Reversing the Question. Does Happiness Affect Individual Economic Behavior? Evidence from Surveys from the Netherlands and Germany

JOB MARKET PAPER

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Abstract

I examine the impact of happiness on economic behavior. I use self-reported happiness data from the DNB Household Survey from the Netherlands and the German Socio-Economic Panel. I consider changes in regional sunshine as an exogenous determinant of happiness. Both long-run and transitory increases in sunshine increase happiness. Instrumenting individual happiness with regional sunshine, I find that happy people save more, spend less, and that the marginal propensity to consume is lower for the happy people. Happy people appear to be more risk-averse in financial decisions and (accordingly) choose safer investments. Happy people spend more time before making decisions and have more control over expenditures. Happy people also expect a longer life and (accordingly) seem more concerned about the future than the present; they also seem to expect less inflation in the future. Secondary findings suggest that happy people are less likely to smoke and have less desire to move.

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1 Introduction

"Success is not the key to happiness. Happiness is the key to success. If you love what you are doing, you will be successful." Albert Schweitzer (1875-1965) 1952 Nobel Peace Prize Winner

Given their background as moral philosophers, classical economists were interested in affect and emotions which govern human nature (Smith, 1759). This interest in emotions continued in economic theory for many years until the marginal revolution. The aim of developing a formal theory based on mechanical laws resulted in the adoption of a concept of utility without these introspective motivational referents. Modern mainstream economics is characterized by rational decision makers maximizing a given utility function under constraints, where utility is simply a labeling that represents a weak ordering of commodity bundles. In conventional microeconomics and macroeconomics, emotions are regularly treated as a factor which can be neglected (in the context of ideal markets or rational decision making). On the other hand, recent contributions from neurological and psychological studies have given strong support to the idea that emotions, in particular happiness, play a role in decision making. These contributions suggest that happiness, also known as "subjective well-being," may be important for decision-making and can be researched empirically.

To date, economists have mainly studied the effects of macroeconomic variables and individual characteristics on subjective well-being. The question asked is whether variables such as unemployment, inflation, income, marital status, health status, and gender influence happiness. The reverse effect has so far received scant attention (Kahneman and Krueger 2006, Lyubomirsky, King, and Diener 2005, Graham 2005). Recent work on subjective well-being by economists and psychologists suggests that there may well be such effects. Psychological experiments suggest that happier people tend to behave differently from people who are less happy, but the direction of causality remains unclear. For example,

are people with high consumption happy, or does happiness lead to greater consumption? Does smoking cause depression, or are depressed people more likely to smoke? Does risk-taking lead to greater happiness, or do happy people take more risks? Similar questions can be posed in a number of areas, including the relationships between health, social capital, productivity, and happiness.

The primary objective of this paper is to establish that there is a casual relationship going from happiness to economic behavior. Establishing this casual relationship can help determine the extent to which the findings from this research should be incorporated into policy analysis. Some of the primary difficulties in establishing this direction of causality is finding an exogenous instrument for happiness, as well as lack of adequate data. As a solution to the first problem, I use exogenous regional sunshine variation as an instrument for current individual happiness. The second problem is solved by using two panel surveys from Germany and the Netherlands. Most of the happiness research is based on cross-sectional data, but I use panel data (i.e. surveys that follow the same people over time) which include both psychological and economic concepts. The paper employs data from the Dutch National Bank (DNB) Household Survey, which is a panel of about 4500 individuals from 1993 to 2006 and the German Socio-Economic Panel (SOEP), which is a panel of about 21000 individuals from 1984-2006. The surveys provide self-reported measures of well-being, such as responses to questions about how happy and satisfied individual respondents are with their lives and importantly, very detailed information about individual consumption, income, wealth, and different measures of behavior.

I study the impact of self-reported happiness on the impact of economic choices such as saving, consumption, and risk-taking behavior (i.e. financial decisions, moving decision, smoking, consuming alcohol). By examining the transition matrix of happiness, I show that individual happiness is fairly persistent over time in Germany and the Netherlands. I develop an instrumental variables estimation method that addresses the potential endogeneity of individual happiness. I find that exogenous increases in regional sunshine increase happiness. The paper uses two instruments for happiness. By matching the exact

dates of individuals' answers to "happiness" questions in the surveys with weather data, the paper first uses the transitory sunshine changes as an instrument. The paper also uses yearly regional averages of sunshine as an instrument for current happiness. Then, I attack the unexplored issue of whether subjective well-being helps determine individual economic choices. Establishing this direction of causality by instrumenting individual happiness by "regional sunshine variation," the paper finds that happy people save more, spend less and are less likely to have debt. Happy people also appear to be more risk-averse in financial decisions and (accordingly) choose safer investments. Happy people are more likely to have life insurance, savings accounts, and operating assets but less likely to own stocks and bonds. The different behaviors of happy people may be due to spending more time before making decisions and having more control over expenditures. Having more control over expenditures is closely related to the concept of "self-control." Happy people also expect a longer life and (accordingly) seem more concerned about the future than the present; they also seem to expect less inflation in the future. Secondary findings suggest that happy people are less likely to smoke, have less desire to move, and are less likely to use internet banking and phone banking.

In Section 2, I give an overview of the related economic literature on correlates of well-being and the impact of well-being on behavior. Section 3 briefly summarizes the data used in the paper. Section 4 gives details about the empirical strategies and details about the identification strategy used in the paper. Section 5 presents the descriptive statistics and the empirical results. Section 6 concludes.

2 Related Literature

2.1 Correlates of Happiness

The concept of happiness has been a major research area in psychology for a long time. However, it has not been used by economists until 1974 (Easterlin, 1974). Economists have been studying the relationship between *individual characteristics* and happiness. They have

identified a U-shaped relationship between *age* and happiness (Oswald 1997, Blanchflower, and Oswald, 2000). *Race.* In all the psychological and sociological studies on the topic of race in the United States, the findings show that blacks are less happy than whites. When people are asked to evaluate the importance of various areas of their lives, good *health* obtains the highest ratings. Marriage raises happiness, as has been found in a large number of studies for different countries and periods. The level of *education* bears little relationship to happiness. Education may indirectly contribute to happiness by allowing a better adaptation to changing environments, but it also tends to raise aspiration levels. See the survey by Frey and Stutzer (2002) for more discussion of the topic.

There is a large amount of research investigating the relationship between individual well-being and *climate*. Petridou, Papadopoulos, Frangakis, Skalkidou, and Trichopoulos (2002) find that there is a positive correlation between the seasonal amplitude of suicide (measured by relative risk) and total sunshine. Van Houwelingen and Beersma (2001) document that the length of day or total hours of sunshine have an impact on suicide rates. Rehdanza and Maddison (2005) analyze a panel of 67 countries, attempting to explain differences in self-reported levels of happiness by weather. Using a panel-corrected least squares approach the paper demonstrates that, even controlling for a range of other factors, climate variables have a particularly powerful effect on self reported levels of happiness. Van Praag and Ferrer-i-Carbonell (2004) and Van Praag and Frijters (1998) investigate the impact of climate on happiness. They find that climate variables such as rain, hours of sunshine, average temperature, and windiness have significant impact on household costs, general satisfaction, and financial satisfaction.

2.2 The Role of Emotions (Happiness) in Decision Making

Current research has been paying more attention to the role of emotions in decision-making. An important feature of emotions that has to be considered is that emotions enable decision makers to avoid procrastination. Moreover, emotions help solve the frame problem, as they limit the range of possible consequences to be considered in a rational-decision process (e.g.

de Sousa 1987). As Ketelaar and Todd (2000) suggest, specific emotions might act as a guide in selecting the information to consider in specific environmental circumstances. According to Damasio (1994), while evaluating different alternatives, emotional reactions may be triggered by particular images associated with certain consequences. These signals help people make approach-avoidance distinctions between options. A large body of research has focused on the role of emotions experienced at the time of decision-making. Immediate emotions can have a direct influence on one's behavior when making decisions, or an indirect influence by impacting the judgments of expected consequences and related expected emotions, as well as on the nature and the depth of information processing (Loewenstein and Lerner 2003). Feelings affect subjects' learning processes by making individuals focus attention on aspects of the situation that are congruent with their mood. Subjects in a negative affective state were found to acquire more negative than positive information to which they have been exposed (Bower and Cohen 1982, Blaney 1986). On the other hand, feelings affect what information is retrieved from memory. Being in a good (bad) mood may facilitate the recall of positive (negative) information from memory, resulting on a biased data base on which the judgment is based. Also, instead of relying on recalled content, people may simplify the judgmental task by asking themselves, "How do I feel about this?" In doing so, they may misread pre-existing mood states as their affective response to what they are thinking about, resulting in mood congruent judgments. Consistent with this "mood-as-information" model, proposed by Schwarz and Clore (1983), mood effects are eliminated when people misattribute their mood to an irrelevant source, such as the *weather*. Tversky and Kahneman (1973, 1974) have suggested that the ideas that come to mind first or most easily may influence judgment. People in a positive affective state were found to be more likely to think about positive possibilities and to be optimistic in their decisions (Isen and Shalker 1982). Wright and Bower (1992) found that happy people are optimistic, in the sense that they report higher probabilities for positive events and lower probabilities for negative events. This inverse pattern has been found in subjects in a negative affective state.

Although emotions have profound implications for decision making, economic models neglect them and fail to predict important aspects of human behavior. Loewenstein and O'Donoghue (2005) consider individual behavior as the outcome of an interaction between two systems: a deliberative system that assesses options with a broad, goal-based perspective, and an affective system that includes emotions and motivational drives. Individuals evaluate available alternatives at a cognitive level, as in traditional models, and at an affective level. Emotional reactions can differ from cognitive evaluations because their determinants are different. For example, in the case of risky options, cognitive evaluation is based largely on the probability and desirability associated with the consequences. In contrast, affective evaluation is more sensitive to outcomes than to probabilities. In formal terms, as a result of the decision-making process, the chosen option x will be the one which maximizes the following utility function: $V(x,s) = U(x, c(s), a(s)) - h(W,\sigma) * [M(xA, a(s)) - M(x, a(s))]$ where $U(x, c(s), a(s))$ identifies the utility function of the deliberative system; $c(s)$ represents the cognitive states induced by the environmental stimuli s; $a(s)$ represents the affective states induced by the environmental stimuli s; $h(W,\sigma)$ is the cost to the deliberative system of exerting willpower, which depends on the current stock of willpower W and on other factors σ that weaken the deliberative system (e.g., cognitive load and stress). $M(x, a(s))$ identifies the motivational function of the affective system, while $x^A \equiv \arg max_{x \epsilon X} M(x, a(s))$ represents the affective optimum. What the present research aims to do is to experimentally manipulate factors σ- particularly, the cognitive load and the environmental stimuli s—particularly, the temporal proximity and the presence of social spillovers—to investigate the outcomes of decision-making when the affective system is put under favorable conditions for playing a larger role.

Risk-taking. A number of studies (Johnson and Tversky 1983, Wright and Bower 1992) have found that affective states influence subjective probability evaluations. Happier people have a different attitude towards taking risks than people who are less happy. They may also prefer different markets and types of financial investments (Kleindorfer, Kunreuther, and Schoemaker 1993). It has been found that people in a positive affective state reported

a higher subjective probability for positive events and a lower subjective probability for negative events. Moore and Chater (2003) observe a significant and positive relationship between affect and risky behavior in the laboratory. An explanation for this pattern relates to the findings that people retrieve more easily mood-congruent memories and focus their attention more on mood-congruent information when assessing subjective probabilities (Wright and Bower, 1992). The empirical research has mixed evidence on the relationship between the optimism of people in positive affective states and risk-taking. For example, Arkes, Terren, and Isen (1988) found that subjects in a positive affective state were willing to pay more for lottery tickets than the control subjects. Valois, Zullig, Huebner, and Drane (2001) and Valois, Zullig, Huebner, Kammermann, and Drane (2002) find that risky behavior of students is associated with low levels of life satisfaction. A number of studies (Isen and Patrick 1983, Isen and Geva 1987, Isen, Nygren, and Ashby 1988) have found that people's response to risk stimuli depends on the gamble's stakes: when faced with high stakes, people in a positive state are more risk-averse with a view to avoiding large losses. In contrast, if the stakes are low, decision makers become risk-seeking in order to benefit from the gain without putting too much on the line (Mano, 1994). Emotions in uncertain or risky situations seem to be sensitive to the possibility rather than the probability of strong positive or negative consequences, causing an overweight of very small probabilities (Loewenstein, Weber, Hsee, and Welch 2001).

Consumption, Savings, and Other Individual Behavior. Psychological experiments have shown that happier people tend to behave differently from people who are less happy. Happy people, for instance, more often smile during social interactions, are more prepared to initiate social contacts with friends, are more inclined to respond to requests for help, are less often absent from work, and are less likely to get involved in work disputes (Frank 1999). Happy people are more likely to save and spend different proportions of their income, to distribute it differently over time, and to acquire different combinations of particular goods and services than than do people who are less happy. Happier people may well be more prepared to exhibit an environmental morale. By using panel data from Russia, Graham,

Eggers, and Sukhtankar (2004) find that happiness affects income, health, and some other factors. They report that people who had higher "residual happiness" in 1995 made more money and were in better health five years later. They claim that this can be due to self-esteem and optimism. Khwaja, Silverman, and Sloan (2006) find that general measures of time preference and self-control are closely related to the decision to smoke. Self-control also can explain over-consumption, wealth accumulation, savings and financial behavior. (Ozdenoren, Salant, and Silverman 2006, Hoch and Loewenstein 1991, Ameriks, Caplin, Leahy, and Tyler 2004, Rabin 1998)

3 Data

The *DNB Household Survey* (formerly known as the CentER Savings Survey) is a panel survey that started in 1993. Data is collected every year with a panel of more than 2000 households. The DNB Household Survey (DHS) data is unique in the sense that they allow studies of both psychological and economic aspects of financial behavior. The DNB Household Survey consists of six questionnaires. The topics covered by each of the questionnaires are: 1. general information on the household which includes regions and provinces of residents 2. household and work 3. accommodation and mortgages 4. health and income 5. assets and liabilities 6. economic and psychological concepts. There are five regions: Three largest cities, West, North, East and South. There are 12 provinces: Groningen, Friesland, Drenthe, Overijssel, Flevoland, Gelderland, Utrecht, Noord-Holland, Zuid-Holland, Zeeland, Noord-Brabant and Limburg. All questionnaires are presented to the CentERpanel, of which 2000 households have participated. Within each household, all persons aged 16 or over are interviewed.

The data is collected from households participating in the Internet panel of CentERdata. The members of those households can fill in a questionnaire on the Internet every week. The questionnaires are answered without the interference of an interviewer, the respondents can answer the questionnaires at a time that is convenient for them, and all the documents (annual statements, bank account statements) required for answering the questions are

within easy reach. However, once they have begun one of the six parts they are required to finish entirely. Since the economics and psychology parts are given together, people answer the economic behavior questions on the same day they answer the happiness question. This enables me to use short-run changes in sunshine as an instrument for happiness. Besides, people answer the happiness questions on different days and months in a year, which supplies extra variation within a year when I instrument happiness with unexpected daily sunshine changes. Although the CentERpanel is an Internet-based panel, there is no need to have a personal computer with an Internet connection. Those households who do not have access to Internet are provided with a so-called settop box with which a connection can be established via a telephone line and a television set. If the household does not have a television, CentERdata provides one. All households can call a help desk or ask for technical advice (at their home). The CentERpanel is representative of the Dutch population.

The *German Socio-Economic Panel Study* (SOEP) offers microdata for research in the social and economic sciences. The SOEP data make it possible to test a wide range of economic and social theories as well as psychological theories. The SOEP is a wide-ranging representative longitudinal study of private households in Germany. The same private households, persons, and families have been surveyed annually since 1984. An immigrant sample was added as well to account for the changes that took place in Germanic society in 1994. This paper uses the *West Germany Panel* from the dataset; therefore it does not include the migrants from East Germany. The SOEP includes information on objective living conditions, values, willingness to take risks, changes currently being undergone in various areas of life, and about the relationships and dependencies among these areas and changes. The SOEP also includes state indicators of individuals. There are 16 states in Germany: Berlin, Schleswig-Holstein, Hamburg, Lower Saxony, Bremen, North Rhine-Westphalia, Hesse, Rhineland-Palatinate, Saarland, Baden-Wuerttemberg, Bavaria, Mecklenburg-West Pomerania, Brandenburg, Saxony-Anhalt, Thuringia, and Saxony. It is also the largest regular survey of foreigners in the Federal Republic of Germany, including households of Turkish, Spanish, Italian, Greek or former Yugoslavian immigrants. The

SOEP covers a wide range of subjects including personality traits, occupational and family biographies, employment, participation and professional mobility, earnings, health, personal satisfaction, household composition, living situation, family and social services, education and training, social security, and environmental behavior.

The *European Climate Assessment Dataset* project (ECAD) started in 2003. The objective of ECAD is to analyze the temperature, precipitation, and climate, with special focus on trends in climatic extremes observed at meteorological stations. For this purpose, a daily dataset of 20th-century surface air temperature and precipitation series has been compiled and tested for homogeneity. To enable European climate assessments on a regular basis, a sustainable system for data gathering, archiving, quality control, analysis and dissemination is realized. Data gathering refers to long-term daily resolution climatic time series from meteorological stations throughout Europe and the Mediterranean provided by contributing parties from over 40 countries. Most series cover at least the period from 1946 to the present. These series include temperature, precipitation, humidity, sunshine, cloudiness, sea level pressure, and snow depth. 1. *Daily mean cloud cover* (CC) Whenever synoptical cloud cover data is available at 00, 06, 12 and 18 UT, mean daily cloud cover is calculated as CC/4. This value in percent is converted to octa's by rounding ((cloud cover in percents/100)*8). 2. Sunshine duration (SS) Whenever synoptical sunshine duration is available (in minutes) at 00, 06, 12 and 18 UT, *daily average sunshine duration* is calculated as SS/4 and the maximum of these four values is gives the *maximum duration of daily sunshine*.

4 Empirical Framework

Instrumental Variables Estimation:

In the context of a linear regression model, if the residual's distribution cannot be considered independent of the regressors's distribution, instrumental variables are needed.

$$y = X\beta + u, \quad E(uu') = \Omega \tag{1}$$

The matrix of regressors X is $n \times K$, where n is the number of observations. The error term u is distributed with mean zero and covariance matrix Ω is $n \times n$. Say, happiness is endogenous in the regressions and the rest of the regressors assumed to be exogenous. So, $E(X_i u_i) \neq 0$. The set of variables is Z. The set of instruments are $Z = [Z_1 \;\; Z_2]$ where Z_1 is the set of excluded instruments and Z_2 is the set of included or exogenous regressors. That is :

$$Regressors \;\; X = [X_1 \;\; X_2] = [Endogenous \;\; Exogenous] \tag{2}$$

$$Instruments \;\; Z = [Z_1 \;\; Z_2] = [Excluded \;\; Included] \tag{3}$$

If there is only one excluded instrument, then the equation is "exactly identified"; if more than one, then the equation is "overidentified." The instrumental variable (IV) or two-stage least squares (2SLS) estimator of β is then:

$$\hat{\beta}_{IV} = [X'Z(Z'Z)^{-1}Z'X]^{-1}X'Z(Z'Z)^{-1}Z'y \tag{4}$$

If the covariance matrix Ω is homoscedastic, the IV estimate is both efficient and consistent. However, if the covariance matrix is heteroscedastic, then the IV estimate is still consistent but the standard errors are inconsistent leading to invalid inference. Then the usual way today is the use of GMM in the presence of heteroscedasticity. In this case, if the equation is exactly identified then GMM estimator is the IV estimator. If the equation is overidentified, then the GMM estimator is:

$$\hat{\beta}_{GMM} = [X'ZWZ'X]^{-1}X'ZWZ'y \tag{5}$$

W is the optimal weighting matrix minimizing the asymptotic variance of the estimator. In the IV regressions, the Anderson canonical correlations likelihood-ratio test statistic and its close relative, the Cragg-Donald chi-squared test statistic are used to test whether the equation is identified or not. The alternative hypothesis for the test is that the instrument

is a valid instrument, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation. Under the null, the test statistic is distributed as chi-squared one. In the paper, the F-statistic form of the Cragg-Donald statistic is reported which has been suggested by Stock and Yogo (2002) as a test for the presence of weak instruments (i.e., that the equation is only weakly identified). See Stock and Yogo (2002) for a tabulation of critical values for the Cragg-Donald statistic. Since my model includes only endogenous regressor, the happiness, the F-statistic form of the Cragg-Donald statistic coincides with the first-stage F test-statistic of the excluded instrument. [1]

Sunshine as an Instrument to Solve Reverse Causality:

Daily sunshine changes. The first instrument used in the paper is the unexpected daily sunshine changes. Daily climate data at station level is used in the paper. I match the daily sunshine data with individual happiness since I know exactly the date when the respondents answer the "happiness" questions. First, I calculate the last ten day weighted average of regional sunshine and calculate the average of this last 10 day average over the last 60 years. The instrument, last 10 day regional sunshine deviation, is computed as the difference between the last ten days weighted average of regional sunshine and the average of this last 10 day average over the last 60 years. Three measures of sunshine are all significant in explaining individual happiness (average duration of sunshine, maximum duration of sunshine, and cloud cover). However, I do not use daily sunshine changes as an instrument for Germany. Although I know the exact dates when people answer the happiness questions, I can not precisely match the weather data to an individuals' residence because I only have information about their state of residence in Germany. I have weather information for 61 stations in Germany, and there are several stations in a state. Since states are very large and within-state weather variation is very high, it is very likely that average sunshine in a state does not represent the weather in every part of a state.

Yearly sunshine averages. The second instrument used in the paper are the yearly regional sunshine averages. By using daily sunshine data, I calculate yearly regional averages of

[1] See Baum, Schaffer, and Stillman (2002) for more discussion of IV-GMM and its implementation in Stata.

cloud cover. Sunshine measure is very sensitive to altitude, angle of the sunshine rays, clouds, wind, and to environment. However, sunshine data from high altitude stations do not match places where people live. On the other hand, cloud cover does not vary from people's residence to the stations. As a result, cloud cover is used as the measure of sunshine in the empirical framework for Germany. Empirical economists should be very careful using climate data. Altitude of the stations, the way measures of sunshine are calculated, and topological situation of the stations and the residence of individuals should be taken into account in empirical analysis. See the figures 1 and 2 for the regional sunshine averages for Germany and the Netherlands.

Transition Probability: The paper shows simple transition probabilities for self-reported happiness and for the regional residence of individuals. The transition probability from state i (say, "very happy") to state j is calculated as the number of individuals who in year $t-1$ report the state of happiness i *and* in year t report the state of happiness j, divided by the total number of individuals who report the state of happiness i in year $t-1$. We compute the transition probability as follows:

$$p_{ij} = \sum_{it} N_{ij} / \sum_{it} N_i \ , \tag{6}$$

where p_{ij} is the transition probability from state i to state j. N_{ij} is the individual N who reports state i in year $t-1$ *and* reports state j in year t. N_i is the individual who reports state i in year $t-1$.

Robustness and the Validity of Instruments:

Economists are generally skeptical of the use of survey data because answers to surveys may be subject to bias from factors such as respondents' mood at the time of the survey and minor changes in the phrasing of survey questions. Therefore, economic analysis generally focus on actual behavior, such as revealed preferences in consumption, savings, and labor market participation. This might be a concern if people misreport their actual behavior due

to differences in their mood. However, respondents use documents to answer questions in the surveys which increase the reliability of the surveys. In the DNB Household Survey, the questionnaires are answered without the interference of an interviewer, the respondents can answer the questionnaires at a time that is convenient for them, and all the documents (annual statements, bank account statements) required for answering the questions are within easy reach. Mood effect probably is not an issue since respondents answer questions by using documents. Using individuals' responses to questions about their intentions and desires, in addition to observed behavior, I implicitly assume that revealed behavior is similar compared to actual behavior. Current research finds that people's answers to questions about their behavior (desires and intentions) are very close to their actual behavior.

Fromme, Katz, and Rivet (1997) find that beliefs about potential benefits are more reliably associated with risk-taking than beliefs about potential negative consequences. Jaeger, Bonin, Dohmen, Falk, Huffman, and Sunde (2007) provide direct evidence that individuals' migration propensities depend on their attitudes towards risk. Using data from the 1989 Survey of Consumer Finances, Schooley and Worden (1996) find that portfolio allocations are reliable indicators of attitudes toward risk, demonstrating an understanding of their relative level of risk- taking. Using the SOEP, Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner (2005) find that the general risk question predicts all risk-taking behaviors including traffic offenses, portfolio choice, smoking, occupational choice, participation in sports, migration, and coefficient of relative risk aversion from the lottery question.

The paper considers the impact of happiness on current and future economic behavior as well as *more recent* individual behavior. Although the happiness we observe is current happiness, we can still make the argument for the influence of current happiness on observed recent behavior. Because, as shown in Table 11, individual happiness is relatively persistent over time (over yearly observations), and it will be very likely that happiness does not change much during a short period of time. Moreover, current happiness is not just a function of current variables, such as current income and current environmental factors but a combination of influences of past, current, and future events. Tversky and Kahneman

(1973, 1974) have suggested that the ideas that come to mind first or most easily may influence judgment, and that people remember recent experiences more precisely.

In my identification strategy, I use regional sunshine as an instrument. The instrumental variables approach implicitly assumes that sunshine influences individual economic behavior only through happiness and is not correlated with any other independent variables. This assumption will not hold if happiness is a proxy for some personality characteristics that are found to be correlates of individual happiness in the psychology literature. I have information on most psychological characteristics of people in the surveys and they are very persistent. Since I am using very short-run changes in sunshine as an instrument for happiness, it is unlikely that sort-run changes in sunshine will affect permanent psychological characteristics.

One of the concerns regarding the use of sunshine as an instrument can be such that individuals may migrate to the sunny regions. However, in the Netherlands most people do not migrate during their lifetime. As shown in Table 19, the probability of living in a region, say "South Holland," conditional on living in the same region in the previous period is nearly 99 percent, confirming that people do not move. [2] Since I only use the West Germany panel from the SOEP, it does not include the migration from East to West and again, most people do not move in West Germany; probability of living in the same state is about 87 percent. Also, the IV results for the Netherlands about consumption, savings, and risk-taking are confirmed with the findings in Germany. This suggests that the results and the use of instruments are not peculiar to one country but applicable to other countries with different cultures and topological structures. Moreover, I show in Table 11 that happiness is fairly consistent over time, suggesting people might differ in some *given* characteristics, gained most probably at birth but not through experience.

The presence of weak instruments is tested by the F-statistics after the first stage. As the results suggest in Table 5, the F-statistics are all higher than 10. Since within a year

[2]Transition matrix for the province residence in the Netherlands is not reported since reporting 12*12 matrix is not easy but the results are quite similar; probability of living in the same province is about 89 percent.

variation of unexpected sunshine is very high but across variation is low. As shown in Table 10 the F-statistics for the yearly sunshine instrument are close to 10.[3] I also find no impact of happiness on actual or desired working hours in Table 20, which suggests that sunshine does not affect economic behavior through individual productivity but through happiness. Another issue is that in Germany, some of the individuals received bad weather benefits which might directly affect individual behavior; however, only one percent of the whole sample had bad weather benefits. Also, the results are shown for the whole sample but consumption and savings results mainly represent the behavior of non-retired individuals. Although I do not report the results here, the impact of happiness on consumption and savings behavior is stronger for the sample of non-retired people. Approximately one sixth of the sample consists of retired people. Concerning the econometric methodology, the results are robust to clustering standard errors by states and provinces and also to the use of time and region fixed effects and to the control of regional average of stations' latitude.

5 Empirical Results

5.1 Descriptive Statistics:

Considering the first stage, Table 1 and Table 2 show the relationship between labor force status, marital status, health status, gender, and happiness. Happiness is a categorical variable taking values 1-5 in order refers to "very unhappy," "unhappy," "neither happy nor unhappy," "happy," and "very happy" categories for the Netherlands. People in the Netherlands are on average happy. Approximately 90 percent of the people who answered the happiness question reported the highest three categories of happiness (neither happy nor unhappy, happy, and very happy). Consider labor force status: unemployed people seem to be relatively unhappy. Twenty seven percent of first time job seekers and 22 percent of second time job seekers report that they are neither happy nor unhappy. People in unpaid work are also very unhappy. Employed people (employed on contract, own business, and

[3]Staiger and Stock (1997) show that in the IV regressions, the F-statistic higher than 10 rejects the presence of weak instruments.

self-employed) report highest values of happiness. Students and disabled people are not very happy. Nearly one sixth of the total sample is retired. Retired people report high levels of happiness. This can be due to having more leisure, and more consumption. On the other hand, the paper shows that for non-retired people happiness increases savings and decreases consumption. Marital status is an important factor for happiness. People living with a partner and married are happier while single, divorced, and widowed people report lower levels of happiness. Health is one of the strongest predictors for happiness. People reporting better health status also report higher values of happiness. Gender does not seem to affect happiness since females and males report similar values of happiness.

Happiness is a categorical variable 0-10 for Germany but recoded here into five categories. Consider labor force: Employed people are very happy. Among the category of non-working people, students and mothers on maternity leave are very happy. Unemployed people are the most unhappy people together with people in military service. Retired people are not very happy as expected. Nearly 34 percent of the retired people report low levels of happiness. Married people in Germany are not as happy as the married people in the Netherlands. Singles again report low levels of happiness. Individuals with a spouse in a native country and separated people report relatively low levels of happiness. Divorced and widowed people are less happy than married people. Health is a very strong predictor for happiness in Germany. People reporting better health status also report higher values of happiness. Table 3 shows summary statistics of happiness by education and gender. People who have higher levels of degrees earned report higher levels of happiness. As in the Netherlands, there does not seem to be any difference between males and females in their happiness in Germany.

Table 4 reports the averages of number of children, income, household size, and age by happiness categories in Germany and the Netherlands. Household size is not very different across happiness categories, but happy and very happy people have a bigger household size in Germany and the Netherlands. In both countries, income and happiness are positively correlated. People with higher income on average report higher values of happiness, but

the correlation seems to be stronger for Germany. This may be due to differences in income inequality. See the survey by Clark, Frijters, and Shields (2008) and Graham and Felton (2005) for more discussion about the relationship between own income, relative income, and happiness. On the other hand, Guven and Sorensen (2007) show that perceptions about income also play a big role in explaining happiness together with relative income and own income. Differences in perceptions about income might explain differences in correlations. People with more children are happier in both countries. There does not seem to be a clear relationship between age and happiness. This may be due to a U-shape relationship between age and happiness mostly found in literature. I also show the importance of different aspects of life for people in Germany in Table 18. The coefficients represent the correlations between total individual happiness and happiness with various aspects of life. The results suggest that income and health are very important for people. Work is not as important as income and health. Leisure and dwelling have similar importance to people, but environment and housework do not seem to be very important for individuals in Germany. R-squared in the fixed effects regression is very low, suggesting that there are other important factors for individuals which can explain the within individual variation in happiness like *weather*. See the Appendix for the exact correlations between individual characteristics and happiness.

5.2 Does Sunshine Affect Happiness? First Stage Results

Apart from the individual correlates of happiness as discussed above, I investigate the impact of sunshine on happiness. First, I study the impact of transitory (daily) changes in sunshine. I consider three measures of sunshine in Table 5. The results suggest happiness increases with unexpected daily sunshine. The coefficient for the first row is 0.04 and t-statistic is 3.4 suggesting that one hour increase in unexpected sunshine increases individual happiness by 0.04 units. The F-statistic is 17.4 which is much higher than 10 rejecting the presence of weak instrument. This is the t-statistic for the hypothesis that unexpected sunshine equals 0. The null hypothesis is that the coefficient for happiness equals 0. Having an F-statistic 17.4 higher than 4 indicates the rejection of the null. The F-statistic is much higher for

maximum duration of sunshine with a value of 22.4 but smaller for average cloud cover with a value of 12.7. All measures of sunshine are very significant in explaining happiness, and presence of a weak instrument is not an issue considering the first stage.

5.3 Impact of Happiness on Economic Behavior: Second Stage Results

Individuals face various economic choices during their lives. From the point of an economist, some of the important ones are savings, consumption, labor supply, asset allocation, risk-taking behavior, and moving. First I consider unexpected transitory changes in sunshine as an instrument for happiness which is expected to influence short frequency outcomes but not permanent ones. The first set of results concerning short-run decisions about savings and consumption are shown in Table 6 for the Netherlands. The dependent variables are recent short-run behavioral outcomes. OLS regression only indicates the positive correlation between happiness and propensity to save. However, the IV regression shows the causal effect of happiness on savings and consumption. The first row shows that happiness increases the probability to save. The first row reports a t-statistic of 1.9 which is nearly significant indicating happier people are more likely to be savers. The second row relates the amount of savings to happiness. The coefficient is significant, indicating that one unit increase in happiness (out of five categories) increases the amount of real savings by 0.11 units. The third row shows how people think once they get happier. Happier people think that saving makes sense considering the general economic situation. The results about savings and consumption might help explain why instrumenting income in a happiness equation appears to raise the coefficient. Oswald and Powdthavee (2007) find that instrumenting income in the happiness equation appears to reduce the coefficient on income. If happy people have a lower marginal utility of purchasing things, then happy people will work less, and then we may have an explanation for the observed low coefficient on income in any happiness equation that does not instrument income.

Most of the choices we make in daily life are related to risk-taking, including investment, consumption, saving, moving, smoking, and driving. Table 7 investigates the relationship

between happiness and risk-taking in the Netherlands. The first row considers the relationship between happiness and risk-taking behavior in financial decisions. OLS estimate suggests that happier people report that they do not want to risk their money when there is a chance to lose it. The IV result shows us that happiness increases risk averseness in financial decisions. Happiness causes people to take less risk which may explain individual differences in asset allocations. I then study whether we observe the same cause and effect between happiness and other risky behavior. Considering the fact that using phone banking, internet banking, getting money from an ATM instead of a counter or smoking, include some risk, the IV results show that happier people use phone banking and internet banking less frequently, they are less likely to get money from an ATM, and smoke less frequently. The results also suggest that risk-taking behavior in different situations might not be independent from one another.

The findings above are quite interesting in the sense that happiness leads to more savings and less risky behavior. But why? Why do happy people spend less or why do happy people not want risks? Tables 8 and 9 investigate possible channels through which happiness might influence consumption and risk-taking behavior. Table 8 studies whether discount rates of happy people are different or do happy people have more self-control? Since, all dependent variables are short-run outcomes and are answered on the same day as the happiness question, they are very likely to be affected by high frequency changes in sunshine. Instrumenting happiness with transitory sunshine changes, the first row shows that unhappy people are less forward looking. Happiness causes people to take into account the future more than the present in their actions. The estimates in the second row confirm this with a t-statistic of 2.8. Unhappy people are more concerned about the immediate consequences of their actions. These results suggest that happiness might actually change the discount factor for individuals. The third, fourth, and fifth rows show that happiness increases self-control. Unhappy people find controlling their expenditures very difficult, and also they do not have control over their investments. The fifth row shows us the impact of happiness on self-control. Happiness causes people to be more disciplined in their actions. The IV

estimates of happiness are significant in all regressions.

In our current actions, expectations play a big role. Table 9 shows that happy people's expectations about the future are different from unhappy people's. First of all, happy people expect lower prices than unhappy people for the next year and also in five years. This may lead to less risky investment today for happy people because they believe that they might get higher profits in the future with lower prices. On the other hand, lower price expectations my lead to less consumption today for happy people. Because happy people want to transfer from the bad state (now) to the good state (future), they can consume more in the future because of lower prices. The optimism about future is observed also as higher life expectancies for happy people. One category increase in happiness leads to 1.1 years higher life expectancy. Besides expectations, happiness also might influence cognitive ability. The fourth row shows that happy people think more before making decisions. Most of the time, thinking more about a decision with pros and cons might lead to different choices. Thinking more may enable individuals to have better understanding of the choices with better comparisons or to consider advantages and disadvantages better.

The second instrument I consider is the exogenous yearly regional sunshine changes. I report the estimates for the first stage in Table 10 for the Netherlands and Germany. The estimates are the coefficients on the yearly sunshine averages with controls. Yearly averages of three measures of sunshine are all significant in explaining happiness with the expected signs. However, the F-statistics are less than 10, suggesting that we might have a weak instrument problem. However, considering that most of the sunshine variation is within a province but across provinces, might explain the low F-statistics. For Germany, I only consider the cloud cover measure as the determinant of happiness (See the empirical section for the discussion of this issue). One percentage increase in yearly cloud cover decreases happiness by 0.11 units (out of 10). The F-statistic is 29.6 suggesting that yearly cloud cover is a strong predictor of happiness and presence of a weak instrument is rejected. The difference in the F-statistics between the Netherlands and Germany can be due to three factors: 1) The sample size is much bigger for Germany. I have weather data for

13 states and 108,000 individual observations over 20 years. However, for the Netherlands weather data is available only for nine provinces and 15,000 individual observations over 13 years. 2) In Germany, happiness is less persistent than the happiness in the Netherlands. Table 11 shows the transition probabilities of happiness for both countries. The diagonals in the matrices indicate the persistence of happiness. The average persistence of happiness (average of the diagonals) in the Netherlands is 51.4 percent. This indicates that for an average person the probability of having the same level of happiness as the previous year's happiness is 51.4 percent. On the other hand, this is just 41.8 in Germany suggesting that happiness is less persistent in Germany than in the Netherlands. 3) Total variation (within and across variation) in measures of sunshine in Germany is much more than in the Netherlands.

After showing that yearly sunshine averages can be used as instruments for happiness, I then show the second stage results. Table 12 studies the impact of happiness instrumented with yearly sunshine on permanent characteristics. The results concerning savings and consumption confirm the findings in Table 6. Happy people are much more likely to have saved during the year. Happiness increases the marginal propensity to save. One point increase in happiness (out of 10) increases marginal propensity to save by 0.83 units (out of 7). The third row indicates that happy people do not consider investing in shares. Again I find happiness decreases risk-taking as found also in Table 7. The fourth row studies possible explanations for the different behavior of happy people. Happy people expect to live longer, probably indicating their optimism about the future. The results with daily sunshine and yearly sunshine might give us come clue about the nature of individual behavior. One may define some of the individual behavior as the sum of a permanent and a transitory component. Having similar results with transitory and permanent weather shocks show us that this might be true for consumption, saving and risk-taking behavior.

As shown in Table 10, yearly average sunshine is a strong instrument for happiness in Germany. The results indicate that happy people are more likely to save monthly, and they also save more in general. Considering consumption, Table 13 shows that happiness

decreases monthly and weekly expenditures. Happy people are also less likely to have debt, indicating that they spend more than they have. The results about consumption and savings in Germany are in line with the findings in the Netherlands. I have shown that happiness decreases risk-taking in the Netherlands in the short-run but what about the long-run? In Table 14 I investigate the impact of happiness on people's asset allocation. Asset allocation is a good indicator of risk-taking. The results are quite promising. Happy people are less likely to own stocks and bonds (risky assets) while happy people are more likely to have operating assets, and private life insurance; all of which are less risky assets. I also consider whether one can observe the similar influence of happiness on other risk related behavior. I investigate the impact of happiness on smoking and moving behavior. Assuming that smoking indicates some risky behavior, I show in Table 15 that happy people smoke less often. Although people do not migrate across states in Germany, the survey asks people whether they would imagine themselves moving to a different part of Germany. The results show that happy people do not desire to move to another state in Germany. The reason for this is probably because they do not want to change their current happy situation.

6 Conclusion

The paper shows that individual happiness does have significant impact on economic decisions. First, the paper verifies that exogenous variation in yearly and daily sunshine has a significant impact on individual happiness in Germany and the Netherlands. Secondly, by using transition matrix of happiness, it is verified that individual happiness is relatively persistent over time. Thirdly, by instrumenting individual happiness with exogenous variation in yearly and daily regional sunshine, the paper investigates the impact of happiness on individual economic behavior. The first set of results concerning savings and consumption show that happy people save more and spend less. The desire to spend is lower among happy people and they are less likely to have debt. The second set of results concerning risk-taking behavior show that happy people do not have a desire to take risks. The results show that happy people are more likely to have life insurance, savings accounts and oper-

ating assets, but are less likely to own stocks or bonds. Happy people are more risk-averse in financial decisions and they prefer safer investment tools. There are significant differences in the economic behavior of happy versus unhappy people. The different behaviors of happy people are found to be due to spending more time before making decisions, having more control over expenditures which is closely related to the concept of "self-control," and expectations to live longer. Happy people are more concerned about the future than the present and they expect lower prices in the future. Secondary findings suggest that happy people are less likely to smoke, use internet banking and phone banking less frequently, and have less desire to move within a country. The findings of the paper imply that better understanding of the relationship between happiness and individual economic behavior may help explain individual differences in consumption and savings, portfolio allocation, risk attitudes, voting, and help regulation of particular economic policies such as tax polices, retirement policies, and timing of policy announcements. Moreover, the results also suggest that the influence of sunshine on climate should be taken much more seriously as important weather changes are currently being experienced around the world.

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Table 1: **Descriptive Statistics: Individual Characteristics and Happiness: The Netherlands**

Happiness:	very unhappy	unhappy	happy nor unhappy	happy	very happy	Total
Labor force status:						
employed on contract	0	0	10	62	28	60
own business	0	1	13	67	19	15668
free profession, self-employed	0	0	13	65	22	585
looking for work after lost job	0	1	13	64	22	356
looking for first-time work	1	2	27	56	13	464
student	1	4	22	65	8	114
own household	0	1	15	70	14	1682
retired	0	1	13	67	19	5012
disabled	0	0	14	68	18	4321
unpaid work	0	3	25	60	12	1392
volunteer	0	1	17	62	20	415
other	0	1	19	60	20	733
Marital status:						
married (community of property)	0	0	11	68	21	16990
married (marriage settlement)	0	0	10	64	26	2384
divorced	0	3	34	58	5	1240
living with partner (not married)	0	1	11	66	22	2325
widowed.	0	2	31	61	6	872
never married	0	2	22	66	10	4645
Health status:						
poor	7	11	34	40	8	152
not so good	0	6	36	48	10	843
fair	0	2	28	60	10	4207
good	0	0	12	71	17	15886
excellent	0	0	6	60	34	5415
Gender:						
male	0	1	15	66	18	15793
female	0	0	15	66	19	13223

Notes: This table shows summary statistics of happiness categories (very happy, happy, neither happy nor unhappy, unhappy, very unhappy) by work status, marital status, and health status. The numbers are row frequencies shown as percentages.

Table 2: **Descriptive Statistics: Individual Characteristics and Happiness: Germany**

Happiness:	very unhappy	unhappy	happy nor unhappy	happy	very happy	Total
Labor force status:						
non-working	2	6	23	47	22	18918
non-working, age 65 and older	4	6	24	44	23	20131
non-working, in education-training	2	4	17	53	24	5210
non-working, maternity leave	1	5	15	54	24	1454
non-working, military-community service	3	7	20	53	16	456
non-working, unemployed	9	14	31	34	11	3907
non-working, but sometimes secondary job	2	5	20	53	21	2034
non-working, but work past 7 days	5	6	20	54	16	266
non-working, but regular secondary job	2	6	24	49	20	1885
working	1	5	20	55	20	74104
working, but non-working past 7 days	1	3	20	57	18	145
Marital status:						
married	2	5	20	52	21	79028
single	2	6	19	53	20	30341
widowed	4	7	27	43	20	10269
divorced	4	8	29	47	13	7120
separated	5	11	28	42	13	1741
spouse in native country	0	20	20	60	9	5
Health status:						
very good	0	1	7	48	43	5844
good	1	2	13	63	21	25388
satisfactory	1	5	28	55	11	21325
poor	3	14	38	39	6	8669
bad	24	26	32	15	3	2422

Notes: This table shows summary statistics of happiness categories by work status, marital status, and health status. The numbers are row frequencies shown as percentages. Happiness is a categorical variable from 0 to 10 (where 0 is totally unhappy and 10 is totally happy) but recoded here as follows : (0,1,2) very unhappy, (3,4) unhappy, (5,6) neither happy nor unhappy, (7,8) happy, (9,10) very happy.

Table 3: **Descriptive Statistics: Individual Characteristics and Happiness: Germany**

Happiness:	very unhappy	unhappy	happy nor unhappy	happy	very happy	Total
Education:						
secondary school	3	6	24	48	20	68737
intermediate school	1	5	19	54	22	29748
technical school	2	6	18	56	19	5863
upper secondary	1	5	16	58	20	17360
dropout, no degree yet	3	6	21	46	24	3469
no degree yet	1	4	14	53	28	804
Gender:						
male	2	5	20	53	20	61472
female	2	6	22	49	21	67038

Notes: This table shows summary statistics of happiness categories by highest degree earned and gender. The numbers are row frequencies shown as percentages. Happiness is a categorical variable from 0 to 10 (where 0 is totally unhappy and 10 is totally happy) but recoded here as follows : (0,1,2) very unhappy, (3,4) unhappy, (5,6) neither happy nor unhappy, (7,8) happy, (9,10) very happy.

Table 4: **Descriptive Statistics: Individual Characteristics and Happiness**

Happiness:	very unhappy	unhappy	happy nor unhappy	happy	very happy
The Netherlands					
Household size	2	2	2	3	3
Income	327	353	343	414	447
Number of children	1	1	1	1	1
Age	40	45	48	47	46
Germany					
Household size	3	3	3	3	2.84
Income	416	465	478	558	572
Number of children	0	1	1	1	1
Age	50	46	47	44	45

Notes: This table shows summary statistics of household size, income, number of children, and age for Germany and the Netherlands by happiness categories (very happy, happy, neither happy nor unhappy, unhappy, very unhappy). The numbers are averages of the row variables by happiness categories. 2.42 indicates that average household size of happy people is 2.42. 39.91 indicates that average age of very unhappy people is 39.91. Happiness takes values 1-5 for the Netherlands but for Germany happiness takes values 0-10. For Germany, happiness is recoded here as follows: (0-1-2) very low, (3-4) low, (5-6) middle, (7-8) high, and (9-10) very high.

Table 5: **Can Transitory Sunshine Changes Explain Happiness: The Netherlands**

Dependent Variable: Self-Reported Happiness

	coef.	t-stat.
1) Average duration of daily sunshine:		
Last 10 day deviation	0.04	3.4
F-statistic	17.3	
Number of observations	17654	
R-squared	0.09	
2) Maximum duration of daily sunshine:		
Last 10 day deviation	0.06	4.7
F-statistic	22.4	
Number of observations	17654	
R-squared	0.09	
3) Daily cloud cover:		
Last 10 day deviation	−0.04	3.6
F-statistic	12.7	
Number of observations	15562	
R-squared	0.09	

Notes: Ordered logit regressions of self-reported happiness on controls and measures of sunshine. Every row reports estimates for different measures of sunshine. Happiness is a categorical variable taking values from 1 to 5. Measures of sunshine are province level daily sunshine variables taken from weather stations. "The last ten day deviation" is the weighted moving average of the last 10 day sunshine measure minus the average of the last ten day sunshine in the last 60 years. Controls for every regression are: labor force status, marital and health status, income, number of children, gender, household size, age, province fixed effects, and year fixed effects.

Table 6: **Transitory Weather Shocks to Happiness and Savings Behavior: The Netherlands**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
1) Recently, have you saved any money?				
Happiness	0.05	9.3	0.45	1.9
Number of observations	21123		16574	
2) Recently, how much money have you saved?				
Happiness	0.04	3.3	1.10	2.1
Number of observations	16109		11084	
3) Do you think it makes sense to save money?				
Happiness	−0.09	9.3	−1.01	2.1
Number of observations	21261		16843	

Notes: Each row reports the estimates for various outcomes. The dependent variables are the answers to the following questions: 1) "Did your household recently put any money aside, yes or no?" 2) "'About how much money has your household put aside recently? 1. $>$ 1.500 2. 1.500-5.000 3. 5.000-12.500 4. 12.500-20.000 5. 20.000-37.500 6. 37.500-75.000 7. $\geq$ 75000." 3)"Do you think it makes sense to save money, considering the current general economic situation? 1. yes, certainly 2. yes, perhaps 3. probably not 4. certainly not." IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the last ten days average cloud cover. The F-statistic after the first stage tests the validity of the instrument. Health and happiness are categorical variables taking values from 0 to 5 but treated as continuous variables here. Controls: Health status, income, age, number of children, schooling, household size, gender, work status, marital status, province and year fixed effects.

Table 7: **Transitory Weather Shocks to Happiness and Risk-Taking Behavior: The Netherlands**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
1) Prepared to take the risk when chance to gain money				
Happiness	−0.12	5.8	−0.99	2.1
Number of observations	19872		15456	
2) Do you use phone banking?				
Happiness	0.02	2.9	−2.71	3.7
Number of observations	11545		9023	
3) Do you use internet banking?				
Happiness	0.03	2.8	−3.09	2.6
Number of observations	5913		4549	
4) Prefer to go to ATM or counter of a bank?				
Happiness	0.03	0.9	−1.61	3.5
Number of observations	12512		10547	
5) How often do you smoke cigarettes now?				
Happiness	0.06	3.9	0.47	3.1
Number of observations	21567		16457	

Notes: Each row reports the estimates for various outcomes. The dependent variables are the answers to the following questions: 1) Please indicate on a scale from 1 to 7 to what extent you agree with the following statement, where 1 indicates totally disagree and 7 indicates totally agree "I am prepared to take the risk to lose money, when there is also a chance to gain money." 2) "Nowadays, a number of banks offer the possibility to arrange your banking affairs through the phone, without the mediation of a person. After entering your personal secret code you can obtain information about the balance of your accounts, and you can transfer money from one account to another. Do you use such a facility?. 1. no 2. yes, very rarely 3. yes, every now and then 4. yes, often 5. yes, very often" 3) "Nowadays, a number of banks offer the possibility to arrange banking affairs through Internet without the mediation of a person. Examples of such a facility are: HomeNet, Internetbanking or Girotel. Do you use such a facility? 1. no 2. yes, very rarely 3. yes, every now and then 4. yes, often 5. yes, very often" 4) "Do you prefer to get your money from an ATM or do you prefer to go to the counter of a bank? 1. I prefer to use the ATM 2. I prefer to go into the bank 3. I have no particular preference" 5) "Do you smoke cigarettes at all? 1. yes, I smoke every now and then 2. yes, I smoke every day 3. no" IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the last ten days average cloud cover. The F-statistic after the first stage tests the validity of the instrument. Health and happiness are categorical variables taking values from 0 to 5 but treated as continuous variables here. Controls: Health status, income, age, number of children, schooling, household size, gender, work status, marital status, province and year fixed effects.

Table 8: **Why Happier People Save More and Do not Want Risks? Discounting and Self-Control: The Netherlands**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
1) I work on things that will only pay off in a couple of years				
Happiness	−0.11	4.2	−1.87	2.6
Number of observations	21426		10854	
2) I am only concerned about the immediate consequences				
Happiness	−0.05	2.1	−1.86	2.8
Number of observations	13456		9787	
3) Do you find it difficult to control your expenditures?				
Happiness	−0.29	14.7	−1.71	2.1
Number of observations	17506		12318	
4) I have good control of my investments and their returns				
Happiness	0.17	7.5	2.64	2.5
Number of observations	13798		10365	
5) Little self-control or disciplined?				
Happiness	0.03	1.7	9.82	3.1
Number of observations	16056		13620	

Notes: Each row reports the estimates for various outcomes. The dependent variables are the answers to the following questions: Please indicate on a scale from 1 to 7 to what extent you agree with the following statement, where 1 indicates totally disagree and 7 indicates totally agree 1) "I often work on things that will only pay off in a couple of years." 2) "With everything I do, I am only concerned about the immediate consequences (say a period of a couple of days or weeks)." 3) "Many people find it difficult to plan or control their expenditures. Do you find it difficult to control your expenditures?" 4) "I have good control of my investments and their returns." 5) "Do you have little self-control or are you very disciplined? Where 1 indicates little self-control and 7 indicates very disciplined." The IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the last ten days average cloud cover. The F-statistic after the first stage tests the validity of the instrument. Health and happiness are categorical variables taking values from 0 to 5 but treated as continuous variables here. Controls: Health status, income, age, number of children, schooling, household size, gender, work status, marital status, province and year fixed effects.

Table 9: **Why Happier People Save More and Do not Want Risks? The Role of Expectations: The Netherlands**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
1) Do you expect prices to go down, stay same, or rise next year?				
Happiness	−0.03	4.2	−0.61	2.1
Number of observations	17456		13560	
2) How much do you expect prices to rise after 5 years?				
Happiness	−0.54	5.4	−9.98	2.1
Number of observations	15942		12362	
3) Own life expectancy				
Happiness	2.02	4.1	11.12	2.9
Number of observations	12560		10075	
4) Slow or quick thinker while making decisions?				
Happiness	0.13	7.2	4.64	2.9
Number of observations	16864		13962	

Notes: Each row reports the estimates for various outcomes. The dependent variables are the answers to the following questions: 1) "Do you expect prices in general to rise, to remain the same, or to go down, in the next 12 months? 1. go down 2. remain the same 3. rise" 2) "By what percentage do you expect prices in total to have risen after 5 years?" 3) "How many years do you expect to live?" 4) "While making your decisions are you a slow thinker or quick thinker?" The IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the last ten days average cloud cover. The F-statistic after the first stage tests the validity of the instrument. Health and happiness are categorical variables taking values from 0 to 5 but treated as continuous variables here. Controls: Health status, income, age, number of children, schooling, household size, gender, work status, marital status, province and year fixed effects.

Table 10: **Can Differences in Regional Sunshine Explain Differences in Individual Happiness: The Netherlands and Germany**

Dependent Variable: Self-Reported Happiness

	coef.	t-stat.
Netherlands		
1) Daily cloud cover:		
Yearly average	−0.16	2.5
F-statistic	6.7	
Number of observations	15570	
R-squared	0.10	
2) Average duration of daily sunshine:		
Yearly average	0.05	2.0
F-statistic	5.3	
Number of observations	17540	
R-squared	0.10	
3) Maximum duration of daily sunshine:		
Yearly average	0.06	2.1
F-statistic	6.1	
Number of observations	17540	
R-squared	0.10	
Germany		
4) Daily cloud cover:		
Yearly average	−0.11	5.5
F-statistic	29.6	
Number of observations	118916	
R-squared	0.26	

Notes: Ordered logit regressions of self-reported happiness on controls and measures of sunshine. Every row shows estimates from different regressions. Happiness is a categorical variable taking values from 1 to 5. Measures of sunshine are province level yearly sunshine variables for the Netherlands and state level yearly sunshine variables for Germany. "Yearly average" is the average of 365 day sunshine measure for a province or state in a year. Controls for every regression are: labor force status, marital and health status, income, number of children, gender, household size, age, province fixed effects, and year fixed effects.

Figure 1: Average Sunshine in the Netherlands

Figure 2: Average Sunshine in Germany

Table 11: **Transition Matrices of Happiness**

The Netherlands

Current happiness:		very low	low	middle	high	very high
Happiness :	very low	24	36	9	27	3
previous:	low	6	33	41	17	1
year:	middle	1	3	60	36	1
	high	0	0	8	81	11
	very high	0	0	1	40	59
	Total	0	1	14	66	18

Germany

Current happiness:		very low	low	middle	high	very high
Happiness :	very low	29	22	27	16	5
previous:	low	8	25	39	23	4
year:	middle	3	10	43	39	5
	high	0	3	17	66	14
	very high	0	1	7	41	51
	Total	2	6	21	52	19

Notes: This table shows probabilities of current happiness conditional on happiness in the previous year. Low, very low, middle, high, and very high are happiness categories. The sample for the Netherlands covers nearly 32000 panel observations. 17 indicates that the probability of having middle happiness conditional on having low happiness in the previous period is 17 percent or 40 indicates that the probability of having high happiness conditional on having very high happiness in the previous period is 40 percent. The original happiness variable for Germany is a categorical variable taking values from 0 to 10. Happiness is recoded here as follows: (0-1-2) very low, (3-4) low, (5-6) middle, (7-8) high, and (9-10) very high. 39 indicates that the probability of having middle happiness conditional on having low happiness in the previous period is 39 percent or 41 indicates that the probability of having high happiness conditional on having very high happiness in the previous period is 41 percent. All numbers are rounded to nearest integer in percentages.

Table 12: **Permanent Weather Shocks to Happiness and Economic Behavior: The Netherlands**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
1) Have you saved any money this year?				
Happiness	0.05	9.3	0.83	1.9
Number of observations	21062		17408	
2) Marginal propensity to save				
Happiness	0.07	4.9	0.83	2.3
Number of observations	20802		15652	
3) I would never consider investments in shares				
Happiness	0.02	1.5	4.47	2.2
Number of observations	19068		15842	
4) Own life expectancy				
Happiness	2.02	4.2	6.30	2.1
Number of observations	12560		10370	

Notes: Each row reports the estimates for various outcomes. The dependent variables are the answers to the following questions: 1) "Has your household put aside any money in the last 12 months, yes or no?" 2) "Some people spend all their income immediately. Others save some money in order to have something to fall back on. Please indicate what you do with money that is left over after having paid for food, rent, and other necessities on a scale from 1 to 7, where 1 means "I like to spend all my money immediately" and 7 means "I want to save as much as possible." 3) Please indicate on a scale from 1 to 7 to what extent you agree with the following statement, where 1 indicates totally disagree and 7 indicates totally agree "I would never consider investments in shares because I find this too risky". 4) "How many years do you expect to live?" The IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the regional yearly average cloud cover. The F-statistic after the first stage tests the validity of the instrument. Health and happiness are categorical variables taking values from 0 to 5 but treated as continuous variables here. Controls: Health status, income, age, number of children, schooling, household size, gender, work status, marital status, province and year fixed effects.

Table 13: **The Impact of Happiness on Savings and Consumption Decisions in Germany**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
1) Do you save monthly this year?				
Happiness	0.95	11.6	−1.15	4.1
2) Average monthly savings this year				
Happiness	0.03	11.8	0.38	2.2
3) Average monthly expenditures this year				
Happiness	−0.11	2.6	10.36	3.2
4) Average weekly expenditures this year				
Happiness	0.08	9.7	0.69	4.1
5) Do you have debt?				
Happiness	0.08	9.7	0.69	4.1
6) Amount of monthly debt				
Happiness	0.08	9.7	0.69	4.1
Number of observations	12456		11624	

Notes: Each row reports the estimates for various outcomes. The dependent variables in order are as follows: 1) Binary variable taking the value 1 if an individual saves money monthly, 0 otherwise. 2) Amount of real monthly savings 3) Amount of real monthly expenditures 4) Amount of real weekly expenditures. 5) Binary variable which is the answer to the question "Last month did you use a certain amount of money to pay back loans that was used to finance purchases? (excluding interest payment of mortgages and loans from a building society)." 6) Amount of real monthly credit debt which is the answer to the question "Last month how much money did use to pay back loans that was used to finance purchases? (excluding interest payment of mortgages and loans from a building society).". The IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the regional yearly average cloud cover. Health and happiness are categorical variables taking values from 0 to 10 but treated as continuous variables here. All independent variables are scaled by 100. Controls: Labor force status, marital and health status, income, number of children, number of household members, age, race, state and year fixed effects.

Table 14: **Can Happiness Explain Asset Allocation in Germany?**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
1) Do you own stocks or bonds?				
Happiness	0.95	11.6	−11.05	4.1
2) Do you have savings accounts?				
Happiness	0.03	11.8	0.38	2.2
3) Do you have operating assets?				
Happiness	−0.11	2.6	10.36	3.2
4) Do you have private life insurance?				
Happiness	0.08	9.7	0.69	4.1
Number of observations	120408		110560	

Notes: Each row reports the estimates for various outcomes. The dependent variables in order are as follows: 1) Binary variable taking the value 1 if the respondent does own stocks or bonds, 0 otherwise. 2) Binary variable taking the value 1 if the respondent does have savings accounts, 0 otherwise. 3) Binary variable taking the value 1 if the respondent does have operating assets, 0 otherwise. 4) Binary variable taking the value 1 if the respondent does have private life insurance, 0 otherwise. Probit and logit regressions give similar results compared to OLS. The IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the regional yearly average cloud cover. Health and happiness are categorical variables taking values from 0 to 10 but treated as continuous variables here. All independent variables are scaled by 100. Controls for regressions are: labor force status, marital and health status, income, number of children, number of household members, age, race, state and year fixed effects.

Table 15: **Does Happiness Affect Smoking Behavior and Moving Decisions In Germany?**

Dependent Variable:	Smoking Behavior		Desire to Move	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Happiness	−0.02	−1.72	−0.13	11.89
	(6.9)	(2.7)	(0.4)	(3.4)
Health	0.01	−0.04	−0.63	−47.81
	(0.4)	(2.6)	(2.3)	(3.3)
Income	0.71	0.01	0.09	−0.80
	(3.3)	(2.7)	(0.4)	(3.3)
Age	−0.07	−0.01	−0.03	−0.55
	(18.5)	(1.3)	(0.7)	(2.6)
Children	0.01	0.01	3.57	11.49
	(1.7)	(1.4)	(4.2)	(3.3)
Education	−0.02	−0.01	−5.45	−6.35
	(12.9)	(0.7)	(27.4)	(10.8)
Household size	−0.02	−0.14	−5.43	−1.84
	(3.5)	(2.5)	(7.8)	(0.9)
Female	−0.06	−0.19	17.2	0.80
	(6.6)	(1.8)	(16.1)	(0.4)
Number of observations	15752	12748	26560	24842

Notes: Each row reports the estimates for various outcomes. The dependent variable for columns 1 and 2 is a binary variable showing if the individual smokes or not. The dependent variable for columns 3 and 4 is a categorical variable 1-4 which is the answer to the question "Could you imagine yourself moving to another part of Germany? 1. very much 2. yes, depending on the situation 3. probably not 4. never." showing the amount of cigarettes consumed. The instrument for happiness is regional yearly cloud cover. Probit and logit regressions give similar results compared to OLS. The IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the regional yearly average cloud cover. Health and Happiness are categorical variables taking values from 0 to 10 but treated as continuous variables here. Income is in thousands and other variables are scaled by 100 to make coefficients understandable. Additional controls: work status, marital status, race, year and state fixed effects.

Table 16: **Individual Correlates of Happiness: The Netherlands (Appendix)**

Dependent Variable: Self-Reported Happiness

	Coef.	t-stat.
Labor force status:		
employed on contract	−0.33	0.9
own business	−0.19	0.5
free profession, self-employed	−0.35	0.9
looking for work after lost job	−0.82	2.1
looking for first-time work	−1.03	2.1
student	−0.16	0.4
own household	−0.45	1.2
disabled	−0.43	1.1
unpaid work	−0.91	2.1
volunteer	−0.36	1.1
Health status:		
not so good	0.96	4.5
fair	1.39	6.9
good	2.37	11.8
excellent	3.30	16.2
Marital status:		
married (marriage settlement)	0.15	2.9
divorced	−1.05	10.8
living with partner (not married)	−0.15	2.4
widowed	−0.95	8.8
never married	−1.04	12.0
Household size	0.33	4.6
Children	−0.40	5.4
Income	0.21	6.8
Male	−0.25	7.1
Age	−0.01	4.5
R-squared	0.09	
Number of observations	20644	

Notes: Ordered logit regression of self-reported happiness on individual characteristics. Province fixed effects and year fixed effects are included in the regression. Dummy for 1993 is excluded. Dummies for the provinces Flevoland and Overijssel are significantly positive but other province dummies are insignificant. All year dummies are insignificant except dummy for 2000 which is negative.

Table 17: **Individual Correlates of Happiness: Germany (Appendix)**

Dependent Variable: Self-Reported Happiness

	Coef.	t-stat.
Labor force status :		
part-time working	−0.08	5.2
not working	−0.03	3.1
Marital status:		
single	−0.21	13.6
widowed	−0.31	16.2
divorced	−0.55	26.6
separated	−0.85	21.4
not with partner	−1.22	1.7
Health	0.42	82.9
Children	−0.03	4.1
Household size	−0.05	8.4
Education	0.04	2.4
Income	0.47	26.1
Female	0.12	11.9
Age	0.01	34.3
R-squared	0.28	
Number of observations	120102	

Notes: OLS regression of life satisfaction on individual characteristics controlling for state fixed effects and year fixed effects. Individual Satisfaction is a categorical variable on a scale from 0 to 10 but used as a continuous variable here. The estimates are similar compared to ordered logit estimates. Health is a categorical variable from 1 to 5 and income is in thousands.

Table 18: **Importance of Different Aspects of Life: Germany (Appendix)**

Dependent Variable: Total Life Satisfaction

	OLS		Fixed Effects	
	Coef.	t-stat.	Coef.	t-stat.
Satisfaction with:				
work	0.13	27.7	0.10	18.6
leisure	0.09	22.2	0.07	13.0
housework	0.02	5.1	0.02	3.8
income	0.18	38.0	0.13	21.5
health	0.22	46.7	0.15	25.1
environment	0.04	8.4	0.03	5.2
dwelling	0.09	18.9	0.06	10.4
R-squared	0.44		0.18	
No. of obs.	22778		22778	

Notes: Regression of total life satisfaction on different aspects of life satisfaction. All variables in the regression are categorical variables from 0 to 10 but used as continuous variables. R-squared from the between effects estimation is 0.56.

Table 19: **Do People Move Across Regions? Transition Matrix of Residence: The Netherlands (Appendix)**

Current residence:		three largest cities	west	north	east	south
Residence:	three largest cities	99	0	0	0	0
previous:	west	0	99	0	0	0
year:	north	0	0	100	0	0
	east	0	0	0	100	0
	south	0	0	0	0	100
	Total	16	29	11	20	24

Notes: This table shows the probabilities of current regional residence conditional on regional residence in the previous year. The sample covers 70000 panel observations and there are 5 regions in the Netherlands; three largest cities, South Holland, North Holland, East Holland, and West Holland. All numbers are rounded to nearest integer in percentages.

Table 20: **Happiness and Working Hours: The Netherlands (Appendix)**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
Average working hours in a week				
Happiness	−0.03	0.3	2.03	0.4
Average working hours in a week at current job				
Happiness	−0.11	4.2	8.59	0.9
Number of hours would like to work in a week				
Happiness	0.04	0.2	9.01	1.3
Number of observations	13750		13526	

Notes: Each row reports the estimates for different measures of working hours. The IV-GMM is used for the instrumental variable regressions. The instrument for happiness is regional yearly cloud cover. The F-statistic after the first stage tests the validity of the instrument. Health and happiness are categorical variables taking values from 0 to 10 but treated as continuous variables here. Controls: Health status, income, age, number of children, schooling, household size, gender, work status, marital status, state and year fixed effects.