Hypertension and Happiness across Nations

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Abstract

In surveys of well-being, countries such as Denmark and the Netherlands emerge as particularly happy while nations like Germany and Italy report lower levels of happiness. But are these kinds of findings credible? This paper provides some evidence that the answer is yes. Using data on 16 countries, it shows that happier nations report systematically lower levels of hypertension. As well as potentially validating the differences in measured happiness across nations, this suggests that blood-pressure readings might be valuable as part of a national well-being index. A new ranking of European nations' GHQ N6 mental-health scores is also given.

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Because humans are extremely social animals, their sense of well-being is to a large extent determined by their social interactions. In hierarchical societies, individuals at every level have to submit … and the recognition of this submissiveness generates emotions such as shame, anger and depression. These emotions lead to the activation of physiological alarm systems such as the hypothalamic pituitary adrenal axis and the sympathetic nervous system. The chronic activation of these systems … results in … hypertension, atherosclerosis, major depression and autoimmune diseases.   Roy (2004)

1. Introduction

This paper examines the cross-country correlation between a measure of psychological well-being and a measure of high blood-pressure. It finds that there is an inverse relationship: 'happier' countries report less hypertension. The paper's first purpose is methodological -- to suggest that this helps validate the kinds of subjective well-being data now being used in comparisons of different nations. Its second purpose is to suggest that blood-pressure readings might form an element in a national well-being index.

For effective policies to be designed, policy-makers have to be able to evaluate the happiness and mental health of their citizens. Some simple measures of well-being -- real Gross Domestic Product, lifespan, height, incidence of cancer -- can straightforwardly be counted. Governments in most developed nations currently do this. But the quantification of subjective well-being in a broader sense, in a reasonably objective way, is more complicated.

The paper takes an unconventional approach to the assessment of well-being[1]. It explores the use of cross-national survey data on hypertension (that is, high blood-pressure). The paper estimates both psychological well-being and blood-pressure

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[1] Recent contributions from psychologists, economists, and other investigators, include Theodossiou 1998, Frey and Stutzer 2002, Easterlin 2003, Van Praag and Ferrer-I-Carbonell 2004, Smith et al 2005, and Gilbert 2006. Historians' perspectives are provided by Crafts (1997) and Offer (2006).

equations. Using Pearson and Spearman rank tests, it finds that the structure of the coefficients on country dummy variables is similar in both kinds of regression equations. Happy countries seem to have fewer blood-pressure problems. This has two implications. First, it suggests that there may be a case to take seriously the subjective 'happiness' measurements made across the world: they follow a pattern like the (inverse of) high-blood-pressure estimates. Second, in constructing new kinds of economic and social policies in the future, where well-being rather than real income is likely to be a prime concern, there are grounds for economists to study people's blood pressure.

Measured psychological well-being levels vary across the industrialized nations. Countries like Denmark, Ireland and the Netherlands score highly in standardized surveys, while nations such as Italy, Germany and Portugal come out as markedly less happy. Perhaps naturally, such research has an interdisciplinary feel and has attracted attention from many kinds of scholars[2]. Whether using regression equations or simple tabulations, small or large samples, simple cross-sections or pooled data, a number of the small social-democratic countries of Europe are consistently found to be among the happiest nations.

While the multi-country studies' findings are intriguing, commentators like Ostroot and Snyder (1985), Argyle (2001) and Kahneman and Riis (2005) point out that it is hard to know what to make of the cross-national claims. First, language differences raise the worry that words like 'life satisfaction' cannot be translated sufficiently consistently to ensure that the variations in reported well-being are meaningful. Second, cultural differences -- in some countries it may be less

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[2] Recent examples include Diener et al (1993), Diener et al (1995a, b), Kenny (1999), Veenhoven (1999), Di Tella et al (2001, 2003), Schyns (2002), Steel and Ones (2002), Blanchflower and Oswald (2004), Fahey and Smyth (2004), Graham (2005),and Dolan and Kahneman (2006).

acceptable to admit to unhappiness -- further complicate inference. Third, when visited, these European nations anecdotally appear similar in wealth, and indeed in most ways of living. None of these objections is definitive; but all of them mean that there are doubts over the substantive interpretation of estimated cross-national happiness variation.

Some writers have made a case for taking subjective well-being data seriously in the evaluation of human welfare[3]. This form of research may even presage a move away from simple GDP targets of the sort that have been favoured in post-war economic policy. However, to make progress on the construction of a national well-being index, a better empirical justification for the use of subjective life-satisfaction and happiness statistics is needed. The paper tries to pursue this aim and relies on one central idea. It is that individuals know whether a doctor has informed them that they suffer from blood-pressure problems. Arguably, such knowledge is relatively free of the cultural and language problems that presumably bedevil questionnaire evidence on happiness.

We implement a test around this idea. The assumption of our paper is that people can provide survey answers to questions about high blood-pressure difficulties in a relatively objective way. It is believed in the medical literature that self-reports of hypertension are correlated with objectively measured readings of blood pressure and seem to have fairly high validity (Giles et al 1995, Muhajarine et al 1997, Vargas et al 1997, Martin et al 2000, Liman-Cost et al 2004, Alonso et al 2005, Yoon and Zhang 2006). The paper's results are also relevant to the debate about the so-called socioeconomic gradient in health and well-being (see, for example, Marmot 2004). It is known that those of high social and occupational status suffer less actual illness, die

later, and report better subjective health than the poor and low-status. Gravelle and Sutton (2006) provide a helpful discussion of self-reported health measures and how they are used. Steptoe (2000) reviews the evidence on the existence of a socioeconomic gradient in hypertension.

2. Measuring well-being

The believability of subjective well-being patterns across nations might be scrutinized in a number of ways. Various happiness correlates could be studied, for instance, in the search for corroboration. Di Tella et al (2003) show, encouragingly for the quality of subjective data, that in a sample of Western nations there is evidence that the rises and falls in suicide rates move in the opposite direction to changes in happiness. The null hypothesis of no correlation, however, can be rejected only at the 10% level. Bray and Gunnell (2006) demonstrate that suicide is negatively correlated with happiness, and can reject the null of a zero correlation at the 5% level; but in a smaller sample Lester (2002) does not find such clear-cut results. Other national correlates studied in the literature include trust and political institutions (Hudson 2006, Helliwell 2003). None of these articles, though, is an attempt to evaluate the persuasiveness of different measures of mental well-being. There is some evidence that happiness and heart rate are negatively associated among men, and that well-being is correlated with cortisol levels and cardiovascular behaviour (Steptoe et al 2005). However, internationally comparable measures of hypertension, where the demographic and educational characteristics of randomly sampled people are known, are in short supply. Social scientists have paid little attention to the idea that blood pressure could play a role as a relevant well-being variable.

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[3] See for example Easterlin (1974), Clark and Oswald (1994), Inglehart (1996), Ng (1997), Oswald

As Ostir et al (2001) and Joynt et al (2003) demonstrate, rates of depression and heart disease seem to be linked. A review of related evidence is available in Rutledge and Hogan (2002). Steptoe and Wardle (2005) offer some evidence that blood pressure is inversely related to reported happiness. Their data come from middle-aged men and women, with positive 'affect' (a psychological term for a form of happiness) assessed through repeated ratings over a working day. Greater happiness is associated with lower salivary cortisol both on working and nonworking days, reduced fibrinogen stress responses, and lower ambulatory heart rate in men. These patterns, Steptoe and Wardle argue, are independent of age, socioeconomic status, smoking, body mass and psychological distress. In addition, happiness is found to be inversely related to ambulatory systolic blood pressure on follow-up, again independently of potential confounders including negative affect. The results establish that affective states are linked to outcomes. Similarly, Lazaro et al (1993) shows that borderline hypertension is associated with worse GHQ mental strain scores.

The work of Jonas and Lando (2000) uncovers a positive connection between anxiety today and hypertension in the future. A population-based cohort of 3310 initially normotensive and chronic disease-free persons in the NHANES I Epidemiologic Follow-up Study is tracked through four follow-up waves (maximum, 22 years). The association between hypertension and baseline negative affect is analyzed using Cox proportional hazards regression, adjusting for baseline age, sex, race, education, smoking, alcohol use, diastolic and systolic blood pressure, body mass index, and change in body mass index as a time-dependent covariate. Steptoe et al (2005) paints a complementary picture. It demonstrates that levels of positive

(1997), Diener (2000), Kahneman et al (2004), and Vemuri and Constanza (2006).

affect in middle-aged men and women are associated with reduced neuroendocrine, inflammatory, and cardiovascular activity. Well-being in the study is assessed by aggregating momentary experience samples of happiness over a working day and is found to be inversely related to cortisol output over the day. Once again, happiness is inversely related to heart rate measured using ambulatory monitoring methods. Strasser (1998) documents evidence that East Europeans have much higher blood pressure readings than citizens from Western Europe. From the perspective of the well-being literature, this is interesting, because it has long been known that Eastern Europe has particularly low happiness scores (Blanchflower, 2001). Banks et al (2006) argues that Americans are less healthy than Europeans; differences in blood pressure form part of the authors' evidence. Wolf-Maier et al (2003) and Stamler et al (1992) document blood pressure internationally and establish that education is inversely related to hypertension. Owen et al (2005) shows strong childhood influences. Colhoun et al (1998) provides a valuable summary of similar evidence.

Despite this epidemiological evidence on groups of medical subjects, little or nothing is known about <u>national</u> correlations between psychological well-being and hypertension. The individual-level association between well-being[4] and blood pressure is also imperfectly understood.

3. Analysis

In this study the data set is Eurobarometer #56.1. It collected identical survey information in September and October 2001 from approximately 15,000 randomly sampled individuals in Denmark, West Germany, Greece, Italy, Spain, France, Ireland, Luxembourg, the Netherlands, Portugal, the United Kingdom, East Germany,

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[4] In principle, it might be possible to learn about the well-being/hypertension connection by using willingness-to-pay survey methods. Johannesson, Jonsson and Borgquist (1991) estimate a figure that individuals are willing to pay for hypertensive therapy, although argue that the Contingent Valuation method here does not work well.

Finland, Sweden, Austria, and Belgium. Among other questions, one was: *Would you say that you have had problems of high blood pressure?* Answers could be given in four different boxes: not at all; no more than usual; rather more than usual; much more than usual. The presumption in the paper is that individuals who said yes had obtained such information from doctors.

We start with descriptive statistics. Using this European cross-section, Table 1(a,b) gives raw numbers on life-satisfaction and blood-pressure answers, where the well-being question in this case is the simple one: *Would you say you are very satisfied, fairly satisfied, not very satisfied, or not at all satisfied with the life you lead?* Table 1(c) gives a cross-tabulation for the two variables, which takes the expected inverse pattern.

Table 2 sets out regression equations in which the dependent variable is a measure of blood-pressure problems. These use Ordinary Least Squares and Ordered Logit methods. They are to be read vertically, and can be thought of as hypertension regression equations. Here the sample size in column 1 is 15,517 individuals. The OLS equations assign the numbers 1 to 4 to people's answers (where 4 is the most severe blood-pressure problems). The independent variables in the first column of Table 2 are country dummies, age, age squared, and a dummy variable for the gender of the respondent. 'Male' does not have an effect that is statistically significantly different from zero. Age in Column 1 of Table 2 enters with a well-determined linear positive effect; there is no evidence for a nonlinear term. The estimated dummy-variable coefficients for nations range from a high of 0.2695 for Portugal and 0.2197 for East Germany to lows of -0.1825 for Sweden and -0.1313 for the Netherlands. Belgium is the omitted, base country. According to these data, the measured levels of hypertension -- without controlling for personal characteristics other than age and

gender -- are therefore high among, from the greatest levels downwards, the Portuguese, the East Germans, the West Germans, the Italians, and the Finns. Nations with low levels of hypertension are, from the lowest upwards, Sweden, the Netherlands, Denmark, the UK, and Ireland. Hypertensive nations might be expected to have shorter longevity. The latest Human Development Report shows, consistently, that Sweden currently has the longest lifespan of the 16 nations at 77.9 years for males, while Portugal at 73.9 years has the shortest length of life. There is, however, not an exact match.[5]

Column 2 of Table 2 adds an Age Left Schooling variable as a simple measure of the individual's level of education. It enters strongly negatively with a coefficient of -0.0035 and a t-statistic that allows the null of zero to be rejected at conventional confidence levels. This result, although in a slightly unusual setting, is the familiar idea of a socio-economic gradient in health: more highly-educated people report fewer problems with hypertension. This is despite the fact that they presumably have more information from, and access to, physicians. Hierarchy's effects are one possible explanation (Roy 2004, Marmot 2004).

It is useful to ensure that the results are not being driven solely by the sub-sample of people who report the two highest levels of hypertension problems (i.e. those using the most extreme language). We seek a pattern with an objective element. To check this, we re-estimated column 2 of Table 2 as a simple probit equation, with the blood-pressure-problems dependent variable being a 0-1 dummy for None and Any. The country dummy structure was unaffected; it was correlated 0.97 with that from column 2 of Table 2 itself.

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[5] We thank Danny Kahneman for the idea that we examine longevity.

In its third column, Table 2 adds a further set of independent variables. These are controls for the individual's life experiences before the age of 18 (such as whether they grew up in a single-parent home), the individual's labour force status including which if any kind of job and occupation they have, and a set of dummy variables capturing different forms of marital status. Adding these makes little difference to the country-dummy coefficients. Column 4 of Table 2 switches to an ordered logit estimator. Because the independent variable on blood pressure problems is not cardinal, the OLogit column is in principle to be preferred. Nonetheless, the structure of the country dummies is not radically altered by going from Column 3 to Column 4 of Table 2. Age squared, however, now enters with a coefficient of -0.0003 and a t-statistic of 4.89, so aging appears with a concave structure. As the turning point in the quadratic is at greater than 100 years old, the substantive consequence for the age effect in going from Column 3 to 4 is small. To explore the robustness of the structure of this hypertension regression specification, we also checked these equations separately for male and female sub-samples. Encouragingly, the general equation structure is similar for men and women. This is helpful to the paper's aim, namely, to try to isolate a unique and well-determined country pattern of well-being.

It might be argued that the data should be partitioned[6] into groups of individuals with different education levels. To check this, the specification of column 3 of Table 2 was re-estimated. This was done, first, on the subsample of those in the data set (57%) who left schooling before the age of 18 and, second, on the subsample of those (the remaining 43%) who left later than 18. Country dummies were then extracted from these two regression equations. The sets of dummies exhibited a

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[6] A referee suggested this.

correlation coefficient of 0.9, which suggests that partitioning does not affect the principal conclusion.

A range of well-being equations is presented in Table 3. The first three columns are for life-satisfaction as a dependent variable; the fourth column uses a happiness variable. Here the data sets differ. Column 1 is for the previous 2001 data set, #56.1. Column 2 draws instead upon 185,711 randomly sample people from the Eurobarometer Trends files; it pools the years 1994, 1995 and 1997-to-2002 inclusive. Finally, Columns 3 and 4 of Table 3 use data on approximately 47,000 individuals from the pooled European Social Surveys of 2002 and 2004. Although not the focus of the paper, these well-being specifications generate the equation form now familiar from modern research on industrialized countries. There is a U-shape in age; males are less happy with their lives; education enters with a positive coefficient.

Two points follow from Table 3. First, regardless of the data set used, the estimated structure of the country dummy variables is similar. Denmark, for example, in the various well-being regression equations is always the happiest country. Greece, Italy, Portugal and East Germany are always low in the well-being country-by-country rankings. Second, and of importance to the paper's thesis, this international dummy-variable structure is approximately the inverse of that found in the nations' dummy-variable coefficients in the earlier blood-pressure problems equations.

Figure 1 illustrates the paper's conclusion. It plots a measure of hypertension problems for each nation against a measure of the level of happiness by nation. The graph displays the country dummies from the fourth column of Table 2 against the country dummies from the fourth column of Table 3. Hence both are conditioned on people's characteristics. Looking, using the final columns of Tables 2 and 3, at the

top and bottom of the ordering: the lowest blood-pressure countries are Sweden (#1), Denmark (#2) and the UK (#3) and these are ranked #3, #1 and #8 in happiness; the three highest blood-pressure countries are West Germany (#14), East Germany (#15) and Portugal (#16), and these are between #12 and #14 in the happiness league table. The only anomaly appears to be Finland; for reasons that are unclear, its position moves around across the different well-being rankings.

Figure 2 depicts the result in an alternative, simpler way. Here the sixteen nations are grouped -- by blood pressure -- into quartiles. The bar chart uses the coefficients from the third column of Table 2, plotted against, on the y-axis, the matching data for the nations' percentages of those saying they are very satisfied with their lives (so there is here no regression-equation correction). In the four countries with low levels of blood-pressure problems, 48.5% of individuals say they are very satisfied with life. Among the highest blood-pressure countries, namely, those in the top quartile of hypertension, only 22.5% of citizens give this satisfaction rating.

We also report simple Pearson correlation coefficients for blood-pressure dummies correlated with the country dummies from equations with various dependent variables for mental well-being. Arguably the most appropriate test relies only on the ordinality of the league-table positions in international measures of blood-pressure difficulties and psychological well-being. A Spearman's rank correlation test is therefore computed. These provide tests of the null hypothesis of no correlation between the country dummies in Table 3 and the country dummies in the right hand column of Table 2.

The four columns in Table 4 are for correlations with the country dummies in, respectively, each of the the four columns of Table 3. The first three columns are life satisfaction equations; the fourth is a happiness equation. Each of the rank correlation

coefficients is significantly different from zero on a one tailed test with cut-off α = 0.05 (n=16); the critical value of Spearman's rank correlation coefficient is 0.425. For a two-tailed test, with α = 0.025, it is 0.507. [McClave, J.T., P.G. Benson and T. Sincich (2001), Table XV11, Appendix B, page 1005.]

Whichever well-being measure is adopted in Table 3, there is evidence of an inverse relationship between national subjective well-being and national blood-pressure problems. For the data of Figure 1, Pearson's R is -0.597 and Spearman's rank correlation coefficient is -0.553. Both are significantly different from zero, given the 16 observations on European nations, at the 5% level. The pattern is the same whether or not OLS coefficients are used.

Objective hypertension measures would be valuable. Kearney et al (2005) is one of the few modern papers to try to document the levels of statistically representative age-adjusted blood-pressure figures by nation. Its conclusions are somewhat consistent with our numbers. For example, for Kearney's sample of six nations, among randomly sampled European males the highest levels of hypertension are found -- in the same order as in our sample -- within Germany followed by Italy and then Spain. Kearney et al (2005) rates Sweden, England and Greece at lower blood-pressure levels. However, the range of European nations in the Kearney sample is too small to allow a full comparison, and the various national samples are collected in slightly different ways and years.

Could the paper's main result be some form of spurious correlation? One concern is the possibility that different degrees of information and health resources are provided to people across nations[7]. In a country where there are relatively few physicians, that nation's citizens might have greater levels of undiagnosed

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[7] We thank Andrew Steptoe for discussions on this issue.

hypertension, which could lead to errors in the data provided earlier in the paper. This difficulty is an important one. We attempt to address it in the following way.

Assume that individuals are informed by doctors that they have hypertension. A natural check is then to examine how the international patterns in reported levels of high blood-pressure correlate with the number of doctors per head of the population. First, if we take, for example, the 3 high blood-pressure nations of East Germany, Portugal and Finland, the mean number of physicians per 100,000 people in these countries according to the latest Human Development Report data is 332. Across the 3 low blood-pressure nations here (Sweden, Netherlands, Denmark), it is almost identical, at 333 physicians per 100,000. This seems encouraging and suggests that the hypertension patterns are not the result merely of different diagnosis levels. Second, and more formally, we took the sample of sixteen nations and calculated a Pearson correlation coefficient -- of approximately 0.3 -- between the number of physicians and the reported blood-pressure variable. Although the two are positively correlated, there is no statistically significant relationship (on a 5% significance cut-off).

By its nature, this counter-argument to the difficulty of potentially different levels of medical advice across nations cannot be definitive. Yet it seems to suggest that the differences we observe in hypertension levels are not in a simple sense because of cross-European differences in access to medical information.

A further check was done. We explored the patterns in a different measure of mental well-being favoured by, for example, Goldberg et al (1997). It is a version of a so-called GHQ (General Health Questionnaire) psychiatric measure. In this case, in Table 5, the dependent variable is a measure of psychological distress that comes from amalgamating answers to the questions:

Have you recently:

1. *Lost much sleep over worry?*

2. *Felt constantly under strain?*

3. *Felt you could not overcome your difficulties?*

4. *Been feeling unhappy and depressed?*

5. *Been losing confidence in yourself?*

6. *Been thinking of yourself as a worthless person?*

To the answers to each of these six, we assigned the integers 0, 1, 2, 3 -- depending whether each was answered *not at all, no more than usual, rather more than usual, much more than usual*. The numerical answers were then summed. Overall, a mental distress score, denoted here GHQ-N6, must by definition lie between 0 and 18. Across Europe, the mean of this psychological score is 3.6 (standard deviation 3.7). A more complete GHQ measure is often computed from 12 questions (Goldberg et al 1997). However, no other GHQ questions were available in the data set, but there is a precedent -- as in Huppert and Whittington 2003 and Hu et al 2006 -- for use of these 'negative' six questions (hence our abbreviation N6). The cross-country pattern in mental distress GHQ-N6 here is consistent with those found in happiness, life-satisfaction and hypertension. This can be seen informally by inspection in Table 5; but, more formally, for the specification in column 3 of Table 5, the country dummies in GHQ-N6 when correlated with those in the blood-pressure equation in column 3 of Table 2 produce a Pearson's correlation coefficient of 0.55, which again is significant at the 5% level.

Appendix 2 provides a European league table of GHQ-N6 mental health. This appears not to have been done before in the literature.

It is of interest to look separately at male equations and female equations (not reported). Doing so, however, replicates the paper's main conclusion.   Redoing the procedure with males alone produces a cross-country correlation coefficient for life satisfaction against blood pressure of -0.51, and in the case of females one of -0.69. These correlations are significantly different from zero at the 5% level.

A referee has raised the possibility that gender and age might need to be interacted in the blood-pressure and well-being equations. We experimented with this.   Interaction terms for Age*Gender and Age-Squared*Gender were included in the equations, and in all but one case the coefficients were insignificantly different from zero, and the variables were thus excluded. In column 3 of Table 3, though, the interaction terms were statistically significant. However, their inclusion had no effect on the country dummies. Indeed, the correlation between the country dummies was 0.999 with them included, so to maintain symmetry with other tables they were excluded.

The focus of this paper has been upon country-level differences in well-being. Nevertheless, it is interesting to get some feel for the individual-level correlation between hypertension and happiness. Table 6 estimates a life satisfaction equation which includes a blood-pressure independent variable that takes the form of a single dummy for any reported problems of hypertension or not. Although a cross-section regression equation of this type cannot uncover the direction of causality[8], the hypertension measure enters significantly negatively in the life-satisfaction specification, with a t-statistic of approximately 20 across the various columns.

Table 7 performs a last check. It replicates the same individual-level result in a life-satisfaction equation estimated with data from the 1999/2000 sweep of the

British National Child Development Study. This data set is a birth cohort of individuals born between the 3rd and the 9th March 1958, who were all aged 42 at the time of interview. Table 7 reveals that the indicator variable for high blood-pressure is again negative in all specifications. It is possible in this data set to allow for obesity, which is a known correlate with hypertension[9]. The negative correlation remains once extra controls are included for body mass index (BMI) and its square, as well as also self-reported assessments of weight.

4. Conclusions

This paper studies the levels of hypertension and happiness across nations. It draws upon data on 15,000 randomly sampled individuals from 16 countries (and on larger samples to provide measures of well-being). The paper provides evidence that happier nations report fewer blood-pressure problems. Figure 2 illustrates the conclusion in a simple way.

A modern literature has claimed that countries like Denmark, Ireland and the Netherlands are particularly happy while nations such as Germany, Italy and Portugal are less happy. Yet it is arguably implausible that words such as 'happiness' or 'satisfaction' can be communicated unambiguously and in exactly the same way across countries, so it is not easy to know whether such cross-national well-being patterns are believable. We offer evidence relevant to this debate. The main finding is that the pattern of country dummies in tables like Table 2 is similar to the (inverse of the) pattern of the dummy variables for countries in a table like Table 3. This is true whatever the chosen well-being proxy and data set. Our results do not seem to be caused by different numbers of physicians across countries.

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[8] In an equation with blood-pressure as the dependent variable, a negative association with well-being is again found.
[9] Obesity is also a correlate with happiness and GHQ scores (Oswald and Powdthavee 2007).

As well as validating the differences in happiness across nations, the paper's finding suggests that blood-pressure readings might be valuable as part of a national well-being index.

The persuasiveness of the paper rests on three assumptions:

(i)   it is reasonable to treat survey evidence on high-blood-pressure problems as a proxy for objective hypertension (for example, Vargas et al 1997);

(ii)   people can report high blood-pressure in a more objective way than they report levels of happiness;

(iii)   the patterns in Figures 1 and 2 are not merely the outcome of something special to this sample of nations.

It might be conjectured that the paper's correlation is illusory and a product of the fact that an inherently cheery nation will be optimistic about everything. This is an important potential concern. However, it is not easy to believe that someone told by their doctor that they have a condition of high blood-pressure has an incentive to conceal or mis-report that. For researchers, the attraction of a blood-pressure question in surveys is that, because it relies on medical opinion given to the individual, it seems valuably different in character from conventional subjective well-being questions. [10]

Future work needs to collect information on objective measures of hypertension and subjective measures of well-being. The construction of a national well-being index, to replace the simple GDP goals adopted by governments in the 20th century, might one day draw upon both happiness and blood-pressure data.

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[10] It would be valuable to explore whether the inverse correlation holds across regions within nations. We have not attempted to do so, although recent work by Bell and Blanchflower (2007) points out that Scotland, a high blood-pressure region of the United Kingdom, also scores poorly on happiness data.

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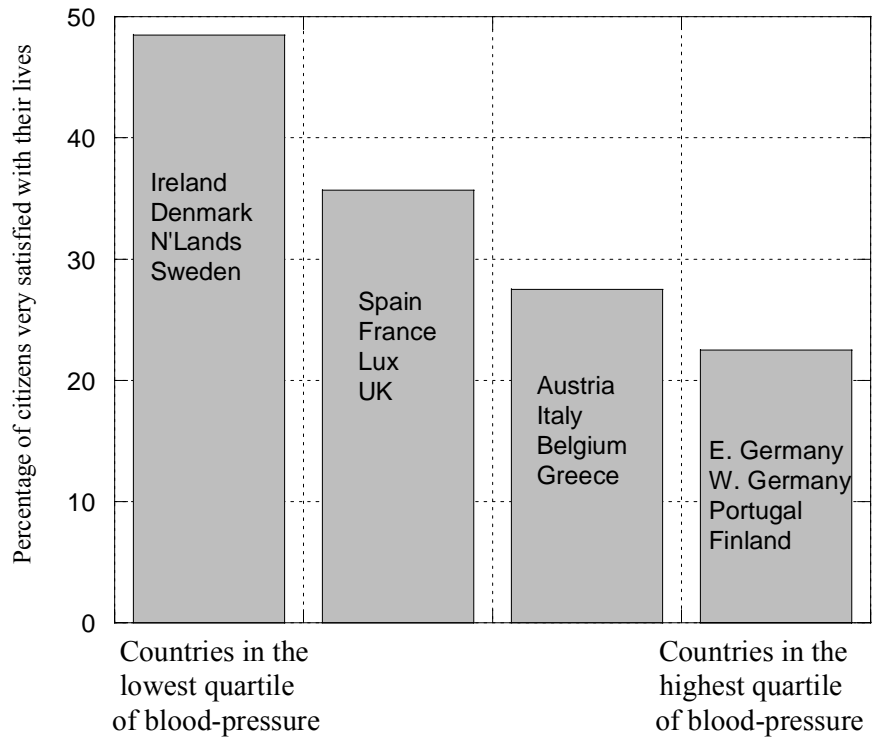
Figure 1.
The Inverse Correlation Between Blood Pressure Problems and
Happiness: 16 European Nations
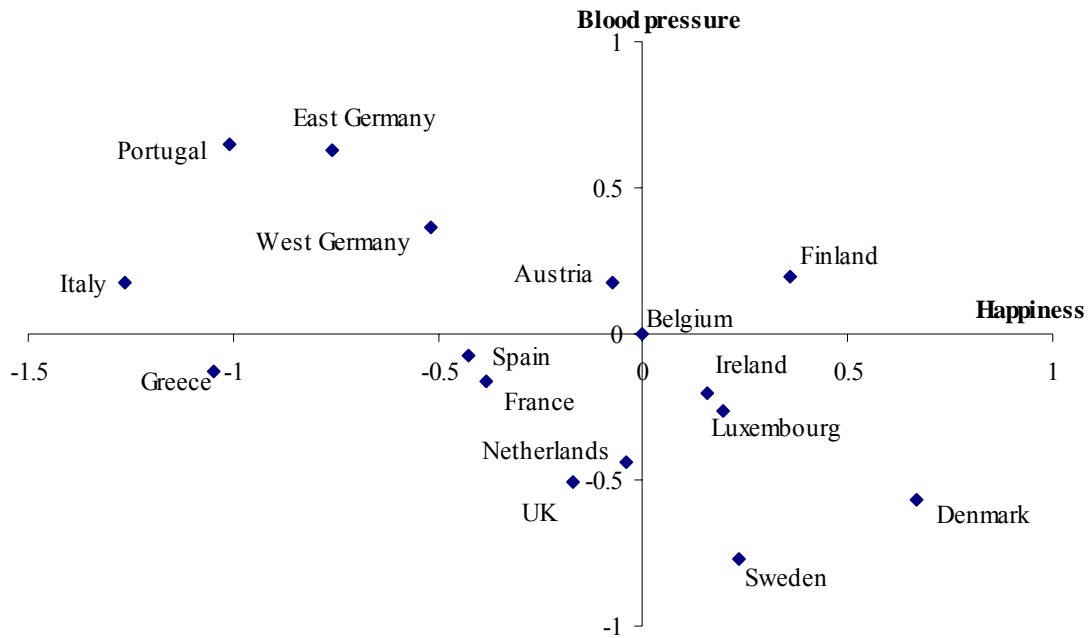
Note: These points plot country-dummy coefficients. The data are drawn from the fourth columns of Tables 2 and Table 3.

Figure 2.
The Inverse Correlation Between Hypertension and Life
Satisfaction: 16 European Nations Aggregated into Quartiles

Table 1. Descriptive Data on High Blood-Pressure and Life Satisfaction Levels

a) **Blood pressure**. Would you say that you have had problems of high blood pressure? (%)

	Not at all	No more than usual	Rather more than usual	Much more than usual	N
Belgium	67	25	6	2	1,015
Denmark	79	11	7	3	977
West Germany	58	30	10	2	944
Greece	70	20	7	4	990
Italy	67	18	10	5	964
Spain	71	21	6	2	989
France	74	17	8	2	989
Ireland	75	20	4	1	977
Luxembourg	74	16	8	2	581
Netherlands	77	18	4	0	980
Portugal	50	33	12	4	977
UK	78	15	5	2	1,273
East Germany	50	35	12	3	961
Finland	64	24	10	3	973
Sweden	80	13	5	1	965
Austria	65	24	10	1	962
EU	69	21	8	2	15,517

b) **Life satisfaction**. Would you say that you are very satisfied, fairly satisfied, not very satisfied, or not at all satisfied with the life you lead? (%)

	Not at all satisfied	Not very satisfied	Fairly satisfied	Very satisfied	N
Belgium	2	12	55	31	1,027
Denmark	0	3	31	66	1,000
West Germany	2	10	61	27	996
Greece	7	18	51	24	1,004
Italy	2	15	71	11	988
Spain	1	11	57	31	997
France	2	13	61	24	991
Ireland	1	7	55	38	991
Luxembourg	1	4	44	51	598
Netherlands	1	5	42	52	1,005
Portugal	3	21	59	18	999
UK	2	8	52	37	1,301
East Germany	3	18	61	18	999
Finland	2	9	63	27	992
Sweden	1	6	55	38	999
Austria	1	6	49	44	998
EU	2	10	54	33	15,885

c) **Cross-tabulation of blood pressure and life satisfaction** (at the individual level: N=15,474)

Blood pressure problems	Life satisfaction				
	Not at all satisfied	*Not very satisfied*	*Fairly satisfied*	*Very satisfied*	*All*
Not at all	0.9	5.3	36.2	26.5	68.9
No more than usual	0.5	2.7	12.9	5.1	21.2
Rather more than usual	0.3	1.6	4.2	1.5	7.6
Much more than usual	0.3	0.6	1.0	0.4	2.3
All	1.9	10.3	54.3	33.5	100.0

Cells here are overall percentages.

Table 2. Blood-Pressure Equations (Eurobarometer Data 2001)

	(1) OLS	(2) OLS	(3) OLS	(4) OLOGIT
Austria	.0628 (2.03)	.0601 (1.94)	.0493 (1.58)	.1772 (1.80)
Denmark	-.1008 (3.26)	-.0910 (2.94)	-.0857 (2.73)	-.5664 (5.18)
East Germany	.2197 (7.08)	.2203 (7.10)	.2079 (6.66)	.6290 (6.70)
Finland	.0931 (3.01)	.0949 (3.07)	.0859 (2.75)	.1967 (1.99)
France	-.0113 (0.37)	-.0103 (0.34)	-.0160 (0.52)	-.1628 (1.60)
Greece	.0102 (0.33)	.0048 (0.16)	.0018 (0.06)	-.1284 (1.26)
Ireland	-.0565 (1.83)	-.0605 (1.96)	-.0610 (1.95)	-.2044 (1.96)
Italy	.1050 (3.39)	.1006 (3.24)	.1042 (3.34)	.1764 (1.76)
Luxembourg	-.0280 (0.78)	-.0326 (0.88)	-.0331 (0.89)	-.2635 (2.14)
Netherlands	-.1313 (4.26)	-.1298 (4.20)	-.1227 (3.94)	-.4413 (4.19)
Portugal	.2695 (8.73)	.2536 (8.13)	.2429 (7.63)	.6478 (6.60)
Spain	.0002 (0.01)	-.0074 (0.24)	-.0081 (0.26)	-.0715 (0.70)
Sweden	-.1825 (5.89)	-.1792 (5.77)	-.1715 (5.45)	-.7688 (6.98)
UK	-.0922 (3.18)	-.0940 (3.24)	-.1092 (3.74)	-.5073 (5.13)
West Germany	.1158 (3.72)	.1145 (3.67)	.1043 (3.33)	.3636 (3.77)
Age	.0108 (6.81)	.0140 (7.78)	.0128 (5.88)	.0675 (9.18)
Age^2	.0000 (0.39)	-.0000 (1.31)	-.0000 (1.63)	-.0003 (4.89)
Male	-.0108 (0.98)	-.0099 (0.89)	.0023 (0.19)	.0222 (0.55)
Age left schooling		-.0035 (3.70)	-.0069 (4.60)	-.0173 (3.53)
Constant	.9156 (22.31)	.9008 (21.71)	1.0923 (13.51)	
_cut 1				2.6653
_cut 2				4.2449
_cut 3				5.8586
Personal controls	No	No	Yes	Yes
Adjusted R^2	.1117	.1122	.1178	
Pseudo R^2				.0847
N	15,517	15,457	15,396	15,396

Notes   The dependent variable here is a measure of reported problems of high blood-pressure. 'Personal controls' are 10 dummy variables relating to the individual's experiences before the age of 18; 16 labour-force status dummies; and 8 marital-status dummies. Belgium is the excluded nation. The question that forms the dependent variable is here, and in some later tables, "Would you say that you have not at all, no more than usual, rather more than usual, much more than usual...had problems of high blood pressure?" where 1=not at all; 2=no more than usual; 3=rather more than usual; 4=much more than usual.
t-statistics are in parentheses.
Source Eurobarometer #56.1: Social Exclusion and Modernization of Pension Systems, September–October 2001. ICPSR #3475

Table 3. Life-Satisfaction and Happiness Equations (For 3 Data Sets)

	(1) Life Sat.	(2) Life Sat.	(3) Life Sat.	(4) Happiness
Austria	.7166 (7.97)	.3113 (11.30)	.1874 (4.47)	-.0736 (1.77)
Denmark	1.7312 (17.84)	1.7569 (64.61)	1.0838 (24.11)	.6664 (14.96)
West Germany	-.0729 (0.82)	-.1499 (5.76)	-.4009 (9.58)	-.5175 (12.44)
Greece	-.6553 (7.00)	-1.2310 (46.52)	-.9375 (22.92)	-1.0484 (25.37)
Italy	-.8091 (9.00)	-.5279 (20.16)	-.5312 (8.69)	-1.2620 (20.66)
Spain	.0269 (0.30)	-.2093 (7.92)	-.4084 (9.13)	-.4272 (9.49)
France	-.2508 (2.79)	-.4712 (18.03)	-.8708 (15.18)	-.3826 (6.76)
Ireland	.4128 (4.60)	.6594 (25.15)	.0089 (0.17)	.1547 (2.99)
Luxembourg	.8609 (7.96)	.7322 (24.40)	.4709 (10.06)	.1941 (4.16)
Netherlands	.9406 (10.40)	.9576 (36.99)	.0925 (1.97)	-.0426 (0.91)
Portugal	-.5965 (6.41)	-1.0906 (41.23)	-1.3899 (31.14)	-1.0065 (22.50)
UK	.3938 (4.66)	.5035 (20.35)	-.3248 (7.76)	-.1724 (4.09)
East Germany	-.5577 (6.22)	-.7309 (28.26)	-.9418 (16.84)	-.7599 (13.67)
Finland	.0783 (0.87)	.2262 (8.31)	.5157 (12.65)	.3572 (8.77)
Sweden	.4342 (4.81)	.8286 (30.35)	.4296 (10.35)	.2320 (5.59)
Age	-.0606 (9.49)	-.0556 (29.96)	-.0592 (20.24)	-.0660 (22.41)
Age^2	.0006 (9.61)	.0005 (29.88)	.0006 (21.10)	.0006 (21.54)
Male	-.1347 (3.80)	-.0801 (7.95)	-.1126 (6.71)	-.1210 (7.19)
Age left schooling	.0279 (6.22)	n/a	.0402 (18.04)	.0328 (14.67)
_cut 1	-5.3108	-4.4028	-5.8812	-7.3341
_cut 2	-3.1896	-2.4880	-5.3270	-6.6011
_cut 3	-.0899	.6171	-4.7165	-5.8587
_cut 4			-4.0504	-5.1357
_cut 5			-3.5589	-4.6052
_cut 6			-2.7168	-3.6172
_cut 7			-2.2229	-3.0341
_cut 8			-1.4008	-2.1261
_cut 9			-.1242	-.7923
_cut 10			.9901	.4328
Schooling dummies	0	9	0	0
Labour force dummies	16	6	2	2
Marital status dummies	9	9	4	4
Year dummies	0	6	1	1
Pseudo R^2	.0998	.0949	.0393	.0331
N	15,760	185,711	47,235	47,244

<u>Notes</u> The dependent variable here is a measure of well-being (life satisfaction in the first three columns; happiness in the fourth column). These are ordered logit equations. Belgium is the excluded country. t-statistics are in parentheses.

<u>Sources</u> Column 1) Eurobarometer #56.1: Social Exclusion and Modernization of Pension Systems, September–October 2001. ICPSR #3475. Column 2) Eurobarometer Trends file ICPSR #4357 for years 1994, 1995, 1997-2002. Columns 3 and 4) European Social Surveys 2002 and 2004.

Table 4.   Tests of the Significance of the Cross-National Inverse Correlation Between Reported Hypertension and Happiness

Coefficients of Correlation Between the Country Dummies in Well-being and Blood-Pressure Equations:

Data set	LifeSat EB561	LifeSat Trends	LifeSat ESS	Happiness ESS
Pearson's	-0.648	-0.495	-0.600	-0.597
Spearman's	-0.638	-0.479	-0.526	-0.553

Note: Each column relates to the country dummies in its equivalent column of Table 3.

Table 5. GHQ-N6 Psychological Distress Equations (Eurobarometer Data 2001)

	(1)	(2)	(3)	(4)
Austria	.0545 (0.33)	.0234 (0.14)	.0155 (0.10)	-.0985 (0.63)
Denmark	-.3185 (1.96)	-.3284 (2.04)	-.2952 (1.83)	-.6924 (4.38)
East Germany	.9965 (6.06)	.9405 (5.76)	.9424 (5.78)	.8156 (5.21)
Finland	1.0331 (6.34)	1.0107 (6.26)	1.0169 (6.30)	.5969 (3.81)
France	.7918 (4.85)	.7713 (4.77)	.7754 (4.79)	.6379 (4.12)
Greece	.7441 (4.58)	.7436 (4.61)	.7257 (4.50)	.6818 (4.33)
Ireland	-.1711 (1.05)	-.1663 (1.03)	-.1789 (1.10)	-.0254 (0.16)
Italy	2.1916 (13.32)	2.1751 (13.33)	2.1603 (13.23)	2.2381 (14.26)
Luxembourg	-.0001 (0.01)	-.0335 (0.18)	-.0408 (0.21)	-.1069 (0.57)
Netherlands	-.3660 (2.23)	-.3899 (2.40)	-.3846 (2.37)	-.2764 (1.77)
Portugal	.7703 (4.68)	.7815 (4.78)	.7288 (4.42)	.4654 (2.87)
Spain	.0049 (0.03)	.0285 (0.18)	.0038 (0.02)	.0852 (0.55)
Sweden	.0170 (0.10)	.0139 (0.09)	.0075 (0.05)	-.1259 (0.81)
UK	.1194 (0.78)	.1159 (0.77)	.1106 (0.73)	-.0158 (0.11)
West Germany	.0574 (0.35)	.0322 (0.20)	.0288 (0.18)	.0516 (0.33)
Age		.0950 (11.40)	.1058 (11.21)	.0958 (8.73)
Age^2		-.0009 (11.56)	-.0010 (11.44)	-.0010 (9.22)
Male		-.6527 (11.25)	-.6501 (11.19)	-.4727 (7.73)
Age left schooling			-.0119 (2.41)	-.0211 (2.77)
Constant	3.2020 (27.99)	1.5962 (7.43)	1.5442 (7.12)	1.4913 (3.57)
Personal controls	No	No	No	Yes
Adjusted R^2	.0296	.0456	.0460	.1349
N	15,441	15,441	15,379	15,379

Notes: The dependent variable is a psychological distress score measured on a scale from 0 to 18. A GHQ-N6 score amalgamates answers to six questions: Have you recently: Lost much sleep over worry? Felt constantly under strain? Felt you could not overcome your difficulties? Been feeling unhappy and depressed? Been losing confidence in yourself? Been thinking of yourself as a worthless person? Its mean in the sample is 3.6 (s.d. 3.7).

'Personal controls' are 10 dummies relating to the individual's experiences before the age of 18; 16 labour force status dummies; and 8 marital-status dummies. Belgium is the excluded country. t-statistics are in parentheses.

Source: Eurobarometer #56.1: Social Exclusion and Modernization of Pension Systems, September–October 2001. ICPSR #3475

Table 6. Ordered Logit Life-Satisfaction Equations including a High Blood-Pressure Dummy Variable (Eurobarometer Data 2001)

	(1)	(2)	(3)	(4)
Blood-pressure dummy	-.8106 (23.28)	-.6985 (19.55)	-.7417 (19.76)	-.4846 (20.00)
Austria		.2607 (3.11)	.2690 (3.21)	.3814 (4.45)
Denmark		1.4783 (15.94)	1.4587 (15.66)	1.7296 (17.50)
East Germany		-.0040 (0.05)	-.0086 (0.10)	.1502 (1.64)
Finland		.3446 (3.88)	.3212 (3.60)	.3686 (4.01)
France		-.3316 (3.71)	-.3187 (3.56)	-.2480 (2.74)
Greece		-.6512 (7.14)	-.6339 (6.93)	-.6584 (6.96)
Ireland		.3857 (4.36)	.4139 (4.67)	.4028 (4.43)
Italy		-.7482 (8.44)	-.7317 (8.24)	-.7675 (8.41)
Luxembourg		.8828 (8.54)	.8541 (7.98)	.8853 (8.03)
Netherlands		.9060 (10.13)	.9217 (10.28)	.9080 (9.89)
Portugal		-.6119 (6.83)	-.5775 (6.38)	-.4689 (4.97)
Spain		-.0101 (0.11)	.0170 (0.19)	.0190 (0.21)
Sweden		.6603 (7.40)	.6890 (7.70)	.7521 (8.23)
UK		-.5311 (5.88)	-.5232 (5.79)	-.4637 (5.07)
West Germany		.0062 (0.07)	.0190 (0.21)	-.0088 (0.10)
Age			-.0366 (7.00)	-.0576 (8.85)
Age^2			.0004 (7.94)	.0006 (9.58)
Male			.0107 (0.33)	-.1233 (3.43)
Age left schooling			.0087 (3.20)	.0263 (5.76)
Personal controls	No	No	No	Yes
Cut 1	-4.2613	-4.2785	-4.8021	-6.1807
Cut 2	-2.2794	-2.2654	-2.7869	-4.0210
Cut 3	.4616	.65622	.1458	-.8439
Pseudo R^2	.0179	.0515	.0535	.1120
N	15,474	15,474	15,414	15,414

Notes: 'Blood-pressure dummy' is a dummy variable for reporting anything except Not At All to the question: "Would you say that you have had problems of high blood pressure?". 'Personal controls' are 10 dummies relating to the individual's experiences before the age of 18; 16 labour force status dummies; and 8 marital-status dummies. Belgium is the excluded country. t-statistics are in parentheses.

Source: Eurobarometer #56.1: Social Exclusion and Modernization of Pension Systems, September–October 2001. ICPSR #3475

Table 7. Ordered Logit Life-Satisfaction Equations including a High Blood-Pressure Dummy Variable (NCDS Data)

	(1)	(2)	(3)	(4)
Blood-pressure dummy	-.1920 (3.65)	-.1979 (3.72)	-.2195 (3.84)	-.1704 (2.97)
Male		-.1961 (5.80)	-.2955 (7.61)	-.3636 (8.08)
Age left schooling		.0316 (4.35)	.0357 (4.57)	.0253 (3.22)
BMI			.1376 (4.84)	.1140 (4.05)
BMI^2			-.0018 (3.99)	-.0013 (3.04)
Underweight			-.5012 (5.59)	-.3586 (3.98)
Slightly overweight			-.1572 (3.23)	-.2047 (4.19)
Very overweight			-.4895 (5.77)	-.5077 (5.96)
Personal controls	No	No	No	Yes
Cut 1	-5.2535	-4.7926	-2.6219	-3.6866
Cut 2	-4.0368	-3.5909	-1.4090	-2.4491
Cut 3	-3.5591	-3.1105	-.9384	-1.9674
Cut 4	-2.9910	-2.5520	-.4023	-1.4162
Cut 5	-2.4197	-1.9766	.1744	-.8177
Cut 6	-1.6553	-1.2060	.9483	.0031
Cut 7	-1.1236	-.6739	1.4842	.5773
Cut 8	-.2092	.2397	2.4042	1.5615
Cut 9	1.1178	1.5671	3.7319	2.9507
Cut 10	2.2642	2.7041	4.8721	4.1147
Pseudo R^2	0.0003	.0015	.0042	.0257
N	11,265	11,027	10,182	10,144

Notes: 'Personal controls' are 17 ethnicity dummies; 11 labour force status dummies; and 5 marital-status dummies. t-statistics are in parentheses. The excluded category is 'about the right weight'. Individuals were asked 'Would you say you were ... 'about the right weight' etc. The 'Blood-pressure' variable is a dummy variable. Respondents were asked 'Have you ever had or been told you had high blood pressure?' Life satisfaction is scored from 0-10. Respondents were told 'here is a scale from 0-10 where '0' means that you are completely dissatisfied and '10' means that you are completely satisfied. Please enter the number which corresponds to how satisfied or dissatisfied you are about the way your life has turned out so far.' t-statistics are in parentheses.

Source: British National Child Development Study #6, 1999/2000

Appendix 1

I. The Wording of the Questions in the International Data

1) Eurobarometer #56.1

a) Blood pressure
 "Would you say that you have not at all, no more than usual, rather more than usual, much more than usual...had problems of high blood pressure?"
Here 1=not at all; 2=no more than usual; 3=rather more than usual; 4=much more than usual.

[NB. It could be argued that someone with a high but unchanging level of hypertension might give the answer 2 rather than a higher number. Nevertheless, as the great majority of the population give answer number 1, such a person would still be identified, within the paper's regression equations, as having blood-pressure problems.]

b) Life satisfaction
Would you say you are very satisfied; fairly satisfied; not very satisfied or not at all satisfied…with the life you lead?"
Here 1=very satisfied; 2 =fairly satisfied; 3=not very satisfied and 4=not at all satisfied.
For the empirical analysis, for clarity we reverse the order and set 1=not at all satisfied; 2=not very satisfied; 3=fairly satisfied and 4=very satisfied.

2) Eurotrends

a) Life satisfaction
"On the whole are you very satisfied; fairly satisfied; not very satisfied or not at all satisfied…with the life you lead?"

Exceptions to this are in Eurobarometer #56.1 noted above which is included in the Eurotrends file and in Eurobarometer #52.1 (Modern Biotechnology, Quality of Life and Consumer's access to Justice, November-December, 1999, ICPSR #2893) and that is also included in the Eurotrends file, where the question is as follows:
"On the whole are you: very satisfied; fairly satisfied; not very satisfied or not at all satisfied…with your life in general?"

Here, in all cases, 1=very satisfied; 2 =fairly satisfied; 3=not very satisfied and 4=not at all satisfied. For the empirical analysis, for clarity we reverse this order and set 1=not at all satisfied; 2=not very satisfied; 3=fairly satisfied and 4=very satisfied.

3) European Social Survey

a) Happiness
"Taking all things together, how happy would you say you are? Please use this card: 'Extremely unhappy' to 'Extremely happy' on a scale of 0-10."

b) Life satisfaction
"All things considered, how satisfied are you with your life as a whole nowadays? Please answer using this card, where 0 means extremely dissatisfied and 10 means extremely satisfied"

Appendix 2

Happiness and Mental Health across Europe

International League Tables of Well-being as Measured by Life Satisfaction and Low Levels of GHQ-N6 Psychological Distress

		Life Satisfaction		Inverse of GHQ-N6	
1	Denmark	3.62	Netherlands	2.84
2	Netherlands	3.46	Denmark	2.88
3	Luxembourg	3.44	Ireland	3.03
4	Austria	3.37	Luxembourg	3.20
5	Ireland	3.30	Belgium	3.20
6	Sweden	3.30	Spain	3.21
7	UK	3.25	Sweden	3.22
8	Spain	3.17	Austria	3.26
9	Belgium	3.15	West Germany	3.26
10	Finland	3.14	UK	3.32
11	West Germany	3.14	Greece	3.95
12	France	3.06	Portugal	3.97
13	East Germany	2.94	France	3.99
14	Portugal	2.92	East Germany	4.20
15	Italy	2.92	Finland	4.24
16	Greece	2.91	Italy	5.39

Note: Here we report the means of the raw life-satisfaction and GHQ-N6 data, where for simplicity people's survey answers have been assigned the integers 1-4 on life satisfaction and 1-6 on GHQ-N6. These table's numbers are not regression-corrected. The GHQ-N6 numbers are reversed so that they can be read as a well-being score rather than a mental strain score.