⟨41-42⟩									−.030	−.41	.47	−.56	.69	✓	mnthStn	⟨2⟩	5162
									(.014)	(.13)	(.15)	(.29)	(.11)				

Table 13: Comparison between naïve and weather-aware models of SWL. *Raw ordered logit coefficients and standard errors are shown. Significance: 1% 5% 10%*

[tab:cloudsCompareNaive-appendix] [/home/cpbl/research/thesis/final/rdc/cloudsCompareNaiveClusb1-withMeans-transposed]

	clouds	clouds (7 days)	T_{high} (°C)	T_{low} (°C)	rain (mm)	snow (cm)	log(HH inc)	trust-N	health	married	asmarried	separated	divorced	widowed	male	noReligion	godImportance	student	employed	domestic	unemployed	retired	age	$(age/100)^2$	clustering	survey	obs.
(1)	−.23	−.72	−.004	−.013	.006	−.020	.72			.40	−.006	−.97	−.14	.058	−.11	−.12	−.050	.80	.41	.43	.14	.79	−.088	9.00	mnthStn	G19	3856
	(.18)	(.38)	(.012)	(.012)	(.005)	(.032)	(.14)			(.11)	(.13)	(.24)	(.16)	(.24)	(.073)	(.10)	(.14)	(.23)	(.20)	(.20)	(.31)	(.23)	(.018)	(1.95)			
(2)	−.34	−.51	−.007	.008	−.011	−.025	.71			.32	−.12		−.60	.24	−.046		.59				−.94		.021	.026	mnthStn	E2	1122
	(.21)	(.51)	(.014)	(.013)	(.010)	(.040)	(.20)			(.15)	(.21)		(.23)	(.27)	(.089)		(.13)				(.32)		(.004)	(.004)			
⟨1-2⟩	−.28	−.64	−.005	−.003	.003	−.022	.71			.37	−.037	−.97	−.29	.14	−.085	−.12	.30	.80	.41	.43	−.39	.79	.016	.026	mnthStn	⟨2⟩	4978
	(.14)	(.30)	(.009)	(.009)	(.004)	(.025)	(.11)			(.089)	(.11)	(.24)	(.13)	(.18)	(.056)	(.10)	(.097)	(.23)	(.20)	(.20)	(.22)	(.23)	(.004)	(.004)			
(3)		−.74					.72			.40	.008	−.97	−.13	.063	−.11	−.12	−.036	.80	.41	.43	.14	.78	−.088	8.97	mnthStn	G19	3856
		(.36)					(.14)			(.11)	(.13)	(.23)	(.16)	(.24)	(.073)	(.10)	(.14)	(.23)	(.20)	(.20)	(.31)	(.23)	(.018)	(1.97)			
(4)		−.56					.72			.32	−.13		−.60	.26	−.046		.58				−.91		.021	.026	mnthStn	E2	1122
		(.52)					(.20)			(.15)	(.20)		(.22)	(.26)	(.088)		(.13)				(.32)		(.003)	(.004)			
⟨3-4⟩		−.68					.72			.37	−.030	−.98	−.29	.15	−.084	−.12	.31	.80	.41	.43	−.38	.78	.018	.026	mnthStn	⟨2⟩	4978
		(.29)					(.11)			(.091)	(.11)	(.23)	(.13)	(.18)	(.056)	(.10)	(.095)	(.23)	(.20)	(.20)	(.22)	(.23)	(.003)	(.004)			
(5)							.72			.40	.023	−.96	−.13	.077	−.11	−.12	−.036	.80	.41	.43	.13	.80	−.088	8.95	mnthStn	G19	3856
							(.14)			(.11)	(.12)	(.23)	(.16)	(.24)	(.072)	(.10)	(.14)	(.23)	(.20)	(.20)	(.31)	(.23)	(.018)	(1.96)			
(6)							.73			.32	−.13		−.60	.28	−.045		.58				−.91		.021	.026	mnthStn	E2	1122
							(.20)			(.15)	(.20)		(.22)	(.26)	(.088)		(.13)				(.32)		(.003)	(.004)			
⟨5-6⟩							.72			.37	−.017	−.96	−.29	.17	−.085	−.12	.31	.80	.41	.43	−.37	.80	.018	.026	mnthStn	⟨2⟩	4978
							(.11)			(.091)	(.11)	(.23)	(.13)	(.18)	(.056)	(.10)	(.096)	(.23)	(.20)	(.20)	(.22)	(.23)	(.003)	(.004)			
(9)	−.26	−.43	−.011	−.007	.003	−.039		.88		.48	.13	−.75	−.10	.056	−.032	−.24	−.036	.53	.38	.29	−.050	.67	−.068	6.58	mnthStn	G19	4915
	(.16)	(.35)	(.010)	(.012)	(.004)	(.027)		(.16)		(.10)	(.10)	(.21)	(.13)	(.18)	(.061)	(.091)	(.12)	(.20)	(.17)	(.18)	(.30)	(.20)	(.014)	(1.52)			
(10)	−.39	−.48	.001	.003	−.022	−.043		.63		.48	.090		−.52	−.001	−.020		.31				−1.11		.019	.024	mnthStn	E2	1245
	(.20)	(.54)	(.013)	(.014)	(.010)	(.038)		(.22)		(.14)	(.19)		(.21)	(.23)	(.088)		(.12)				(.25)		(.003)	(.004)			
⟨9-10⟩	−.31	−.45	−.007	−.003	−.0004	−.040		.80		.48	.12	−.75	−.22	.034	−.028	−.24	.14	.53	.38	.29	−.69	.67	.015	.024	mnthStn	⟨2⟩	6160
	(.13)	(.29)	(.008)	(.009)	(.004)	(.022)		(.13)		(.081)	(.092)	(.21)	(.11)	(.14)	(.050)	(.091)	(.085)	(.20)	(.17)	(.18)	(.19)	(.20)	(.003)	(.004)			
(11)		−.44						.84		.50	.14	−.70	−.080	.027	−.062	−.22	−.025	.52	.36	.28	−.066	.62	−.069	6.78	mnthStn	G19	5144
		(.35)						(.16)		(.10)	(.10)	(.21)	(.13)	(.17)	(.062)	(.090)	(.12)	(.19)	(.17)	(.18)	(.31)	(.19)	(.014)	(1.49)			
(12)		−.56						.58		.48	.083		−.54	.0002	−.023		.31				−1.10		.019	.024	mnthStn	E2	1245
		(.56)						(.23)		(.14)	(.18)		(.22)	(.22)	(.087)		(.12)				(.26)		(.003)	(.004)			
⟨11-12⟩		−.47						.76		.49	.13	−.70	−.20	.017	−.049	−.22	.14	.52	.36	.28	−.67	.62	.015	.024	mnthStn	⟨2⟩	6389
		(.29)						(.13)		(.082)	(.091)	(.21)	(.11)	(.14)	(.050)	(.090)	(.084)	(.19)	(.17)	(.18)	(.20)	(.19)	(.003)	(.004)			
(13)								.88		.49	.15	−.74	−.085	.075	−.031	−.24	−.025	.53	.37	.28	−.063	.67	−.069	6.58	mnthStn	G19	4915
								(.16)		(.10)	(.11)	(.21)	(.13)	(.18)	(.061)	(.091)	(.12)	(.20)	(.17)	(.18)	(.31)	(.20)	(.014)	(1.53)			
(14)								.59		.48	.082		−.54	.019	−.022		.30				−1.10		.019	.024	mnthStn	E2	1245

Continued on next page

	clouds	clouds (7 days)	T_{high} (°C)	T_{low} (°C)	rain (mm)	snow (cm)	log(HH inc)	trust-N	health	married	asmarried	separated	divorced	widowed	male	noReligion	godImportance	student	employed	domestic	unemployed	retired	age	$(age/100)^2$	clustering	survey	obs.
								(.23)		(.14)	(.19)		(.21)	(.22)	(.087)		(.12)				(.26)		(.003)	(.004)			
⟨13-14⟩								.79		.48	.14	−.74	−.21	.053	−.028	−.24	.14	.53	.37	.28	−.66	.67	.015	.024	mnthStn	⟨2⟩	6160
								(.13)		(.082)	(.092)	(.21)	(.11)	(.14)	(.050)	(.091)	(.086)	(.20)	(.17)	(.18)	(.20)	(.20)	(.003)	(.004)			
(17)	−.20	−.36	−.013	−.004	.001	−.031			3.00	.46	.091	−.64	−.10	.12	−.10	−.27	−.012	.41	.22	.22	−.044	.53	−.076	8.06	mnthStn	G19	4901
	(.16)	(.34)	(.010)	(.012)	(.005)	(.025)			(.15)	(.099)	(.11)	(.21)	(.13)	(.19)	(.063)	(.092)	(.12)	(.18)	(.15)	(.17)	(.28)	(.18)	(.014)	(1.49)			
(18)	−.33	−.62	.003	.003	−.017	−.046			1.65	.55	.069		−.47	−.017	−.033		.39				−1.12		.022	.028	mnthStn	E2	1245
	(.21)	(.55)	(.013)	(.014)	(.011)	(.041)			(.24)	(.13)	(.20)		(.21)	(.23)	(.085)		(.12)				(.27)		(.003)	(.003)			
⟨17-18⟩	−.25	−.44	−.007	−.001	−.002	−.035			2.62	.49	.086	−.64	−.20	.063	−.078	−.27	.19	.41	.22	.22	−.61	.53	.018	.028	mnthStn	⟨2⟩	6146
	(.13)	(.29)	(.008)	(.009)	(.005)	(.021)			(.13)	(.079)	(.095)	(.21)	(.11)	(.15)	(.051)	(.092)	(.084)	(.18)	(.15)	(.17)	(.20)	(.18)	(.003)	(.003)			
(19)		−.38							3.00	.48	.10	−.58	−.064	.10	−.14	−.25	−.003	.41	.20	.22	−.057	.50	−.076	8.13	mnthStn	G19	5130
		(.34)							(.14)	(.097)	(.10)	(.21)	(.13)	(.19)	(.064)	(.091)	(.12)	(.18)	(.14)	(.17)	(.28)	(.17)	(.014)	(1.46)			
(20)		−.68							1.61	.54	.066		−.49	−.014	−.036		.38				−1.11		.022	.028	mnthStn	E2	1245
		(.57)							(.24)	(.13)	(.20)		(.21)	(.22)	(.085)		(.12)				(.28)		(.003)	(.004)			
⟨19-20⟩		−.46							2.64	.50	.094	−.58	−.17	.053	−.099	−.25	.18	.41	.20	.22	−.60	.50	.018	.028	mnthStn	⟨2⟩	6375
		(.29)							(.12)	(.078)	(.093)	(.21)	(.11)	(.14)	(.051)	(.091)	(.083)	(.18)	(.14)	(.17)	(.20)	(.17)	(.003)	(.004)			
(21)									3.01	.47	.11	−.63	−.091	.14	−.10	−.27	−.002	.41	.21	.21	−.058	.53	−.076	8.06	mnthStn	G19	4901
									(.15)	(.10)	(.11)	(.21)	(.13)	(.20)	(.063)	(.092)	(.12)	(.18)	(.15)	(.17)	(.28)	(.18)	(.014)	(1.49)			
(22)									1.60	.54	.063		−.49	.006	−.034		.37				−1.11		.022	.028	mnthStn	E2	1245
									(.24)	(.13)	(.20)		(.21)	(.22)	(.085)		(.12)				(.28)		(.003)	(.004)			
⟨21-22⟩									2.63	.49	.100	−.63	−.20	.084	−.077	−.27	.19	.41	.21	.21	−.59	.53	.018	.028	mnthStn	⟨2⟩	6146
									(.13)	(.080)	(.095)	(.21)	(.11)	(.15)	(.051)	(.092)	(.084)	(.18)	(.15)	(.17)	(.20)	(.18)	(.003)	(.004)			
(25)	−.23	−.66	−.005	−.012	.004	−.011	.39	.69	2.93	.44	−.017	−.81	−.11	.14	−.16	−.17	−.066	.54	.27	.33	.086	.58	−.091	9.82	mnthStn	G19	3833
	(.19)	(.38)	(.012)	(.013)	(.006)	(.034)	(.13)	(.20)	(.17)	(.11)	(.13)	(.23)	(.15)	(.26)	(.074)	(.10)	(.14)	(.20)	(.18)	(.18)	(.31)	(.20)	(.017)	(1.85)			
(26)	−.38	−.52	−.006	.011	−.015	−.042	.54	.51	1.56	.37	−.11		−.51	.26	−.075		.59				−.87		.022	.027	mnthStn	E2	1122
	(.21)	(.53)	(.014)	(.013)	(.009)	(.041)	(.20)	(.22)	(.23)	(.14)	(.23)		(.22)	(.28)	(.094)		(.13)				(.31)		(.003)	(.003)			
⟨25-26⟩	−.30	−.61	−.005	−.0005	−.002	−.024	.43	.61	2.43	.42	−.040	−.81	−.24	.19	−.13	−.17	.28	.54	.27	.33	−.38	.58	.019	.027	mnthStn	⟨2⟩	4955
	(.14)	(.31)	(.009)	(.009)	(.005)	(.026)	(.11)	(.15)	(.14)	(.085)	(.11)	(.23)	(.13)	(.19)	(.058)	(.10)	(.096)	(.20)	(.18)	(.18)	(.22)	(.20)	(.003)	(.003)			
(27)		−.67					.35	.62	2.95	.44	−.012	−.78	−.085	.064	−.17	−.16	−.020	.51	.21	.30	.026	.49	−.090	9.71	mnthStn	G19	4017
		(.37)					(.12)	(.20)	(.17)	(.10)	(.12)	(.23)	(.15)	(.25)	(.072)	(.10)	(.13)	(.20)	(.17)	(.19)	(.31)	(.20)	(.017)	(1.82)			
(28)		−.58					.56	.48	1.53	.37	−.11		−.52	.27	−.074		.57				−.84		.022	.027	mnthStn	E2	1122
		(.55)					(.20)	(.23)	(.23)	(.14)	(.22)		(.22)	(.27)	(.093)		(.13)				(.32)		(.003)	(.003)			
⟨27-28⟩		−.64					.41	.56	2.44	.42	−.036	−.78	−.22	.16	−.14	−.16	.29	.51	.21	.30	−.40	.50	.019	.027	mnthStn	⟨2⟩	5139
		(.31)					(.10)	(.15)	(.13)	(.082)	(.11)	(.23)	(.12)	(.18)	(.057)	(.10)	(.092)	(.20)	(.17)	(.19)	(.22)	(.20)	(.003)	(.003)			
(29)							.39	.68	2.94	.44	.007	−.81	−.10	.15	−.16	−.17	−.051	.54	.26	.32	.065	.58	−.092	9.82	mnthStn	G19	3833
							(.13)	(.20)	(.17)	(.11)	(.13)	(.23)	(.15)	(.26)	(.072)	(.11)	(.14)	(.20)	(.17)	(.18)	(.31)	(.20)	(.017)	(1.87)			
(30)							.57	.48	1.52	.37	−.11		−.52	.29	−.073		.57				−.83		.022	.027	mnthStn	E2	1122
							(.20)	(.23)	(.23)	(.13)	(.22)		(.22)	(.28)	(.093)		(.13)				(.32)		(.003)	(.003)			

Continued on next page

	clouds	clouds (7 days)	T_{high} (°C)	T_{low} (°C)	rain (mm)	snow (cm)	log(HH inc)	trust-N	health	married	asmarried	separated	divorced	widowed	male	noReligion	godImportance	student	employed	domestic	unemployed	retired	age	$(age/100)^2$	clustering	survey	obs.
⟨29-30⟩							.44	.59	2.42	.41	−.024	−.81	−.23	.22	−.13	−.17	.29	.54	.26	.32	−.37	.58	.019	.027	mnthStn	⟨2⟩	4955
							(.11)	(.15)	(.14)	(.085)	(.11)	(.23)	(.12)	(.19)	(.057)	(.11)	(.094)	(.20)	(.17)	(.18)	(.22)	(.20)	(.003)	(.003)			