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Marina-Selini Katsaiti

Obesity and Happiness

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German Socio-Economic Panel Study (SOEP)
DIW Berlin
Mohrenstrasse 58
10117 Berlin, Germany

Contact: Uta Rahmann | urahmann@diw.de

Obesity and Happiness

Marina-Selini Katsaiti *

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Abstract

This paper provides insight on the relationship between obesity and happiness. Using the latest available cross sectional data from Germany (GSOEP 2006), UK (BHPS 2005), and Australia (HILDA 2007). We examine whether there is evidence on the impact of overweight on subjective well being. The Hausman test is employed in the univariate and multivariate specifications chosen and reveals evidence for the presence of endogeneity in the German and the Australian data. Instrumental variable analysis is performed under the presence of endogeneity whereas for the UK we run OLS regressions. Results indicate that in all three countries obesity has a negative and significant effect on the subjective well being of individuals. For Germany, using a differences-in-differences methodology, I find that non-overweight/non-obese individuals are on average 0.5 units happier than their overweight/obese counterparts. Our findings also have important implications for the effect of other socio-demographic, economic and individual characteristics on well being.

JEL codes: D60, I31

Keywords: Happiness, Obesity, Instrumental Variable Analysis, Subjective Well Being

*Department of Economics, National and Kapodistrian University of Athens, 5 Stadiou Str., 10561, Athens, Greece; E-mail: mkatsaiti@elke.uoa.gr

1 Introduction

Happiness is one of life's fundamental goals. Whether people pursue better jobs or higher income, try to achieve better health or a stable family life, want to win an olympic medal or the Nobel prize, the motivation behind their effort is normally happiness. People may drink alcohol or smoke tobacco because they derive temporary satisfaction. The motivation behind gambling or racing is the adrenalin that makes them feel "high". Similarly, people derive instant pleasure from eating food. However, in the long run, consumption of food in excess of daily caloric needs leads to excessive weight gain and often lowers subjective well being.

Happiness can be defined as the degree to which people positively assess their life situation (Veenhoven (1996)) and depends on a variety of individual and social characteristics. These characteristics differ in how important they are to each individual and are measured by ordinal ranking. Happiness is often defined in terms of living a good life, rather than a simple emotion.

Happiness is naturally the subject of psychological and sociological research as well as medicine, and is associated with good health. Economics research has connected happiness with the concept of utility since the 18th century and the works of Bentham and Jevons. This multidisciplinary research has identified several determinants of happiness. The most important ones include demographics, socioeconomic traits, education, and health related characteristics.

The economics literature on happiness addresses several research questions and identifies significant determinants of subjective well being such as age, employment status, health condition, marital status, education level, and income. This literature has only recently touched on the issue of obesity in an attempt to

investigate whether obesity significantly reduces individual satisfaction. According to the official definition employed by the Centers for Disease Control (CDC) and by World Health Organization (WHO) obesity is measured using the Body Mass Index (BMI), which is the ratio of weight, in kilograms, over height, in meters, squared. A BMI greater than 25 denotes that someone is overweight, whereas a BMI over 30 indicates that an individual is obese.

With the exception of Stutzer (2007), none of the empirical studies has addressed the issue of reverse causality in the data. Intuition naturally relates greater BMI with lower happiness levels, through deterioration in health, lower self esteem, or lower social acceptance. However, we cannot neglect the possibility of reverse causality between mental health and BMI. Although BMI could affect subjective well being, *ceteris paribus*, individual satisfaction may also influence consumption behaviors and BMI. Consequently appropriate methods should be used to allow for dual causality and to control for omitted variable bias.

The purpose of this study is to examine determinants of individual satisfaction and the impact of obesity on personal well being by using cross sectional survey data from Germany, UK, and Australia. This research contributes to the obesity and happiness literature in three ways. First, we analyze the most recently available cross sectional data from those three countries. In addition, this is the first study to investigate the relationship between obesity and happiness in the Australian data. For Germany, we also use a differences-in-differences methodology, tracking the same individuals over time, to determine if becoming obese lowers happiness levels. Second, we test for reverse causality in the data using instrumental variable techniques to enhance the identification of parameters. Finally, a

comparative analysis is used to identify the similarities and dissimilarities in the determinants of happiness across countries. With respect to consumption theory, our empirical findings have vital implications for the theoretical approach of the relationship between utility and weight. They suggest that functional forms traditionally used in micro theory cannot capture the atypical relation between weight and well being, since food consumption does not always result in positive marginal returns.

Section 2 review the relevant literature. Section 3 describes the estimation methodology and the data, and Section 4 presents and examines the empirical results. Section 5 summarizes the primary findings and offers some final remarks.

2 The Literature

The medical literature provides diverse conclusions about the relationship between obesity and depression. Roberts, Kaplan, Shema, and Strawbridge (2000) use data from Alameda County, California, to investigate whether the obese are at greater risk for depression. They conclude that, among other groups, the obese, females, and those with two or more chronic health conditions are at higher risk for depression. In addition, they find that, when all individuals with depressive symptoms in the previous year are excluded, there is greater relative risk for future depression for the obese than for the non-obese. This result holds in specifications that control for a number of variables affecting the risk of depression. Based on their results and on the results of other studies, they conclude “that the obese may be at increased risk for depression.”

Reed (1985) uses data from the First National Health and Nutrition Exam-

ination Survey (NHANES I) and identifies young, more educated, obese females as a subgroup of worse mental health condition. Several studies find strong evidence of the relationship between overweight/obese individuals and depression in females (Noppa and Hällström (1981), Palinkas, Wingard, and Barrett-Connor (1996), Reed (1985)). Larsson, Karlsson, and Sullivan (2002) analyse the effect of overweight and obese on health-related quality-of-life (HRQL) in Sweden. Using data from a cross-sectional survey on 5633 men and women aged 14-64, their regression analysis finds the following: overweight and obesity for young men and women(16-34 years) leads to poor physical health, but not mental health. For middle-aged (35-64 years) individuals, obese men and women report health impairments, however only women report mental health problems.

The same effect for females is supported by a study of adolescents aged 11 to 21 years. Needham and Crosnoe (2005) find evidence that relative weight is associated with depressive symptoms for girls but not for boys. Greeno, Jackson, Williams, and Fortmann (1998) also confirm that females with lack of perceived eating control and higher BMI are associated with lower life satisfaction levels. For men only the lack of perceived eating control explains lower happiness levels.

In the economics literature, Frey and Stutzer (2000) analyze why happiness should be the focus of economic research as it is directly related to the concept of utility (“their mutual aim is to investigate individuals and social welfare” p. 5). They stress on the fact that happiness is not represented well through the “objectivist” way economists have measured satisfaction using revealed preferences. They argue that happiness is a completely “subjectivist” measure of individual well being and has often little association with revealed preferences. In addition happiness

depends heavily on factors which cannot be controlled through behavioral change or personal choice. Frey and Stutzer (2000) identify significant determinants of subjective well being both at the micro and the macro level. According to their results, important individual determinants of well-being include unemployment, income, education and marital status.

Stutzer (2007) investigates i) the probability of being obese given certain socioeconomic and demographic characteristics, ii) the effect of obesity on happiness taking into account self-reported self control levels. His intuition stands on the hypothesis that only individuals who feel unable to control their food consumption should have lower happiness levels due to obesity. Using Swiss data, he finds that lower self control is associated with lower happiness levels given the presence of obesity. Stutzer (2007) checks for reverse causality. He finds no evidence that stress eating leads to lower happiness levels of obese individuals with limited self control.

A similar study by Oswald and Powdthavee (2007) examines data from the UK and Germany, using regression analysis to identify the relationship between BMI and self reported life satisfaction. For the British data they also explore the impact of BMI on psychological distress and on self-reported “perception of own weight”. Under all univariate and multivariate specifications in both datasets, BMI has a negative and significant effect on subjective well being. Moreover, for the British regressions they find that BMI increases psychological distress and is positively associated with perception of own weight. Employment status, age, education, income, marital status, and disability status stand out as significant determinants of individual happiness under most specifications. However, Oswald

and Powdthavee (2007) do not test for reverse causality in their specifications which can have serious implications for the robustness of their results. Our paper tests for endogeneity in the univariate and multivariate specifications and corrects for it by using 2SLS.

3 Empirical Estimation

3.1 Methodology

Surprisingly, existing literature, with the exception of Stutzer (2007), examining the relationship between happiness and obesity does not address the issue of endogeneity that could be resulting from dual causality and/or omitted variable bias. It is natural to think that higher or lower weight would influence personal happiness and satisfaction through self-esteem, self-valuation, impact on personal attractiveness, and “averageness” with respect to the social norms. Reverse causality could stem from the following fact. People often claim that they have gained or lost weight due to depression issues, or because they are not feeling well. Thus, it is evident that endogeneity should be considered in structural equation specifications and results should be tested for robustness.

For this purpose, we conduct the Hausman test in order to detect endogeneity if present. If the null hypothesis that “the difference in coefficients is not systematic” between the ordinary least squares (OLS) and the instrumental variable estimates is rejected, then we have statistical evidence that endogeneity is present and must use an instrumental variable approach to conduct valid inference. We also apply the Durbin-Wu-Hausman test which indicates whether the OLS is a consistent

estimator.

In the presence of endogeneity we use the following setup to examine the relationship between BMI and happiness.

$$y_1 = X\gamma + \beta y_2 + u, \quad \text{where } EX'u = 0 \text{ and } Ey_2'u \neq 0. \quad (1)$$

Here X is an $n \times K$ matrix of control variables typically used to examine the relationship between happiness and obesity (Cornlisse-Vermatt, Antonides, Ophem, and den Brink (2006), Frey and Stutzer (2000), Blanchflower (2008)). y_1 is a self reported life satisfaction or happiness indicator; and y_2 is BMI. The reduced form equation for y_2 is:

$$y_2 = \tilde{Z}\delta + v \quad (2)$$

\tilde{Z} is an $n \times k$ matrix of instrumental variables where $E[\tilde{Z}'u] = 0$ and $\delta \neq 0$.

The instrument used here is individual height. *BMI* is correlated with the instrument by definition since height is used in the construction of *BMI*. Height is chosen due to its high explanatory power and plays the role of a “statistical” instrument since it produces large first stage F-statistics. Staiger and Stock (1997) suggest as a “rule of thumb” a first-stage F-stat of 10 as an indication of “strong” instruments, that is a first-stage F-stat on the *IVs* and not the entire set $J = [X \quad \tilde{Z}]$. This is important because when instruments are weak the parameters would be weakly identified and might lead to incorrect inference. Shaw, Katsaiti, and Jurgilas (2006) show that weak instruments associated with unbounded confidence intervals can often lead to erroneous inference. Thus, it is important to

ensure the validity of our results through the magnitude of the first-stage F-stat on the IV. Results on the F-statistic indicating the strength of the instrument appear in results tables. This methodology is used for cross sectional regressions with data from three countries: i) Germany, ii) UK, and iii) Australia.

In addition to the instrumental variable regressions, we use a differences in differences design to capture the effect of BMI on the happiness levels of the same individuals. The data record happiness and BMI levels for two groups for two time periods. One of the groups is exposed to treatment in the second period whereas the other group is not. The first group (treatment group) includes individuals with normal weight in the first period who became overweight or obese in the second. The second group (control group) includes individuals with normal weight in both periods. We compute the average change in the happiness levels of the two groups and the average gain in the control group is subtracted from the average gain in the treatment group. This method removes biases in the second period comparisons between the two groups that could result from time trends or from permanent differences between the two groups. This exercise reveals the difference in happiness levels between the two groups due to obesity, *ceteris paribus*.

Here let A be the control group and B the treatment group. The equation of interest is

$$y = \beta_0 + \beta_1 dB + \delta_0 d2 + \delta_1 d2 * dB + u \quad (3)$$

Here y denotes happiness. The dummy dB captures the differences between the two groups in the first period. $d2$ captures factors that would cause changes in y across the two groups regardless of changes in BMI. The coefficient of interest

is δ_1 . The differences-in-differences estimate is:

$$\hat{\delta} = (\bar{y}_{B,2} - \bar{y}_{B,1}) - (\bar{y}_{A,2} - \bar{y}_{A,1}), \quad (4)$$

where $\hat{\delta}$ is the estimate of the impact of obesity on happiness.

3.2 Data

The data for Germany come from the German Socio-Economic Panel (GSOEP), a representative longitudinal study of individuals and households for the year 2006. For the differences-in-differences estimation we use data for 2002 and 2006, tracking the same individuals across time. The aim of the GSOEP survey is to collect data on living conditions, focusing on the micro-level, together with demographic, economic, sociological, political, and other individual and household characteristics (Wagner, Frick, and Schupp (2007)). The data contain information about German citizens, foreigners, and immigrants to Germany. Our dataset includes information on 19,786 individuals.

For the UK, we use the British Household Panel Survey (BHPS) data for 2005. This survey includes households from England, Scotland, Wales and Northern Ireland. It contains data on approximately 22,000 individuals. It provides information on demographics, economic situation, household characteristics, and individual health.

For Australia we use the Household, Income and Labour Dynamics in Australia (HILDA) Survey for year 2006. Unfortunately, longitudinal data for weight and height is not available and thus panel analysis is not an option. HILDA provides somewhat limited information compared to the German and British surveys,

eliminating some of the variables of interest that we included in the analysis of the other two countries. Specific data regarding financial situation (credit/savings), house ownership, religion, politics, and race are not included, since they are not available in the dataset. Year 2006 is chosen because it is the only year for which weight and height information is provided.

Descriptive statistics on German, British and Australian data are presented in Tables 1, 2, and 3 respectively.

For the purposes of our empirical analysis we choose the following variables. Age, gender, years of education, religion, income, employment status, marital status, disability, whether they hold a civil servant job, house ownership, retirement, financial status (credit or savings), and support to a particular political party. BMI is used to control for individual weight. Finally happiness is measured using the self reported self satisfaction or happiness index.

In detail, all happiness indicators are measured with an eleven point index from 0 “completely dissatisfied” to 10 “completely satisfied”. The question is: “How satisfied are you with your life, all things considered?”. For British data, the satisfaction index is measured on a 0 to 7 scale, unlike the other two countries. Information on religion, age, marital status, employment and retirement status, house ownership, disability, financial situation, and political party membership is captured using dummy variables. The British data also contain a dummy variable for British ethnicity. For the German regressions dummies are used to control for religion and region of residence. For the Australian data we control for region of residence of the individual.

Subjective survey data, like that used in the present study, could be prone

to several systematic or non-systematic biases (Kahneman, Diener, and Schwarz (1999)). However as Frey and Stutzer (2005) report, “the relevance of reporting errors depends on the intended usage of the data”. Thus, when the purpose is not to measure or to compare levels in an absolute sense, the bias does not seem to be relevant. So, for the purpose of identifying parameters that influence happiness these measures are valid.

4 Results

4.1 Results for Germany

The explanatory variables used for the purpose of our regression analysis follow our intuition on what determines happiness and are in agreement with the literature on this topic (Oswald and Powdthavee (2007), Cornlisse-Vermatt et al. (2006)). The Hausman test reveals evidence of endogeneity in the German regressions presented in Table 4 and thus the OLS estimator is inconsistent. Hence we use instrumental variable analysis.

Findings indicate that obesity has a negative and significant impact on “overall life satisfaction” under univariate and multivariate OLS and 2SLS regressions. We present the OLS results in Table 4. However, due to the evidence of endogeneity we only comment on the instrumental variable results.

In detail, *BMI* has a negative and significant effect on individual happiness in univariate and all multivariate specifications. The multivariate 2SLS regression results are presented in Table 4. The results presented in Column 4 indicate that each unit increase in *BMI* reduces happiness by 1/3; that is for an individual

whose *BMI* is 24, a 3 unit increase in *BMI* reduces overall happiness by a whole unit. The results presented in Table 4, Columns 2, 3, 4 and 5 indicate that as we add explanatory variables to the equation of interest, the magnitude of the coefficient on *BMI* goes down. However, across specifications the coefficient does not change substantially. In addition, the values of the coefficients of interest, analyzed here, point to the absolute magnitude of their impact. However, given that happiness is a subjective measure and its interpretation is not absolute but rather relative, it is useful to provide some understanding of how a certain increase in *BMI* could be interpreted in monetary terms. In particular, and according to the results in Table 4, Column 4, a 100% increase in income has an equivalent impact on happiness as 1.5 unit reduction in *BMI*. This verifies our suspicion that increases in *BMI* have strong effects on individual happiness.

Regarding the rest of the explanatory variables we observe the following. For additional years of age the effect is not statistically different from zero and the same holds for the years of education one receives. Single, divorced, separated and widowed individuals seem to be less happy compared to married people. The results on marital status show that being separated impacts happiness most. In terms of magnitude, being separated reduces subjective well being as much as being physically disabled; it decreases well being by almost 0.70 units. These two variables have the strongest effects on individual well being under all univariate specifications. Political party membership increases well being as much as a 1 unit reduction in *BMI*. Unemployment in Germany reduces happiness by a mere 0.10, which is comparable to a half unit increase in *BMI* or a 30% decrease in income. German women are less happy compared to men by as much as non-retired when

compared to retired people. As expected, and in accordance with the literature, income has a positive impact on happiness, as do home ownership and financial asset ownership. Having debt from credit has a similar effect in magnitude as being unemployed. The estimated effects of house ownership and debt from credit are significant at the 1% level whereas the coefficient on financial assets is significant at the 5% level. Last, having a civil servant job increases self satisfaction.

In accordance with the regression analysis the differences in differences methodology reveals that a 0.5 unit difference between happiness levels of the control group and the treatment group. This analysis implies that non-obese individuals are on average half a unit happier than their obese counterparts, on a 0 – 10 scale. This result confirms again our hypothesis that the overweight/obese population is on average less happy than the non-overweight/non-obese population, and that this difference is in fact caused by their higher BMI. The differences-in-differences estimation gives us a more concrete picture of the magnitude of the effect of belonging to one group as compared to the other, *ceteris paribus*.

In general our results compare well in sign and significance levels with those of Oswald and Powdthavee (2007). However, there is variation in the magnitude of the impact of some variables. It is important to note that their analysis is based on 2002 GSOEP data, while the present analysis uses the 2006 GSOEP data. There are no differences in terms of the signs of the effects between the Oswald and Powdthavee (2007) results and ours.

4.2 Results for the UK

For Britain, the regression results are similar to the German ones. However, there is no statistical evidence for the presence of endogeneity in the British regressions and therefore no need to use instrumental variable methods. The British results are reported in Table 6.

As expected, and in agreement with the German results, BMI has a negative impact on individual happiness. This result holds under all specifications, univariate and multivariate, and is statistically significant in all cases. However, the magnitude of the effect in the British data is significantly smaller than that in the German results. In particular, for Britons a one unit increase in *BMI* reduces well being by a mere 0.01 unit whereas for Germans the corresponding effect is 0.24. A simple comparison between the two countries given these results implies that in Germany weight gain has a more drastic effect than in the UK. For Britain we are hesitant to make inference in terms of the monetary equivalent effect of weight gain on happiness, the reason being that our results for income are not statistically different from zero. This could be due to different social norms and status symbols that often differ across countries Graham and Felton (2005).

Age has a negative impact on individual well being, and the effect of aging becomes weaker with time. Being divorced, separated, widowed or never married reduces your life satisfaction when compared to being married. All four results are highly significant and in agreement with the British results. Again the most drastic impact comes from being separated, which can reduce individual happiness by 0.73 on a 1 – 7 scale. These results compare well with those of Oswald and Powdthavee (2007). Characterizing the impact of i) gender and ii) years in

education has been proven tricky in the British data. In the multivariate specification shown in Table 6, column 2, where only BMI, age, education and gender are included in the explanatory variables, both variables have a positive and statistically significant effect on individual happiness. However, in the multivariate specifications (Table 6, columns 3 and 4) we get the reverse sign for both education and being female. Only the coefficient on education is statistically significant. In particular, on the magnitude of those coefficients, we see that in the multivariate specifications (columns 3 and 4) an increase in education by 3 years is associated with a 0.1 decrease life satisfaction.

The results on income and political party support are not statistically different from zero. On the other hand, house ownership and savings from current income have a statistically significant and positive impact of approximately 1/4 on well being, supporting the findings of the German regressions. Physical disability, as expected, decreases well being by almost a whole unit and is highly significant. Smoking also reduces life satisfaction and the same result holds for being unemployed.

Due to possible diversity in individual happiness levels that could be attributed to race differences, we control for the individual's ethnic group using dummy variables.

4.3 Results for Australia

The Hausman test used for the Australian multivariate specifications reveals strong evidence of the presence of endogeneity in the Australian regressions. The OLS results are reported in Table 7. The instrumental variable regression results are

reported in Table 8 and are analyzed below. Once again, our results resemble, for the most part, those for Britain and Germany discussed above. Most coefficients are consistent with expectations.

BMI is found to have a negative and significant impact on life satisfaction. For Australians a one unit increase in BMI has stronger impact when compared to Britons and weaker when compared to Germans. In particular, in the multivariate specification presented in Table 8, Column 4, a one unit increase in BMI decreases well being by 0.055 units, less than the effect of one year of aging. In monetary terms, for Australians a 3 unit reduction in BMI is equivalent to a doubling in income.

The effect of BMI, age, education, gender and disability need not be discussed separately for the five different specifications presented in Table 7, as there are only small differences across them. The coefficients on age and education are of comparable size to the British regressions. They both have a negative and statistically significant effect. In Australia females are happier than men. Disability, once again has, a very strong negative and statistically significant effect on subjective well being, and is similar in magnitude to the equivalent effect in the German regressions. Once again, as observed before, for marital status the most dramatic effect comes from being separated. These two coefficients on physical disability and separation are significant at the 1% level. Being divorced, single or widowed all reduce satisfaction when compared to being married, and each effect is statistically significant. Surprisingly, being employed reduces life satisfaction but this finding is not significant. Moreover, in the Australian data, individuals are classified as employed or not employed, without taking into account whether one is a

student, unemployed by choice or retired. In the sample we don't include pupils under 18 and persons over 65 years of age. Even by doing this, the effect cannot be interpreted as the conventional impact of unemployment reported in most empirical studies.

Individuals seem to be happier with the presence of children in the household, though this result is not highly significant. On the other hand the total number of people in the household has a negative and significant effect. Each additional member in a household reduces happiness as much as a one unit increase in BMI. For Australians the coefficient on income is positive and significant as expected. With regards to the magnitude of the effect, a 100% increase in income increases happiness as much as a 3 unit reduction in BMI. For all multivariate 2SLS regressions the first stage F-statistics on the instrument are much larger than 10, confirming the strength of the IV and the consistency of our estimates.

5 Conclusions

This study investigates the impact of obesity on individual happiness using cross sectional data for Germany, United Kingdom, and Australia. Our empirical analysis has contributed to the understanding of the impact of obesity on happiness in the following ways. Using instrumental variable methodology, when needed, we have shown that obesity has a negative and statistically significant effect on individual well being in all specifications tested. In addition, we have learnt that when examining this relationship using individual data it is necessary to test for the presence of endogeneity in our regressions, since dual causality and/or omitted variable bias are often present. This study contributes to the literature by

examining the relationship between obesity and happiness using Australian data.

In addition to this analysis, we apply a differences-in-differences methodology using data from Germany for 2002 and 2006. Results indicate that non-overweight/non-obese individuals are on average 0.5 units happier, on a 0-10 scale, than their overweight/obese counterparts, *ceteris paribus*. To our knowledge this is the only study using differences-in-differences approach to unravel the impact of obesity on happiness. Moreover, we have identified a number of determinants of individual happiness which are common to a very large extent across countries. The magnitude of these coefficients for each country regressions is different but signs match for the most part.

The results of this study highlight the significant effect of BMI on subjective well being. The findings point to a possible time-inconsistency in individual preferences, since standard consumption theory assumes that food consumption choices should maximize individual utility. However, BMI, which depends on individual caloric intake, appears to lower satisfaction and thus utility. This is important because it implies a fallacy in the assumptions of rational behavior and/or utility maximization.

The negative effect of obesity on happiness, stemming from our regression analysis, provides fruitful evidence that standard economic theory, where positive marginal returns to consumption are assumed, is not appropriate for modeling food consumption and individual weight. This analysis provides support for a more flexible utility function that allows for both positive and negative marginal returns to food consumption.

References

- Blanchflower, D. G. (2008). International Evidence on Well-being. Iza discussion papers 3354, Institute for the Study of Labor (IZA).
- Cornlisse-Vermatt, J. R., Antonides, G., Ophem, J. V., & den Brink, H. M. V. (2006). Body Mass Index, Perceived Health, and Happiness: their determinants and structural relationships. *Social Indicators Research*, *79*, 143–158.
- Frey, B., & Stutzer, A. (2000). Maximising Happiness?. *German Economic Review*, *1*(2), 145–167.
- Frey, B., & Stutzer, A. (2005). Happiness Research: State and Prospects. *Review of Social Economy*, *62*(2), 207–228.
- Graham, C., & Felton, A. (2005). Variance in Obesity Across Cohorts and Countries: A Norms-Based Explanation Using Happiness Surveys. Working paper 42, CSED.
- Greeno, C., Jackson, C., Williams, E., & Fortmann, S. (1998). The Effect of Perceived Control over Eating on the Life Satisfaction of Women and Men: Results from a Community Sample. *International Journal of Eating Disorders*, *24*(4), 415–419.
- Kahneman, D., Diener, E., & Schwarz, N. (1999). *Well-being: The Foundations of Hedonic Psychology*, pp. 61–84. Russel Sage Foundation: New York.
- Larsson, U., Karlsson, J., & Sullivan, M. (2002). Impact of overweight and obesity on health-related quality of life - a Swedish population study. *International Journal obesity*, *26*, 417–424.

- Needham, B., & Crosnoe, R. (2005). Overweight Status and Depressive Symptoms During Adolescence. *Journal of Adolescent Health, 36*(1), 48–55.
- Noppa, H., & Hällström, T. (1981). Weight gain in adulthood in relation to socioeconomic factors, mental illness, and personality traits: a prospective study of middle-aged women. *Journal of Psychosomatic Research, 25*, 83–89.
- Oswald, A., & Powdthavee, N. (2007). Obesity, Unhappiness, and the Challenge of Affluence: Theory and Evidence. *Economic Journal, 117*, F441–F459.
- Palinkas, L., Wingard, D., & Barrett-Connor, E. (1996). Depressive symptoms in overweight and obese older adults: a test of the "jolly fat" hypothesis. *Journal of Psychosomatic Research, 40*, 56–60.
- Reed, D. (1985). The relationship between obesity and psychological general well-being in United States women. *Journal of Psychosomatic Research (Abstract), 46*, 3791.
- Roberts, R., Kaplan, G., Shema, S., & Strawbridge, W. (2000). Are the Obese at Greater Risk of Depression?. *American Journal of Epidemiology, 152*(2), 163–170.
- Shaw, P., Katsaiti, M.-S., & Jurgilas, M. (2006). Corruption and Growth under Weak Identification. Working papers 17, University of Connecticut.
- Staiger, D., & Stock, J. H. (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica, 65*, 557–86.
- Stutzer, A. (2007). Limited Self-Control, Obesity and the Loss of Happiness. Iza discussion papers 2925, Institute for the Study of Labor (IZA).

Veenhoven, R. (1996). Happy Life-Expectancy. *Social Indicators Research*, 39, 1–58.

Wagner, G., Frick, J., & Schupp, J. (2007). The German Socio-Economic Panel Study (SOEP)- Scope, Evolution and Enhancements. *Schmollers Jahrbuch*, 127(1), 139–169.

Table 1: Descriptive Statistics: GSOEP 2006

	[1] Obs	[2] Mean	[3] Std. Dev.	[4] Min	[5] Max
Life satisfaction	19380	6.75	2.06	1	10
BMI	18794	25.8	4.6	12.02	67.47
Age	19380	48.2	17.48	17	97
Years of Education	19380	11.34	4.05	0	18
Divorced	19380	0.073	0.26	0	1
Married	19380	0.59	0.49	0	1
Widowed	19380	0.065	0.24	0	1
Single	19380	0.23	0.42	0	1
Female	19380	0.52	0.49	0	1
Belong to political party	18958	0.48	0.49	0	1
Income	19380	38018	39327	0	2432608
House Owner	19365	0.56	0.49	0	1
Financial Assets	19365	0.40	0.49	0	1
Retired	19216	0.24	0.43	0	1
Disabled	19380	0.11	0.31	0	1
Civil Serv job	18958	0.044	0.20	0	1
Unemployed	19380	0.45	0.49	0	1

Source: SOEP, 2006

Table 2: Descriptive Statistics: BHPS 2005

	[1] Obs	[2] Mean	[3] Std. Dev.	[4] Min	[5] Max
Life satisfaction	15791	4.83	1.91	1	7
BMI	14004	25.4	4.76	8.13	90.62
Age	15791	46	18.55	15	98
Years of Education	14002	10.97	1.26	0	19
Divorced	15791	0.05	0.22	0	1
Married	15791	0.53	0.499	0	1
Widowed	15791	0.073	0.26	0	1
Female	15791	0.45	0.49	0	1
Belong to political party	15791	0.34	0.47	0	1
Income	15205	27670	16409	0	302247
House Owner	15791	0.725	0.44	0	1
Saves	15791	0.38	0.48	0	1
Retired	15791	0.19	0.39	0	1
Disabled	14766	0.218	0.41	0	1
Smoker	15791	0.23	0.42	0	1
Unemployed	15791	0.027	0.16	0	1

Source: BHPS, 2005

Table 3: Descriptive Statistics: HILDA 2006

	[1] Obs	[2] Mean	[3] Std. Dev.	[4] Min	[5] Max
Life satisfaction	12901	7.88	1.48	0	10
BMI	11088	26.26	5.4	13.14	66.59
Age	17457	35.87	22.32	1	93
Years of Education	12758	11.97	2.53	0	18.5
Divorced	17457	0.045	0.21	0	1
Married	17457	0.45	0.499	0	1
Single	17457	0.179	0.38	0	1
Separated	17457	0.019	0.139	0	1
Widowed	17457	0.040	0.196	0	1
Female	17457	0.514	0.49	0	1
Income	17414	70115	50459	0	505805
Disabled	12901	0.183	0.38	0	1
Not Employed	10458	0.32	0.46	0	1

Source: HILDA, 2006

Table 4: German Life Satisfaction index: measuring the impact of BMI (OLS), GSOEP 2006

Dependent Variable: Life Satisfaction					
	[1]	[2]	[3]	[4]	[5]
BMI	-0.037 [-12.94]	-0.028 [-9.52]	-0.20 [-7.09]	-0.017 [-6.08]	-0.015 [-5.49]
Age		-0.046 [-10.42]	-0.073 [13.54]	-0.067 [-12.39]	-0.068 [-12.70]
Age Squared		0.00042 [9.74]	0.0006 [12.46]	0.0006 [11.43]	0.0006 [11.65]
Years of Education		0.052 [14.14]	0.02 [5.51]	0.017 [4.64]	0.020 [5.52]
Single			0.389 [-9.07]	-0.217 [-5.02]	-0.22 [-5.11]
Divorced			-0.48 [-9.80]	-0.262 [-5.24]	-0.298 [-5.99]
Widowed			-0.32 [-5.54]	-0.166 [-2.87]	-0.177 [-3.10]
Separated			-0.60 [-6.39]	-0.397 [-4.20]	-0.44 [-4.71]
Female		-0.031 [-1.19]	0.029 [1.11]	0.034 [1.30]	0.04 [1.53]
Belong to political party			0.30 [11.75]	0.238 [9.12]	0.20 [7.77]
Income				0.46 [20.29]	0.43 [18.78]
Debt from credit			-0.22 [-6.53]	-0.22 [-6.50]	-0.19 [-5.73]
House Owner			0.31 [11.85]	0.167 [6.08]	0.163 [5.92]
Financial Assets			0.34 [12.75]	0.213 [7.64]	0.21 [7.84]
Retired			0.12 [2.32]	0.211 [3.98]	0.25 [4.79]
Handicapped			-0.80 [-18.99]	-0.79 [-19.08]	-0.82 [-19.87]
Civil Serv job			0.33 [5.26]	0.244 [3.91]	0.20 [3.34]
Unemployed			-0.194 [-5.63]	-0.096 [-2.79]	-0.096 [-2.83]
Constant	7.86 [104.41]	8.20 [71.12]	8.83 [59.28]	4.45 [11.40]	4.30 [10.97]
Regional Dummies	No	No	No	No	Yes
Religion Dummies	No	No	No	Yes	Yes
R^2	0.0088	0.0217	0.0940	0.1138	0.1309
	N=18794	N=18794	N=18779	N=18772	N=18772

Robust t-stats in brackets

* Significant at 5% level

Table 5: German Life Satisfaction index: measuring the impact of BMI (2SLS), GSOEP 2006

Dependent Variable: Life Satisfaction					
	[1]	[2]	[3]	[4]	[5]
BMI	-3.69	-0.38	-0.31	-0.28	-0.24
	[-1.01]	[-7.51]	[-5.71]	[-5.14]	[-4.47]
Age		0.064	0.016	0.014	0.001
		[3.80]	[0.92]	[0.80]	[0.10]
Age Squared		-0.0004	-0.00009	-0.0008	0.00002
		[-3.25]	[-0.60]	[-0.51]	[0.18]
Years of Education		0.008	-0.005	-0.004	0.001
		[1.06]	[-0.80]	[-0.70]	[0.28]
Single			-0.58	-0.416	-0.38
			[-9.04]	[-6.26]	[-6.06]
Divorced			-0.70	-0.498	-0.49
			[-9.53]	[-6.42]	[-6.66]
Separated			-0.916	-0.719	-0.71
			[-6.97]	[-5.44]	[-5.63]
Widowed			-0.17	-0.064	-0.092
			[-2.25]	[-0.89]	[-1.33]
Female		-0.523	-0.39	-0.352	-0.29
		[-6.64]	[-4.59]	[-4.09]	[-3.44]
Belong to political party			0.29	0.23	0.21
			[8.93]	[7.55]	[6.99]
Income				0.358	0.34
				[10.19]	[10.50]
Debt from credit			-0.14	-0.14	-0.13
			[-3.29]	[-3.36]	[-3.34]
House Owner			0.23	0.12	0.11
			[6.42]	[3.58]	[3.39]
Financial Assets			0.13	0.056	0.089
			[2.66]	[1.22]	[2.00]
Retired			0.27	0.329	0.34
			[3.77]	[4.80]	[5.31]
Handicapped			-0.62	-0.639	-0.68
			[-10.19]	[-10.76]	[-11.75]
Civil Serv job			0.24	0.18	0.16
			[3.10]	[2.43]	[2.23]
Unemployed			-0.17	-0.10	-0.10
			[-3.96]	[-2.43]	[-2.53]
Constant	102.4	15.07	14.79	10.79	9.76
	[94.73]	[15.11]	[13.10]	[7.74]	[7.08]
Instrument (s)	Height	Height	Height	Height	Height
P-value	0.3135	0.000	0.000	0.000	0.000
F-stat (first stage)	1.02	48.91	74.23	71.99	54.03
Religion Dummies	No	No	No	Yes	Yes
Regional Dummies	No	No	No	No	Yes
R^2
	N=18794	N=18794	N=18779	N=18772	N=18772

Robust t-stats in brackets

* Significant at 5% level

Table 6: British Life Satisfaction Regressions and the effect of BMI (OLS), BHPS 2005

Dependent Variable: Life Satisfaction Index				
	[1]	[2]	[3]	[4]
BMI	-0.013 [-3.99]	-0.013 [-3.68]	-0.010 [-2.96]	-0.010 [-2.89]
Age		-0.0149 [-2.64]	-0.042 [-6.69]	-0.043 [-6.74]
Age Squared		0.0002 [4.43]	0.0005 [7.47]	0.00049 [7.53]
Yrs of Education		0.045 [3.01]	-0.027 [1.84]	-0.037 [-2.45]
Divorced			-0.61 [-8.45]	-0.58 [-7.98]
Separated			-0.73	-0.718
Widowed			[6.09]	[-5.94]
Never Married			-0.57 [-7.71]	-0.57 [-7.60]
Female		0.104 [3.00]	-0.008 [-0.23]	-0.014 [-0.43]
Support a political party			0.035 [0.99]	0.037 [1.04]
Log Income				0.029 [0.94]
Saves				0.25 [7.30]
House Owner			0.317 [7.43]	0.278 [6.40]
Smoker			-0.31 [-7.65]	-0.28 [-6.97]
Retired			0.181 [2.77]	0.208 [3.19]
Disabled			-0.94 [-22.42]	-0.926 [-22.11]
Unemployed			-0.28 [-2.76]	-0.224 [-2.15]
Constant	5.19 [58.33]	4.72 [20.90]	6.35 [26.46]	6.04 [16.23]
Ethnicity Dummies	No	No	Yes	Yes
Religion Dummies	No	No	Yes	Yes
R^2	0.0012	0.0098	0.0928	0.0963
	N=13564	N=12183	N=12176	N=12159

Robust t-stats in brackets

* Significant at 5% level

Table 7: Australian Life Satisfaction Regressions and the effect of BMI (OLS), HILDA 2006

Dependent Variable: Life Satisfaction Index				
	[1]	[2]	[3]	[4]
BMI	-0.006 [-2.54]	-0.003 [-1.16]	-0.0016 [-0.58]	-0.0019 [-0.68]
Age		-0.043 [-11.09]	-0.094 [-10.03]	-0.093 [-9.94]
Age Squared		0.0005 [13.25]	0.0012 [10.80]	0.0012 [10.71]
Yrs of Education		-0.0043 [-0.75]	-0.022 [-3.32]	-0.017 [-2.43]
Divorced			-0.51 [-8.03]	-0.49 [-7.69]
Separated			-0.86 [-9.68]	-0.844 [-9.53]
Widowed			-0.20 [-1.55]	-0.18 [-1.38]
Single			-0.38 [-8.33]	-0.36 [-7.86]
Female		0.044 [1.62]	0.12 [3.94]	0.12 [4.06]
Disabled			-0.68 [-15.01]	-0.68 [-14.96]
Not Employed			-0.028 [0.74]	-0.034 [-0.89]
No of child in household			-0.036 [1.33]	0.025 [0.92]
No of people in household			-0.067 [-2.86]	-0.060 [-2.58]
Ln Income			0.132 [4.29]	0.148 [4.80]
Constant	8.08 [118.71]	8.69 [77.12]	8.63 [24.49]	8.46 [22.58]
Regional dummies included	No	No	No	Yes
R^2	0.0006	0.0284	0.0745	0.0794
	N=11085	N=10963	N=8450	N=8450

Robust t-stats in brackets

* Significant at 5% level

Table 8: Australian Life Satisfaction Regressions and the effect of BMI (2SLS), HILDA 2006

Dependent Variable: Life Satisfaction Index					
	[1]	[2]	[3]	[4]	[5]
BMI	-0.054	-0.045	-0.044	-0.055	-0.048
	[-2.65]	[-2.25]	[-2.22]	[-2.13]	[-1.92]
Age	-0.024	-0.027	-0.032	-0.079	-0.080
	[-2.94]	[-3.23]	[-3.82]	[-6.50]	[-5.08]
Age Squared	0.0003	0.0004	0.0005	0.001	0.001
	[4.51]	[5.29]	[6.11]	[7.59]	[8.06]
Yrs of Education	-0.015	-0.026	-0.037	-0.036	-0.028
	[-2.13]	[-3.69]	[-5.22]	[-3.82]	[-3.02]
Divorced				-0.53	-0.51
				[-8.10]	[-7.77]
Separated				-0.89	-0.87
				[-9.70]	[-9.55]
Widowed				-0.185	-0.164
				[-1.40]	[-1.24]
Single				-0.40	-0.38
				[-8.42]	[-7.96]
Female	0.012	0.022	0.038	0.081	0.09
	[0.41]	[0.75]	[1.27]	[2.26]	[2.52]
Disabled		-0.71	-0.66	-0.62	-0.63
		[-16.64]	[-15.66]	[-11.75]	[-11.95]
Not Employed				-0.036	-0.040
				[-0.93]	[-1.04]
No of child in household				0.032	0.021
				[1.15]	[0.77]
No of people in household				-0.056	-0.051
				[-2.29]	[-2.09]
Ln Income			0.18	0.114	0.135
			[8.58]	[3.53]	[4.18]
Constant	9.76	9.73	7.90	10.04	8.05
	[22.25]	[22.62]	[15.87]	[13.13]	[13.85]
Regional dummies included	No	No	No	No	Yes
R^2	.	0.0375	0.0451	0.0360	0.0500
F-stat	63.09	123.76	118.05	46.87	32.17
P-value	0.000	0.000	0.000	0.000	0.000
No observations	N=10963	N=10963	N=10911	N=10911	N=8450

Robust t-stats in brackets

* Significant at 5% level

Table 9: Equivalence between the effect of BMI and other variables on happiness across Germany, UK, and Australia

	[1] Germany	[2] UK	[3] Australia
1 Year of Age	(zero effect)	4 ϖ *	1.1 ϖ *
1 Year of Education	(zero effect)	4 ϖ *	0.8 ϖ *
Divorced	2 ϖ *	> 20 ϖ *	11.5 ϖ *
Single	1.5 ϖ *	> 20 ϖ *	7 ϖ *
Separated	3 ϖ *	> 20 ϖ *	21 ϖ *
Widowed	1/3 ϖ	> 20 ϖ *	4 ϖ *
Female	1 ϖ *	1.5 ϖ	-1.3 ϖ
100% Income Increase	-1.5 ϖ *	-3 ϖ	-4.5 ϖ *
Unemployed	1/2 ϖ *	22 ϖ	-1 ϖ
Handicapped	2.5 ϖ *	> 20 ϖ	18 ϖ
Belong to political party	-1 ϖ	-3 ϖ	
Retired	-1.5 ϖ *	20 ϖ *	
House Owner	-1/2 ϖ	> 20 ϖ	
Financial Assets	-1/3 ϖ	-2.5 ϖ	

ϖ denotes Unit of BMI

Variables with asterisks are significant at the 5% level