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Cahit Guven

Weather and Financial Risk-Taking: Is Happiness the Channel?

Berlin, August 2009

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ISSN: 1864-6689 (online)

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Weather and Financial Risk-Taking:

Is Happiness the Channel?

Cahit Guven *

August 2009

Abstract

Weather variables, and sunshine in particular, are found to be strongly correlated with financial variables. I consider self-reported happiness as a channel through which sunshine affects financial variables. I examine the influence of happiness on risk-taking behavior by instrumenting individual happiness with regional sunshine, and I find that happy people appear to be more risk-averse in financial decisions, and accordingly choose safer investments. Happy people take more time for making decisions and have more self-control. Happy people also expect to live longer and accordingly seem more concerned about the future than the present, and expect less inflation.

JEL Classification: D01, D91, G11
Keywords: happiness, risk-taking, climate.

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I Introduction

There have been several studies on the influence of weather on financial variables (Subrahmanyam 2007), generally with mixed results. Hirshleifer and Shumway (2003), using data from 26 countries spanning the period 1982 to 1997, show that morning sunshine in the city of a country's leading stock exchange has significant impacts on the daily market index and stock returns. Moreover, Keef and Roush (2005) provide evidence related to the influence of sunshine on the interest rates of bank bills, government bonds, and the returns of stock indices in New Zealand. Furthermore, Keef and Roush (2007) find that sunshine and temperature are also significantly correlated with stock market returns in Australia. Floros (2008) finds the same correlation in the case of Europe.

On the other hand, Gerlach (2007) documents that the main source of calendar and weather anomalies is not psychological or institutional factors, but market responses to macroeconomic news, not psychological or institutional factors. Jacobsen and Marquering (2008) argue that the correlation between climate and stock returns might be spurious, and conclude that climate affects stock returns through mood changes of investors is premature. They show that stock market returns tend to be significantly lower during summer and fall than during winter

and spring. They also find that the anomalies in stock returns can be explained by a simple winter/summer dummy. On the contrary, Loughran and Schultz (2004) find little evidence that cloudy weather in the city in which a company is based, affects its returns.

Further to this mixed evidence, the channels through which weather might affect financial variables are also unknown. Based on their findings, Goetzmann and Zhu (2005) claim that the behavior of market-makers, rather than individual investors, may be responsible for the relationship between returns and weather. In this respect, emotions, and specifically happiness, can be investigated to inform people on policy issues (Frey and Stutzer 2002; Kahneman and Krueger 2006; Lyubomirsky, King, and Diener 2005) and to explain various individual behaviors (Camerer, Loewenstein, and Prelec 2005). Recently, Huang and Goo (2008) documented the relationship between investors' happiness levels and overconfidence. They found that when natural environmental happiness is stronger, investors are less likely to be overconfident. On the other hand, when the happiness of the investment atmosphere is stronger, investors are more likely to be overconfident.

The main focus of this paper is to show that *self-reported happiness* is one of the channels through which the weather, and specifically sunshine, affects individual risk-taking behavior. Establishing this relationship could explain the correlation

between weather and financial variables found in the literature, and could also help to determine the extent to which the findings from this research should be incorporated into policy analysis. Using an instrumental variables approach, the paper establishes a casual relationship going from happiness to risk-taking behavior. To do so, it uses exogenous regional sunshine as an instrument for current individual happiness. The paper uses data from the Dutch National Bank (DNB) Household Survey, which is a panel of about 4500 individuals covering the period 1993 to 2006, and the German Socio-Economic Panel (SOEP), which is a panel of about 21000 individuals surveyed from 1984 to 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, as well as, very detailed information on wealth and different measures of risky behavior.

The instrumental variables approach taken in this paper addresses the potential endogeneity between financial behavior and individual happiness. In the first stage, the paper finds that exogenous increases in regional sunshine increase happiness. Specifically, two instruments are used. By matching the exact dates of individuals' answers to "happiness" questions in the surveys with the weather data, the paper first uses the transitory sunshine changes as an instrument. Secondly, yearly regional averages of sunshine serve as an instrument for current happiness. The

first stage results show that these variables are strong instruments and that the results do not suffer from weak instruments problem. Then, in the second stage, the unexplored issue of whether subjective well-being helps to determine individual's risk-taking behaviors is investigated. Establishing the direction of this causality using instrumenting individual happiness by "regional sunshine," the paper finds that happy people 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 are less likely to own stocks and bonds. Happy people also have a lesser desire to invest in shares, because they find them too risky. The different behaviors of happy people may be due to taking more time for making decisions and having more 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 related to other forms of risk-taking behavior suggest that happy people are less likely to smoke and have less desire to move. Happy people also use internet banking and phone banking less frequently, and prefer to use bank branches to ATMs.

The remainder of the paper is organised as follows. Section 2 provides an overview of the related economic literature on correlates of well-being and the

impact of well-being on risk-taking behavior. Section 3 summarizes the data, and Section 4 provides the details about the empirical strategy and the identification strategy. Section 5 presents the descriptive statistics and the empirical results, and Section 6 concludes.

II Related Literature

A Correlates of Happiness

Happiness has been being studied extensively in psychology for a long time. However, it was not until 1974 that it was considered by economists as a research concept (Easterlin, 1974), since which time there has been a proliferation of studies on the relationships between various *individual characteristics* and happiness. For instance, Oswald (1997) and Blanchflower, and Oswald (2000) identify a U-shaped relationship between *age* and happiness. Considering *race* in the United States, it has been found that blacks are less happy than whites overall. *Health* has been found to be the strongest predictor of happiness. In a large number of studies covering various countries and periods, *marriage* has also been found to be correlated with higher levels of happiness. There is a limited relationship between happiness and the level of *education*, since education may contribute to happiness

indirectly 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 on these issues.

Rehdanza and Maddison (2005) explain differences in self-reported levels of happiness using *weather* in a panel of 67 countries. They find that climate variables have a powerful effect on self reported levels of happiness, controlling for a range of other factors. Van Praag and Ferrer-i-Carbonell (2004) and Frijters and Van Praag(1998) also study the influence of climate on happiness. They show that climate variables such as rain, hours of sunshine, average temperature, and windiness are strongly correlated with household costs, financial satisfaction, and general satisfaction. Becchetti, Castriota, and Bedoya (2007) estimate the relative gains and losses (in terms of happiness) arising from the change in climate when individuals move from one city to another (e.g. from Paris to Madrid). They show significant links between happiness and several climatic factors (rain, fog, temperature, wind).

B Risk-taking

A number of studies (e.g., Johnson and Tversky 1983) have found that affective states influence subjective probability evaluations. Happier people have different

attitudes towards risk-taking 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 report higher subjective probabilities for positive events and lower subjective probabilities for negative events. Moore and Chater (2003) observe a significant positive relationship between affect and risky behavior in the laboratory. One explanation for this pattern relates to the finding that people retrieve mood-congruent memories more easily, and focus their attention more on mood-congruent information when assessing subjective probabilities. The empirical research to date 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) find that subjects in a positive affective state are willing to pay more for lottery tickets than the control subjects are. Valois, Zullig, Huebner, and Drane (2001) and Valois, Zullig, Huebner, Kammermann, and Drane (2002) find that risky behavior on the part of students is associated with low levels of life satisfaction. A number of studies (e.g., Isen and Patrick 1983; Isen and Geva 1987; Isen, Nygren, and Ashby 1988) have found that people's responses to risk stimuli depend 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).

III Data

The *DNB Household Survey* (formerly known as the CentER Savings Survey) is a panel survey that started in 1993. The data are collected annually for a panel of more than 2,000 households and are representative of the Dutch population. The *DNB Household Survey* (DHS) data are unique in the sense that they allow studies of both the psychological and economic aspects of people's financial behavior. The DHS consists of six questionnaires. The topics covered by the questionnaires are: i) general information on the household, which includes the regions and provinces of residence; ii) household and work; iii) accommodation and mortgages; iv) health and income; v) assets and liabilities; and vi) economic and psychological concepts. 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 CentER-panel. Within each household, all persons aged 16 or over are interviewed. The questionnaires are answered without the interference of an interviewer, the respondents can answer the questionnaires at any time that is convenient for them during each year, and all of 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 it completely. Since the economics and psychology parts are provided together, people will answer the economic behavior questions on the same day they answer the happiness question. This enables me to use daily changes in sunshine as an instrument for happiness in order to investigate its impact on economic behavior. Besides this, people answer the happiness question on different days and months through the year, which supplies extra variation within a year when happiness is instrumented with unexpected daily sunshine changes. Happiness is a categorical variable taking values 0-5. The dependent variables (measures of risky behavior) are available in different two forms: i) binary variables such as whether or not a person expects prices to go down; and ii) continuous variables such as perceived longevity. DHS also includes various subjective variables such as whether a person considers investing in shares or not, based on a seven point scale.

The *German Socio-Economic Panel Study* (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. The SOEP includes information on objective living conditions, values, the willingness to take risks, changes currently being undergone in various areas of life, and about the relationships and dependencies among these areas and the changes. The SOEP also includes state indicators of the 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. Happiness is a categorical variable taking values 0-10. The dependent variables (measures of risky behavior) are available in two different forms: i) binary variables such as whether or not a person owns stocks or bonds; and ii) subjective variables such as whether or not a person considers moving to another state based on a four point scale.

The *European Climate Assessment Dataset* consists of long-term daily resolution climatic time series for over 40 countries from meteorological stations throughout Europe and the Mediterranean. 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. Three different measures of sunshine are available in the dataset. i) Cloud cover (CC) is measured four times a day at hours 00, 06, 12 and 18. *Mean daily cloud cover* is therefore calculated as CC/4. This value (in percentages) is converted to octa's by rounding ((cloud cover in percents/100)*8). ii) Sunshine duration (SS) is measured four times a day at hours 00, 06, 12 and 18, and *daily average sunshine duration* is calculated as SS/4. iii) the maximum of these four values is the *maximum duration of daily sunshine*.

IV Empirical Framework

Instrumental Variables Estimation:

In the context of a linear regression model, if the residuals's distributions 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, which also includes happiness, is $n \times K$, where n is the number of observations. The error term u is distributed with mean zero, and the covariance matrix Ω is $n \times n$. Happiness is endogenous in the regression, and the rest of the regressors are assumed to be exogenous, so $E(X_i u_i) \neq 0$. 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 there is 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, then 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 inconsisten,t leading to an invalid inference. The contemporary method of addressing this problem is GMM. 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:

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

Where 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 statistics, are used to test whether the equation is suitably identified or not. The alternative hypothesis for the test is that the instrument is valid, 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 has a chi-squared distribution. In this paper, the F-statistic form of the Cragg-Donald statistic, which has been suggested by Stock and Yogo (2002) for testing for the presence of weak instruments (i.e., that the equation is only weakly identified), is reported. See Stock and Yogo (2002) for a tabulation of the critical values for the Cragg-Donald statistic. Since my model includes only one endogenous regressor, i.e. happiness, the F-statistic form of the Cragg-Donald statistic coincides with the first-stage F statistic of the excluded instrument.[1]

Sunshine as an Instrument for Happiness

Daily sunshine changes. I find that daily expected sunshine changes do not affect risk-taking behavior. If it is already known that tomorrow is going to be sunny, it will not change individual's behaviors. What matters for the risk-taking

[1]See Baum, Schaffer, and Stillman (2003) for more discussion of IV-GMM and its implementation in Stata.

behavior is not the expected but the unexpected sunshine. The first instrument for happiness is the unexpected daily sunshine changes, as observed at the station level. I match the daily sunshine data with individual happiness data, since I know the exact date on which the respondents answered the "happiness" question. First, I calculate the last ten day weighted average of regional sunshine[2] and calculate the average of the 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 the last 10 day average over the last 60 years.[3] For instance, if today is the 10th of October 2009, I calculate the weighted average of sunshine from October 1, 2009 to October 10, 2009 for a given region. Next, I find the average sunshine between October 1 and October 10 for that region between 1949 and 2009, then I subtract the latter from the former to find the unexpected sunshine. The three measures of changes in sunshine are all significant in explaining individual happiness (average duration of sunshine, maximum duration of sunshine, and cloud cover). Although the exact dates when people answer the happiness question are known, I cannot match the weather data with an individual's residence precisely because only information

[2]Data from dates closer to the survey date are given a higher weight.

[3]This is the time period over which people experiences weather changes through their life-time, since the average life expectancy is around 70 years.

about the state of residence is available. Weather data are available for 61 stations in Germany, and there are several stations in each state. Since states are very large and within-state weather variation is very high, it is very likely that the average sunshine in a state will not represent the weather in every part of that state. The main difference between cloud coverage and sunshine (hours) is the seasonality, because there are fewer hours of sunshine in winter. In autumn and winter, there are quite often fog and low level stratus in the valleys, while up on the hills and mountains there is fine weather. Most cities and villages are down near the rivers, while some of the measurement stations may be on hill tops. As a result, since cloud cover is a better measure of sunshine for the empirical analysis, because it does not change much within a state and represents more people, I focus only on cloud cover as a measure of sunshine.

Yearly average sunshine. The second instrument is the regional yearly sunshine average. The regional yearly sunshine average is calculated as the average of sunshine measure for a state or province over the 365 days in a year. The sunshine measure is very sensitive to altitude, the angle of the sun's rays, clouds, wind, and the environment. However, sunshine data from high altitude stations do not match the places where people live. On the other hand, cloud cover does not vary much between people's residences and the stations. As a result, cloud cover is used as

the measure of sunshine in the empirical framework. See Figures 1 and 2 for the regional sunshine averages for Germany and the Netherlands. Both yearly sunshine averages and daily sunshine changes affect happiness. However, unexpected daily sunshine changes only influence happiness in the short-run. Hence, unexpected daily sunshine changes are expected to change consumption behavior only temporarily. However, yearly sunshine changes can change consumption behavior permanently.

Transition Probability: I show transition probabilities for self-reported happiness and for the residence of individuals. Hence, the time series behavior of happiness and the mobility of individuals can be observed.[4] The transition probability from state i (say, "very happy") to state j is calculated as the number of individuals who report the state of happiness i in year $t-1$ *and* the state of happiness j in year t, divided by the total number of individuals who report the state of happiness i in year $t-1$. The transition probability is computed as follows:

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

[4]This information is very important for the validity of the instruments and the correct use of the dependent variables, as is discussed in the robustness part.

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* state j in year t; and N_i is the individual who reports state i in year $t-1$.

V Empirical Results

A Descriptive Statistics:

Tablse I and II show the relationships between happiness and labor force status, marital status, health status, and gender. Happiness is a categorical variable taking values 1-5, which refers to the "very unhappy," "unhappy," "neither happy nor unhappy," "happy," and "very happy" categories, respectively, 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 of three categories of happiness (neither happy nor unhappy, happy, and very happy). Consider labor force status: unemployed people seem to be relatively unhappy. 27 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 self-employed) report the highest values of happiness, while students and disabled people are not very

happy. Nearly one sixth of the total sample is retired. Retired people report high levels of happiness, which could be due to having more leisure and higher 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 of happiness: people reporting a 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 taking values from 0 to 10 for Germany but it is recoded here into five categories. Consider the labor force status: Employed people are very happy. Among the categories of non-working people, students and mothers on maternity leave are very happy. Unemployed people are the most unhappy, together with people on military service, however retired people are not very happy as would be expected. Nearly 34 percent of retired people report low levels of happiness. With regard to marital status, 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 the native country and separated people both report relatively low levels of happiness. Divorced and widowed people

are also less happy than married people. Health is a very strong predictor of happiness in Germany. People reporting a better health status also report higher values of happiness. Table III shows summary statistics of happiness by education and gender. People who have earned higher levels of degrees earned report higher levels of happiness. As in the Netherlands, there does not seem to be any difference between the happiness of males and females in Germany.

Table IV reports the averages of the number of children, income, household size, and age by happiness categories in Germany and the Netherlands. Household size does not vary much across happiness categories, but happy and very happy people have slightly bigger household sizes in Germany and the Netherlands. In both countries, income and happiness are positively correlated. People with higher incomes report higher values of happiness on average, but the correlation seems to be stronger for Germany. This may be due to differences in income inequality. See the surveys 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 of relative income also play a big role in explaining happiness together with relative income and own income. Differences in perceptions of incomes might explain the differences in correlations. People with more children are happier in

both countries, but there does not seem to be any clear relationship between age and happiness. This may be due to the U-shaped relationship between age and happiness which is mostly found in the literature. I also show the importance of different aspects of life for people in Germany in Table XIV. The coefficients represent the correlations between the total individual happiness and happiness with various aspects of life. The results suggest that income and health are very important to people. Work is not as important as income or health. Leisure has a similar importance to people to dwelling, but environment and housework do not seem to be very important for individuals in Germany. The R-squared value 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 such as the weather. See the Appendix for the exact correlations between individual characteristics and happiness.

B Sunshine and Happiness: First Stage Results

In addition to 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 V. The results suggest that happiness increases with the amount of unexpected daily sun-

shine. The coefficient for the first row is 0.04 and the t-statistic is 3.4, suggesting that a 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, thus rejecting the presence of a weak instrument. This is the t-statistic for the hypothesis that the unexpected sunshine equals 0. The null hypothesis is that the coefficient of happiness equals 0. Having an F-statistic higher than 4 indicates the rejection of the null. The F-statistic is much higher for the maximum duration of sunshine, with a value of 22.4, but, is smaller for the average cloud cover, with a value of 12.7. All measures of sunshine are very significant in explaining happiness, and the presence of a weak instrument is not an issue, considering the first stage.

C Impact of Happiness on Risky Behavior: Second Stage Results

Individuals face various economic choices during their lives. From the point of view of an economist, some of the important choices are related to asset allocation and investment behavior. First, I consider unexpected transitory sunshine changes as an instrument for happiness, which is expected to influence short-term outcomes but not permanent ones. The dependent variables are recent short-run behavioral

outcomes. Most of the choices we make in daily life are related to risk-taking, including investment, consumption, saving, moving residences, smoking, and driving. Table VI 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. The OLS estimate suggests that happier people report that they do not want to risk their money when there is a chance of losing it. The IV result shows us that happiness increases risk averseness in financial decisions. Happiness causes people to take fewer risks which may explain individual differences in asset allocations. I then study whether we observe the same cause and effect relationship between happiness and other risky behaviors. Cox and Rich (1964) examine various determinants of telephone shopping and find that the degree of risk perceived by the consumers explains most of the individual variation regarding telephone shopping. Considering phone banking, internet banking, getting money from an ATM instead of a counter, and smoking, the IV results show that happier people use phone banking and internet banking less frequently, are less likely to get money from an ATM, and smoke less frequently.[5] The results suggest that risk-taking behaviors in different situations might not be independent from one another.

[5]In the wording of the questions, individuals are told that phone banking, internet banking or getting money from an ATM is risky before answering the respective question.

The findings above are quite interesting in the sense that happiness leads to less risky behavior. But why? Tables VII and VIII investigate possible channels through which happiness might influence risk-taking behaviors. Table VII studies whether the discount rates of happy people are different and whether 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. Therefore, we instrument happiness with transitory sunshine changes. The first row shows that happier people are more forward looking. Happiness causes people to take the future into account 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 of individuals. The third, fourth, and fifth rows show that happiness increases self-control. Unhappy people have less control over their their expenditures and investments. 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 VIII 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' time. This may lead to less risky investments today for happy people because they believe that they may get higher profits in the future with lower prices. On the other hand, lower price expectations may lead to a decrease in consumption today for happy people. The same optimism about the future is also observed also in higher life expectancies for happy people. A one category increase in happiness leads to a 1.1 year higher life expectancy. Besides these expectations, happiness may also influence cognitive ability. The fourth row shows that happy people think more before making decisions. Often, thinking more about the pros and cons of decision might lead to different choices. Thinking more may enable individuals to have a better understanding of the choices, with better comparisons, or at least 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 IX for the Netherlands and Germany. The estimates are the coefficients of the yearly sunshine averages with controls. The yearly averages of the three measures of sunshine are all significant in explaining happiness and have the expected signs. However, the F-statistics are lower than 10, suggesting that we might have a weak instrument problem. Most of the sunshine variation is within a province but not across provinces, and this

might explain the low F-statistics. A one percentage increase in yearly cloud cover decreases happiness by 0.11 units (out of 10). The F-statistic for this is 29.6, suggesting that the yearly cloud cover is a strong predictor of happiness, and the presence of a weak instrument is rejected. The difference between the F-statistic of the Netherlands and Germany could be due to one or more of three factors: 1) The sample size is much bigger for Germany. I have weather data for 13 states, with 108,000 individual observations over 20 years. However, for the Netherlands weather data is only available for nine provinces, with 15,000 individual observations over 13 years. 2) In Germany, happiness is less persistent than in the Netherlands. Table XV shows the transition probabilities of happiness for the two 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 means that for the average person the probability of having the same level of happiness as in the previous year is 51.4 percent. On the other hand, this value is just 41.8 in Germany, suggesting that happiness is less persistent in Germany than in the Netherlands. 3) The total variation (both within and across variation) in the measures of sunshine for Germany is much greater than in the Netherlands.

In Table X, I investigate the impact of happiness on people's asset allocation

and investment behaviors. Asset allocation is a good indicator of risk-taking behavior. The results are quite promising. Happy people are less likely to own stocks and bonds (risky assets), but more likely to have operating assets, and private life insurance (less risky assets). Happy people also considers less investing in shares, which are risky assets. I also examine whether one can observe a similar influence of happiness on other risk related behavior. I therefore, investigate the impact of happiness on smoking and moving behavior. Assuming that smoking is an example of a risky behavior, I show in Table XI that happy people smoke less often. Also, although people do not migrate across states in Germany much, the survey asks people whether they could imagine themselves moving to a different part of Germany. The results show that happy people do not desire to move to a different state of Germany. The reason for this is probably that they do not want to change their current happy situation.

VI Further Issues

Validity of Instruments

The instrumental variables approach implicitly assumes that sunshine only influences individual economic behavior through happiness, and is not correlated

with any other independent variable. This assumption will not hold if happiness is a proxy for some personality characteristics that are found to be correlates of individual happiness. In this context, one could argue that although weather can shift happiness, which in turn shifts risk-taking, weather can also potentially shift beliefs (optimism versus pessimism). Several considerations suggest that this is not a problem. On theoretical grounds, most of people's psychological characteristics are available in the surveys, and they are very persistent. Further, psychology studies argue that weather-induced happiness primarily affects risk preferences (leading to less risk-taking) rather than optimism (leading to more risk-taking). On statistical grounds, since I use very short-run changes in sunshine as an instrument for happiness, it is unlikely that short-run changes in sunshine will affect permanent psychological characteristics. In fact, Hansen's J-statistics for excludability suggest that there is no problem in this case. Further support of this point comes from the F-statistics after the first stage. Table V shows that the F-statistics are all higher than 10, rejecting the presence of weak instruments.[6]

Another concern regarding the use of sunshine as an instrument could be such that individuals may migrate to the sunnier regions. However, in the Netherlands

[6]Staiger and Stock (1997) show that in the IV regressions, values of the F-statistic which are higher than 10 indicate the rejection of the presence of weak instruments. I also find no impact of happiness on actual or desired working hours in Table XVII. This suggests that sunshine affects economic behavior through not individual productivity, but through happiness.

most people do not migrate during at any stage their lifetime. As is shown in Table XVI, the probability of living in a given 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 much. 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 within West Germany; the probability of staying in the same state is about 87 percent. Also, the IV results for the Netherlands regarding consumption, savings, and risk-taking are confirmed by the findings for Germany. This suggests that neither the results nor the use of instruments is peculiar to one country; rather, they are also applicable to other countries with different cultures and topological structures.

Issues on Survey Data

Researchers may be skeptical about the use of survey data because the answers to the surveys may be subject to biases from factors such as respondents' moods at the time of the survey and minor changes in the phrasing of survey questions. This might be a concern if people are misreporting their actual behavior due to differences in their mood. However, in this case, the respondents use documents to answer questions in the surveys, which increases their reliability. In the DNB Household Survey, the questionnaires are answered without any interference from

the interviewer, the respondents can answer the questionnaires at whatever time that is most convenient for them, and all of the documents (annual statements, bank account statements) required for answering the questions are within easy reach. Therefore, mood effects can not be an explanation for the results. Using individuals' responses to questions about their intentions and desires, in addition to their observed behaviors, I, along with a huge body of literature, assume that the revealed behavior is similar compared to the 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 the 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 here is current happiness, we can still make an argument for the influence of current happiness on observed recent behavior, because, as is shown in Table XV, individual happiness is relatively persistent over time (over yearly observations), and it is very likely that happiness does not change much over short periods of time. Moreover, I show in Table XV that happiness is fairly consistent over time, suggesting that people might differ in some *given* characteristics, gained most probably at birth but not through experience. Moreover, current happiness is not just a function of current variables, such as current income and current environmental factors, but is a combination of the influences of past, current, and future events.

Happiness and Optimism

From a psychological perspective, many researchers have noted that optimism in one domain of activity does not necessarily translate into optimism about other domains (Weinstein, 1980). In other words, optimism is often thought to be either event or domain based, and while individuals may display optimism about a certain event, this does not necessarily translate into optimism about other events.

Weinstein and Klein (1996) caution, "Studies of biases...must be careful to ask, 'Biased about what?,' and should refrain from assuming that what is found in one domain will apply in another." Prior research in psychology indicates that optimism in the domain of weather need not necessarily imply optimism in other areas such as finance. To the best of our knowledge, there have been no studies to date showing a causal influence of optimism on stock markets or risk-taking at the individual level in addition to correlation.

Other Issues

In Germany some of the individuals received bad weather benefits during the sample period, which might directly affect individual behavior. However, it appears that only one percent of the whole sample had bad weather benefits. Also, the results are shown for the whole sample but the 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 behaviors 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 (see Moulton 1990, for further discussion on clustering), and also to the use of time and region fixed effects and to the control of the regional average of stations' altitude.

There is also the danger of picking up a time trend if the countries are systematically getting sunnier. This is only an issue for annual sunshine averages, since in the short-run I use the unexpected sunshine changes. The results are robust to the use of year dummies to which will pick up any time trends.

One should also be careful about the inferences in the paper. The paper only uses happiness as a channel through which sunshine influences risk-taking. It does not identify the relationship between happiness or fitted happiness and risk-taking behavior, as providing a good quantitative measure of how happiness affects risk preference, since there can also be variations in beliefs, and many individual characteristics which are correlates of happiness are controlled in the regressions.

Moreover, I do not attempt to distinguish make a sharp linguistic distinction between happiness and mood. However, in the paper happiness is shown to be influenced by sunshine hence it might be better to think of it as a transient mood rather than a personality trait. Also, the "mood-as-information" model proposed by Schwarz and Clore (1983) suggests that mood effects are eliminated when people misattribute their mood to an irrelevant source, such as the weather. On the other hand, I can not assess exactly how long-lasting the effects of happiness on risk-taking through sunshine are. Monthly happiness data (as a panel) are needed in order to assess these long-lasting effects.

Implications

The results suggest that individuals are more risk averse on sunny days. This might suggest that individuals do not want to hold risky stocks, and thus sell these risky stocks on sunny days, implying a positive correlation between sunshine and the stock market. However, more risk averse people might also want to buy less risky stocks. The influence of sunshine on the decision to buy or sell stocks might depend on the riskiness and the quantity of stocks an individual owns. Do do other events affect happiness, and how do we expect that to affect trading and prices? Suppose that happiness is the predominant channel through which weather affects returns. What does that mean for any of the other questions we care about in finance? For further work, it would be useful to investigate possible applications of these ideas for understanding financial markets.

VII Conclusion

Many studies have confirmed that there is a strong relationship between sunshine and financial variables. However, the channels through which sunshine affects financial variables are unknown. This paper shows that happiness is one channel through which sunshine influences individual risk-taking behavior. Firstly, the

paper verifies that the exogenous variation in yearly and daily sunshine has a significant impact on individual happiness in Germany and the Netherlands. Secondly, by instrumenting individual happiness with regional sunshine, the paper investigates the impact of happiness on individual risk-taking behavior. Happy people are more risk-averse in financial decisions and they prefer safer investment tools. The results show that happy people are more likely to have life insurance, savings accounts, and operating assets, but are less likely to own stocks or bonds. Happy people also have less desire to invest in shares because they find them too risky. There are significant differences in the risk-taking behaviors of happy versus unhappy people. The different behaviors of happy people are found to be due to taking more time for making decisions, having more self-control, and expectating to live longer. Happy people are more concerned about the future than the present and expect lower prices in the future. Secondary findings suggest that happy people are less likely to smoke and have less of a desire to move within a country. Happy people also use internet and phone banking less frequently, and prefer to use bank branches rather than ATMs.

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Table I: **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 labor force status, marital status, and health status. The numbers are row frequencies, shown as percentages and rounded to the nearest integer.

Table II: **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
in education-training	2	4	17	53	24	5210
maternity leave	1	5	15	54	24	1454
military-community service	3	7	20	53	16	456
unemployed	9	14	31	34	11	3907
sometimes secondary job	2	5	20	53	21	2034
work past 7 days	5	6	20	54	16	266
regular secondary job	2	6	24	49	20	1885
working	1	5	20	55	20	74104
working:						
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 labor force status, marital status, and health status. The numbers are row frequencies, shown as percentages and rounded to the nearest integer. The original happiness variable for Germany is a categorical variable taking values from 0 to 10 (where 0 is totally unhappy and 10 is totally happy), but it is 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 III: **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 the highest degree earned and gender. The numbers are row frequencies, shown as percentages and rounded to the nearest integer. The original happiness variable for Germany is a categorical variable taking values from 0 to 10 (where 0 is totally unhappy and 10 is totally happy), but it is 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 IV: **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	3
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 and rounded to the nearest integer. 3 indicates that average household size of "happy" people is 3. 40 indicates that average age of "very unhappy" people is 40. Happiness takes values 1-5 for the Netherlands. The original happiness variable for Germany is a categorical variable taking values from 0 to 10 (where 0 is totally unhappy and 10 is totally happy), but it 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 V: **Unexpected Transitory Sunshine Changes and 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 measures of sunshine and control variables. Each 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 sunshine deviation" is the weighted average of the last 10 day sunshine measure minus the average of the last ten day sunshine measure over the last 60 years. Control variables: labor force status, marital and health status, income, number of children, gender, household size, age, province and year fixed effects.

Table VI: **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, I do not smoke." The IV-GMM is used for the instrumental variable regressions. The instrument for happiness is the last ten day cloud cover deviation. 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 are treated as continuous variables here. Control variables: health status, income, age, number of children, schooling, household size, gender, labor force status, marital status, province and year fixed effects.

Table VII: **Why Happier People 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 day cloud cover deviation. 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 are treated as continuous variables here. Control variables: Health status, income, age, number of children, schooling, household size, gender, labor force status, marital status, province and year fixed effects.

Table VIII: **Why Happier People 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 day cloud cover deviation. 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 are treated as continuous variables here. Control variables: Health status, income, age, number of children, schooling, household size, gender, labor force status, marital status, province and year fixed effects.

Table IX: **Regional Sunshine and 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 measures of sunshine and control variables. Each row shows estimates from different regressions. Happiness is a categorical variable taking values from 1 to 5. The measures of sunshine are province-level sunshine variables for the Netherlands and state-level sunshine variables for Germany. "Yearly average sunshine" is the average sunshine over 365 days for a province or state. Control variables: labor force status, marital and health status, income, number of children, gender, household size, age, province and year fixed effects.

Table X: **Can Happiness Explain Investment Behavior?**

	OLS		IV	
	coef.	t-stat.	coef.	t-stat.
Germany:				
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	
The Netherlands:				
5) I would never consider investments in shares				
Happiness	0.02	1.5	4.47	2.2
Number of observations	19068		15842	

Notes: Each row reports the estimates for various outcomes. The first four rows are regressions for Germany and the last row is for the Netherlands. The dependent variables in order are as follows: 1) Binary variable taking the value 1 if the respondent does own stocks or bonds, and 0 otherwise. 2) Binary variable taking the value 1 if the respondent does have savings accounts, and 0 otherwise. 3) Binary variable taking the value 1 if the respondent does have operating assets, and 0 otherwise. 4) Binary variable taking the value 1 if the respondent does have private life insurance, and 0 otherwise. 5) 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". 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 regional yearly cloud cover average. Health and happiness are categorical variables taking values from 0 to 10, but are treated as continuous variables here. All independent variables are scaled by 100. Control variables: labor force status, marital and health status, income, number of children, number of household members, age, race, state and year fixed effects.

Table XI: **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 whether the individual smokes or not. The dependent variable for columns 3 and 4 is a categorical variable from 1 to 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." The instrument for happiness is the regional yearly cloud cover average. Probit and logit regressions give similar results to OLS. The IV-GMM is used for the instrumental variable regressions. Health and happiness are categorical variables taking values from 0 to 10, but are treated as continuous variables here. Income is in thousands and other variables are scaled by 100 to make the coefficients understandable. Additional control variables: Labor force status, marital status, race, year and state fixed effects.

VIII Supplementary Appendix

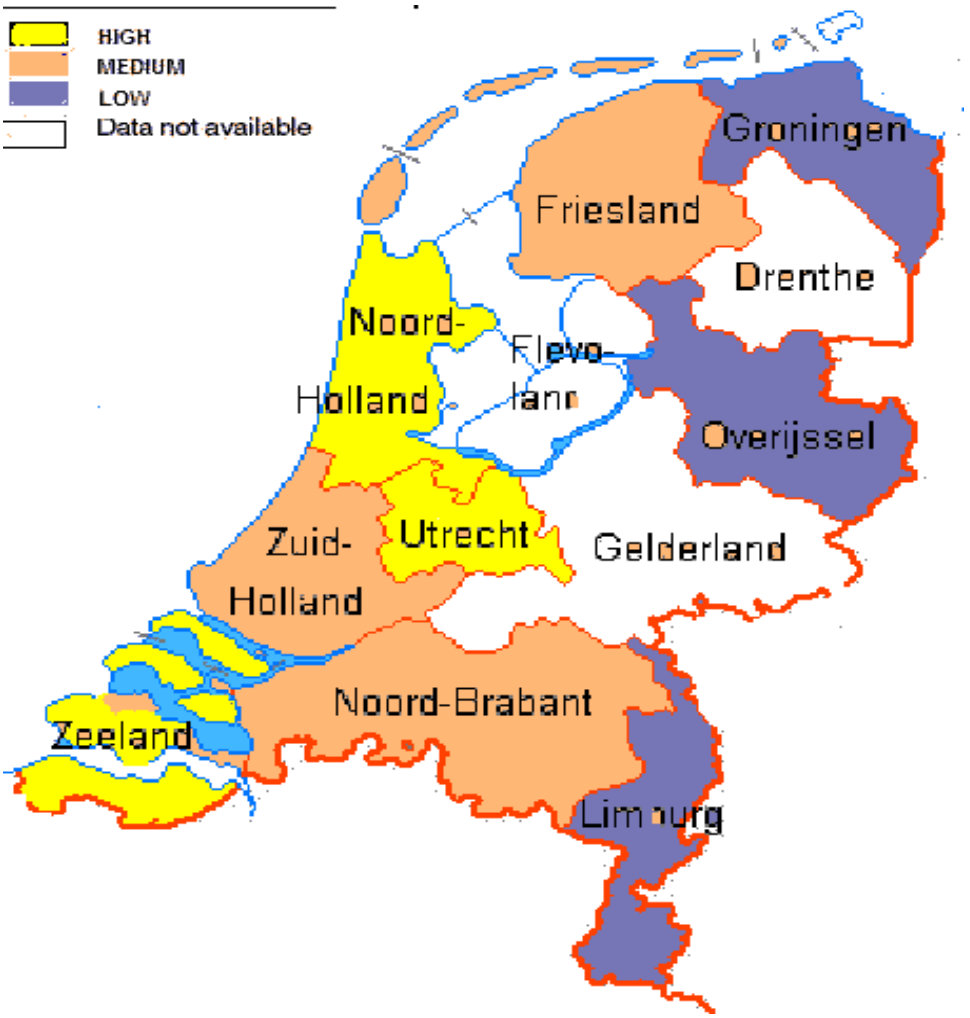

Figure 1: Average Sunshine in the Netherlands

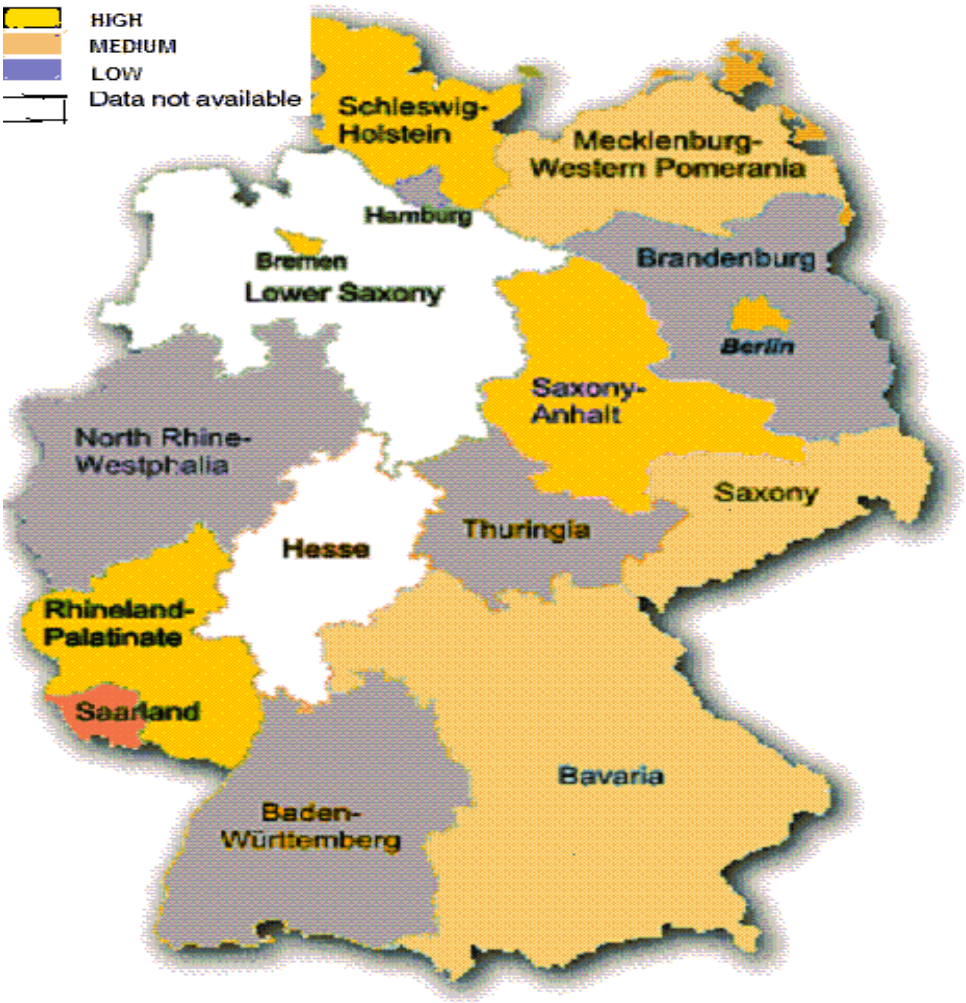

Figure 2: Average Sunshine in Germany

Table XII: **Individual Correlates of Happiness: The Netherlands**

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 and year fixed effects are included in the regression. The dummy for 1993 is excluded. The dummies for the provinces Flevoland and Overijssel are significantly positive, but the other province dummies are insignificant. All year dummies are insignificant, except for the dummy for 2000, which is negative.

Table XIII: **Individual Correlates of Happiness: Germany**

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 and year fixed effects. Individual satisfaction is a categorical variable from 0 to 10, but is used as a continuous variable here. The estimates are similar to ordered logit estimates. Health is a categorical variable from 1 to 5 and income is in thousands.

Table XIV: **Importance of Different Aspects of Life: Germany**

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 are used as continuous variables. The R-squared value from the between effects estimation is 0.56.

Table XV: **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 the 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 the nearest integer in percentages.

Table XVI: **Mobility Across Regions. Transition Matrix of Residence: The Netherlands**

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 XVII: **Happiness and Labor Supply: The Netherlands**

	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 average. 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. Control variables: Health status, income, age, number of children, schooling, household size, gender, labor force status, marital status, state and year fixed effects.