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Gross national happiness as an answer to the Easterlin Paradox? ☆

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Abstract

The Easterlin Paradox refers to the fact that happiness data are typically stationary in spite of considerable increases in income. This amounts to a rejection of the hypothesis that current income is the only argument in the utility function. We find that the happiness responses of around 350,000 people living in the OECD between 1975 and 1997 are positively correlated with the level of income, the welfare state and (weakly) with life expectancy; they are negatively correlated with the average number of hours worked, environmental degradation (measured by SOx emissions), crime, openness to trade, inflation and unemployment; all controlling for country and year dummies. These effects separate across groups in a pattern that appears broadly plausible (e.g., the rich suffer environmental degradation more than the poor). Based on actual changes from 1975 to 1997, small contributions to happiness can be attributed to the increase in income in our sample. Interestingly, the actual changes in several of the 'omitted variables' such as life expectancy, hours worked, inflation and unemployment also contribute to happiness over this time period since life expectancy has risen and the others have, on average, fallen. Consequently the unexplained trend in happiness is even bigger than would be predicted if income was the only argument in the utility function. In other words, introducing omitted variables worsens the income-without-happiness paradox.

JEL classification: D63; H00; I31; O00; Q3
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1. Introduction

> [It] does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our courage, nor our wisdom, nor our devotion to our country. It measures everything, in short, except that which makes life worthwhile.... Senator Robert Kennedy on GDP[2]

A number of social observers have pointed out that the enormous increases in income in the industrial democracies over the last century do not seem to be accompanied by differences in happiness.[3] In a seminal

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[2] Cited in Mankiw (1999).
[3] Early warnings on the limits to growth were made by the Club of Rome in 1972. See also Scitovsky (1976) and Hirsch (1976).

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paper, Easterlin (1974) showed that one could approach these issues using what are now called "happiness data", namely the responses that individuals give concerning a simple well-being question such as "Are you happy?". Using data for the US, he showed that happiness responses in a particular year were positively correlated with an individual's income. But over time, average happiness responses were untrended in spite of a sharp increase in average income levels. More recently, Blanchflower and Oswald (2000) showed a similar pattern for the period following the publication of Easterlin's paper (see also Easterlin, 1995). Similar findings, or with slight detectable trends, have been observed in a variety of countries (see, for example, Veenhoven, 1993; Inglehart and Klingemann, 2000).

Economists have argued that these findings reflect the fact that the true utility function looks different from that assumed in the standard model. Easterlin (1974) argued that a utility function capturing a concern for relative income could explain these findings.[4] Others contend that comparisons with one's own past are enough to explain the puzzle. For example, habit formation may lead individuals to become accustomed to high income, so that only increases in income result in happiness gains (see Frederick and Loewenstein, 1999, for a review).[5] In this paper we do not deny the importance of this view, or the usefulness of a broader theoretical approach based on psychology. In fact our approach can be regarded as a direct application of experienced utility theory (see, for example, Kahneman and Thaler, 1991).[6] But we argue that a natural hypothesis is that omitted variables could also explain it.

Thus, we study if the apparent paradox of flat happiness with rising income is not simply a result of failing to take into account changes in other relevant variables such as pollution or hours worked, to name just two variables that could have accompanied income growth and that a standard model predicts may reduce utility.

Our approach, then, echoes the arguments made in debates surrounding the appropriateness of using GDP as an indicator of development. In 1973 William Nordhaus and James Tobin famously asked "Is growth obsolete?". Their answer was a partial yes. They argued in favor of making adjustments to GNP so that some value was given to leisure and household work and some costs to urbanization. They then constructed what they called a *Measure of Economic Welfare* for the American economy and observed that it grew like GNP over the period under study, albeit more slowly. The Kennedy quote at the beginning of the paper shows the enormous appeal that this logic has, well beyond economists. Indeed, a variety of authors and organizations have advocated more comprehensive measures of well-being, capturing other elements of modern life besides income, in particular environmental degradation.[7] We offer some guidance on the weights to be used in such aggregation.

The present paper studies these questions by relying on a variant of the happiness data analyzed by Easterlin (1974). These consist of the answers given by hundreds of thousands of people, across many countries and years, to a simple well-being question such as "On the whole, are you satisfied with the life you lead?". Such data have been used extensively in psychology research where it is argued that the data pass a series of what are sometimes called validation exercises (see, for example, Kahneman et al., 1999). The most convincing of these, perhaps, consist of showing that happiness data correlate well with variables that are associated with physical manifestations of true internal happiness, such as smiling or electronic readings of the part of the brain that governs positive

[4] The main challenge for including interdependent preferences seems to be deriving restrictions on equilibrium behavior to provide the theory with empirical bite. The literature on the topic is quite large. Pollak (1976), Hirsch (1976), Scitovsky (1976), Frank (1985, 1999) and Clark and Oswald (1998), amongst others, as well as Veblen (1899) and Duesenberry (1949), have made related arguments. Frey and Stutzer (2002) and Stutzer (2004) discuss relative income and the happiness evidence. Brown, Gardner, Oswald and Qian (2004) argue that it's a person's ranked position that matters (instead of their wage relative to the average wage).

[5] See also Duesenberry (1949), Pollak (1970), Carroll et al. (2000), Clark (1999), Easterlin (2001) and Di Tella, Haisken-De New and MacCulloch (2007).

[6] Rabin (1998) makes the connection to well-being data explicitly. Ng (1996) discusses the theoretical structure of subjective well-being responses while Kahneman et al. (1997) propose a formal axiomatic defense of experienced utility (see also Tinbergen, 1991; van Praag, 1991). van Praag (1971) is an early attempt to operationalize the concept of experienced utility based on verbal qualifiers, focusing on income satisfaction. See also Section 2 in Frey and Stutzer (2002).

[7] There are many such general measures of welfare based on multiple indicators. Considerable impetus to develop a national environmental indicator set occurred following the 1989 G-7 Economic Summit Leaders' request to the OECD to develop indicators in the context of improved decision-making. Canada is one of the most advanced in this respect, having passed the Well-Being Measurement Act (Bill C-268) for the purpose of developing and publishing measures to indicate "the economic, social and environmental well-being of people, communities and ecosystems in Canada". Its' key provisions require a Standing Committee of the House of Commons to "receive input from the public through submissions and public hearings" so that they can identify "the broad societal values on which the set of indicators should be based". See also Dasgupta (2000). Nordhaus (2002) proposes how to incorporate improvements in health.

emotions.[8] Although subjective data have been used extensively in some fields in economics, such as contingent valuation studies, happiness data require only a minimum of information processing and understanding of the workings of the economy (see Diamond and Hausman, 1994, for a criticism of the kind of subjective data used in contingent valuation studies).

Following Easterlin's paper, a small happiness literature has emerged in economics.[9] The literature on the relationship between income and happiness includes (besides the papers cited above) Winkelmann and Winkelmann (1998) who use individual panel data for Germany, Di Tella et al. (2003) who look at the evidence on changes in income across a panel of 12 OECD countries and Gardner and Oswald (2001) who use data on lottery winners. Happiness data have also been used to investigate a number of other outstanding issues in economics, including the costs of falling unemployed (Clark and Oswald, 1994), the role of democratic institutions (Frey and Stutzer, 2000), the structure of individual preferences (Konow and Earley, 1999; Luttmer, 2005), the inflation–unemployment trade-off (Di Tella et al., 2001), macroeconomic volatility (Wolfers, 2002), entrepreneurship (Blanchflower and Oswald, 1998), the environment (ch.11 in van Praag and Ferrer-i-Carbonell, 2004), partisan versus opportunistic models (Di Tella and MacCulloch, 2005), inequality (Alesina et al., 2004; Graham and Pettinato, 2002), public policy on addiction (Gruber and Mullainathan, 2002) and the role of social norms and social capital (Luttmer, 2005; Stutzer and Lalive, 2000). Using data on OECD and non-OECD nations, Helliwell (2003) suggests that happiness depends on factors like the effectiveness and stability of government, the rule of law and the control of corruption. He finds that these 'quality of institutions' effects are large compared to those coming from economic growth. See Frey and Stutzer (2002) for a review.

The strategy for this paper, in a nutshell, consists of focusing on the components of individual preferences as they appear in a standard textbook formulation. These include income, the variability of income, effort when working, leisure, the quality of leisure and the expected time horizon. We then find empirical proxies and check how the relationship between income and happiness fares after controlling for these other plausible correlates of happiness. We then estimate the part of the change over time in reported happiness that can be accounted for by changes in each variable to see which ones have made the biggest contribution to happiness over the period from 1975 to 1997. The rest of the paper is organized as follows. Section 2 describes our data set, the basic theory and empirical strategy. Section 3 has two parts. In Section 3.1 we present our basic results on the determinants of happiness, while Section 3.2 uses these estimates and the actual changes in the variables under study to account for the changes in happiness across Europe and the US over the 23-year period covered in our sample. Section 4 concludes.

2. Data, theory and empirical strategy

2.1. Well-being data

The use of subjective data implies a departure from traditional economics, where individual preferences are inferred by choices made rather than vague notions of how people say they feel or what they say they want. The principle is made explicit in the work on revealed preference (Samuelson, 1948). A relatively recent development is the interest in data on people's opinions regarding some variable of interest. Perhaps the most convincing work deals with the taste for redistribution (see Luttmer, 2001; Alesina and La Ferrara, 2005) and the study of motivation (Frey et al., 1996). This approach relies on the individual's ability to formulate an opinion on the topic being asked. For example, if they are asked about cuts in the welfare state they are assumed to be able to form an intelligent opinion on the subject that incorporates the relevant information, such as the tax gains and insurance losses that arise or any reductions in the unemployment rate that can occur. In fact, the use of these kind of data for valuation of the environment has been criticized precisely on these grounds (e.g., see Diamond and Hausman, 1994, and Section 3.1 on the environment below).

An approach that reduces the informational and computational burden on the individual is to simply ask them a well-being question and then correlate the answers with changes in the variable of interest. For example, in order to investigate the benefits of the welfare state, the approach consists of asking individuals if they are happy and then see if this correlates with changes in some

[8] On electroencephalogram measures of prefrontal brain activity, see Sutton and Davidson (1997). On heart rate and blood pressure measures of responses to stress, see Shedler et al. (1993). Di Tella et al (2003) show that micro-happiness regressions (where well-being answers are regressed on personal characteristics of respondents) have a similar structure across a number of nations. This is an unlikely outcome if the data contain no information. For more on validation, see Section 3.

[9] Argyle (1987), ch. 5, discusses the vast psychological literature on income and happiness. For references to the literature on subjective well-being in psychology and political science, see Diener and Suh (2000), Veenhoven (1988, 1998), Inglehart (1990) and Lane (2002).

parameter measuring the generosity of the welfare state. This relies only on the ability of individuals to evaluate their own level of happiness with some precision. Psychologists, who have worked with these data have provided an array of evidence showing that well-being data are correlated with physical reactions that are associated with true happiness. These include Pavot (1991) and Ekman et al. (1990) who find that individuals reporting to be very happy tend to smile more (i.e., the duration of so-called "Duchenne smiles"). Shedler et al. (1993) show that happiness data are negatively correlated with heart rate and blood pressure measures of responses to stress and Sutton and Davidson (1997) show that happiness data are positively correlated with electroencephalogram measures of prefrontal brain activity (the part of the brain that is associated with optimism and other positive states of mind). Lastly, average happiness level within countries appears to be negatively correlated with suicide rates, an event that presumably expresses true internal unhappiness (see Di Tella et al., 2003).

Konow and Earley (1999) discuss other studies that are helpful in assessing the validity of well-being data, some of them based on correlating the data with other subjective data. Siedlitz et al. (1997), for example, show that happiness data correlate well with subject recall of positive life events. Diener (1984) and Sandvik et al. (1993) have shown that the data correlate with reports of friends and family members on the subject's well-being. A potential problem with all subjective data is framing, the fact that sometimes apparently similar questions elicit different answers depending on the way they are asked. The validation exercises described above indicate that the framing problem with happiness data is small. Furthermore, Fordyce (1988) shows that the different measures of well-being correlate well with one another, which has been later confirmed by Konow and Earley (1999) with experimental data, Blanchflower and Oswald (2000) for data from the UK and the US and Di Tella et al. (2003) for data from 12 OECD countries. The psychology literature has also considered the possibility that subjects are influenced by what they believe to be the socially desirable response when they answer surveys. If the social norm is to be happy, subjects may bias their response upwards. Since the first studies in the area, psychologists have found evidence pointing out that this concern may be exaggerated (e.g., Rorer, 1965; Bradburn, 1969). Konow and Earley (1999) present experimental evidence showing that the Marlowe–Crowne measure of social desirability is uncorrelated with happiness data.

A different approach to study the validity of happiness data is taken in Di Tella et al. (2003). They present micro-econometric happiness and life satisfaction regressions for 12 European countries and the US. These regress the well-being answers on a set of personal characteristics, including age, sex, education, employment status, income, and marital status. They show that these equations share a similar structure across countries, an unlikely event if the data contain no information.

2.2. Data sources

Our main data source is the Euro-Barometer Survey Series, which interviews a random sample of Europeans during the 23-year period covering 1975–97 and asks a series of socio-economic questions. The main question of interest asks: "On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?" (The small "Don't know" and "No answer" categories are not studied here). Data are available on this question for just under half a million people (or 481,712 observations to be precise). However this reduces to 344,294 observations for which a complete set of data on a large number of personal characteristics, which are needed for our subsequent tests, is also available. Another well-being question asking respondents simply how happy they are is also available from Euro-Barometer, but is only asked for a shorter period, 1975–86. "Happiness" and "life satisfaction" are highly correlated (the correlation coefficient is 0.56 for the period 1975–86) and previous work has found that similar conclusions are reached with both data sets. In fact, the life satisfaction question was included in the survey in part because the word "happy" translated imprecisely across languages.

Well-being data for the U.S. comes from the United States General Social Survey (GSS, 1972–2000). There is no "life satisfaction" question available. Instead, there is a "happiness" question that reads, "Taken all together, how would you say things are these days — would you say that you are very happy, pretty happy, or not too happy?" (Small "Don't know" and "No answer" categories are not studied here). This was asked in each of 18 years between 1975 and 1997 (in some years no GSS was conducted) and we use the responses of 26,855 individuals. In order to include the U.S. data into a data set that also contains the Euro-Barometer data we converted the European answers into three categories by merging the answers in the bottom two categories ("not very satisfied" and "not at all satisfied"). We tried a second method, where we assumed simply that were a 4th additional happiness category offered in the U.S., it would have been empty. This resembles closely the actual distribution of answers in Europe, in which only 4.8% of

Table A
Happiness in 12 OECD nations (Europe and the United States): 1975 to 1997

YEAR	Europe				United States		
	Not at all satisfied	Not very satisfied	Satisfied	Very satisfied	Not too happy	Pretty happy	Very happy
1975	3.9	12.8	55.7	27.6	13.2	54.5	32.3
1976	4.2	13.8	53.6	28.4	12.2	53.2	34.6
1977	4.4	13.4	52.2	29.9	11.5	53.4	35.1
1978	4.5	12.3	52.3	30.9	9.2	56.6	34.3
1979	4.4	13.5	52.1	30.0	*n.a.*		
1980	4.1	12.9	53.7	29.3	13.2	53.5	33.3
1981	6.8	14.4	49.5	29.3	*n.a.*		
1982	4.1	13.0	53.7	29.2	12.7	55.0	32.2
1983	6.0	14.5	54.5	25.1	13.2	55.7	31.1
1984	5.5	14.7	53.2	26.7	12.7	52.5	34.8
1985	6.0	16.2	53.7	24.0	11.2	60.4	28.4
1986	5.9	15.7	54.5	23.9	10.7	56.7	32.6
1987	5.7	16.1	54.7	23.6	12.2	56.5	31.3
1988	5.3	20.0	51.4	23.4	9.1	56.8	34.1
1989	4.3	12.8	55.8	27.1	9.7	57.4	33.0
1990	4.5	11.1	52.7	31.8	9.0	56.8	34.3
1991	3.7	13.6	54.5	28.3	11.0	58.5	30.5
1992	4.4	14.5	54.4	26.7	*n.a.*		
1993	5.2	16.1	53.8	25.0	11.5	57.9	30.6
1994	4.5	15.2	55.0	25.3	11.9	59.6	28.5
1995	5.0	14.6	55.6	24.8	*n.a.*		
1996	4.3	14.4	58.2	23.1	11.5	57.8	30.8
1997	4.5	16.8	53.8	24.9	*n.a.*		

Notes: All numbers are expressed as percentages. For Europe they are based on a total 344,294 observations and for the United States a total of 26,855 observations. For the United States, '*n.a.*' refers to '*not available*' data due to there being no General Social Survey conducted for these years.

people chose the bottom category. The two methods yield similar conclusions. Our results are also robust to using the original four categories for Europe and excluding the U.S. from our sample. Table A reports the time series of our happiness data for Europe and the U.S. The data point in the direction of general happiness, as most people are satisfied with their life. Table B reports summary statistics for the aggregate variables, including measures of both between- and within-group variation.

2.3. Theory and empirical strategy

We assume individual preferences can be described by:

$$\text{Utility} = U(\text{MACRO}, \text{MICRO}) \quad (1)$$

The basic linear regression that we seek to estimate is of the form:

$$\text{HAPPINESS}_{\text{ist}} = \alpha\text{MACRO}_{\text{st}} + \beta\text{MICRO}_{\text{ist}} + \eta_s + \lambda_t + \mu_{\text{ist}} \quad (2)$$

where HAPPINESS_{ist} is the utility of individual i, who lives in country s, in year t. The vector, MACRO_{st}, refers to a set of variables aggregated at the country level that vary with each year and the vector, MICRO_{ist}, refers to a vector of personal characteristics of the individual.[10] Since individuals may be affected by health and environmental quality (e.g., see Murphy and Topel, 1999) empirically we allow for utility levels to vary with the country's life expectancy (Life expectancy), individual age (Age) and level of total sulphur oxide emissions in kilograms per capita (SOx emissions). Another possibility suggested in opinion polls is that individuals are more stressed when the level of crime in society (Crime) is high.

Individual utility may also depend on both income and leisure. Employed individuals derive income from work and receive benefits when unemployed. We proxy the latter by Benefits, the parameters of the unemployment benefit system as summarized by the OECD. Individuals are assumed to have to carry nominal money balances for transactions purposes, something that is negatively

[10] An open question in the happiness literature is that individuals may be appealing to two related but different notions of well-being when they answer, namely their instantaneous happiness or their lifetime expected utility. If it is the former, one would expect variables that should affect individuals in the future (such as life expectancy) to play a less important role.

Table B
Summary statistics for aggregate variables, 12 OECD nations: 1975–97

Variable	Units	Observations	Mean	SD	Minimum	Maximum
GDP per capita	GDP (1990 US$ and *x*-rates)	Total=245	16,414	5159	5284	30,411
Between		n=12		5175	6874	24,407
Within		$\bar{t}$=20.4		2212	11,155	24,741
GDP per capita (in logs)	log GDP (1990 US$ and *x*-rates)	Total=245	9.647	0.365	8.6	10.3
Between		n=12		0.385	8.8	10.1
Within		$\bar{t}$=20.4		0.136	9.3	10.2
GDP growth	Δ GDP (1990 US$ & *x*-rates)	Total=245	324	342	−563	1757
Between		n=12		112	91	537
Within		$\bar{t}$=20.4		325	−552	1545
GDP growth (in logs)	Δ log GDP (1990 US$ & *x*-rates)	Total=245	0.021	0.021	−0.030	0.107
Between		n=12		0.009	0.011	0.041
Within		$\bar{t}$=20.4		0.020	−0.030	0.087
Unemployment rate	Proportion	Total=245	0.093	0.039	0.032	0.241
Between		n=12		0.039	0.063	0.203
Within		$\bar{t}$=20.4		0.023	0.035	0.142
Inflation rate	Proportion	Total=245	0.069	0.055	−0.007	0.245
Between		n=12		0.035	0.032	0.161
Within		$\bar{t}$=20.4		0.044	−0.037	0.231
Unemployment benefits	Proportion (b/w)	Total=245	0.296	0.164	0.003	0.731
Between		n=12		0.162	0.022	0.583
Within		$\bar{t}$=20.4		0.037	0.155	0.443
Crime rate	log (total per 100,000 people)	Total=245	4.034	1.500	−0.105	6.220
Between		n=12		1.515	0.815	5.787
Within		$\bar{t}$=20.4		0.612	1.500	5.803
SOx emissions	kg per capita	Total=245	48.8	23.1	8	103
Between		n=12		18.4	20.8	90.0
Within		$\bar{t}$=20.4		15.3	9.4	82.3
Life expectancy	Years	Total=245	75.2	1.6	71.3	78.5
Between		n=12		1.1	73.7	77.3
Within		$\bar{t}$=20.4		1.3	72.0	78.7
Divorce rate	Total per 1000 people	Total=245	1.745	1.264	0	5.220
Between		n=12		1.323	0	4.832
Within		$\bar{t}$=20.4		0.268	0.447	3.279
Hours worked	log (Annual hours)	Total=245	7.462	0.031	7.377	7.555
Between		n=12		0.006	7.441	7.464
Within		$\bar{t}$=20.4		0.031	7.377	7.555
Openness	log((imports+exports)/GDP)	Total=245	−0.542	0.522	−1.845	0.430
Between		n=12		0.533	−1.675	0.250
Within		$\bar{t}$=20.4		0.095	−0.877	−0.257

Note: SD is the Standard Deviation.

affected by the level of inflation (Inflation). Individual net income can be decomposed into each person's position relative to the mean (Personal income position) and the country mean (GDP per capita). This allows us to distinguish the effect of an increase in income relative to the rest of the population (status or relative income effects), from the effects of a general increase in income in the population. In summary, an individual's income can be expressed as $r_{ist}\, GDP_{st}$ so that applying logarithms we get $\log r_{ist} + \log GDP_{st}$ (the two terms included in our regression). We also include a 'change in income' term proxied by the growth rate of the economy (GDP Growth). Relative income and adaptation are the two main alternative hypotheses to explain the Easterlin paradox besides omitted variables.

The effect of leisure on utility is assumed to depend on its' quantity and quality. Empirically, the quantity of leisure is proxied by (the inverse of) the annual average of hours worked in the country (Hours worked). It's hard to think of convincing proxies for the quality of leisure given the enormous variation in the way individuals spend their free time. We assume, however, that most people value being part of a strong and cohesive family. One possible way to capture this effect is by including the rate of divorce in each country (Divorce) and individual controls for being married (Marital status) and for the

number of children (Children). Second, it is likely that individuals who have retired have more time for leisure than employed individuals, leading us to include indicators for retired status (Retired). A third approach to capture the quality of leisure is by including information on the characteristics of the place where individuals live, such as the size of their city of residence (Size of community). Big cities, on the one hand, are expected to have more amenities, such as cinemas and restaurants, which are expected to increase the quality of leisure time. On the other hand, cities may be crowded, commuting time is often long and scenic views and other natural amenities are scarcer.

Finally, individual preferences typically posit that uncertainty is an important component of well-being. Forward-looking individuals know that with some probability they will be unemployed. The costs of falling unemployed depend on the income received while unemployed (Benefits) and the expected duration of unemployment spells. The latter depends on (and is proxied by) the unemployment rate (Unemployment rate). There may also exist non-economic costs of falling unemployed, such as emotional distress and any change in future expectations due to updates in individual ability. Thus, we control for individual unemployment status (Unemployed). Likewise, certain types of employment have higher non-pecuniary returns; the self-employed being an obvious candidate as they have the benefit of not having a boss (Self employed). We allow the probability of losing a job to depend on how good employment (and income) prospects are in the future, given by the degree of openness of the economy to external shocks (Openness). Finally, educated individuals are more easily re-hired, as witnessed by their lower unemployment rate. Accordingly, we include individual educational attainment (Education). We also include dummy variables for each country, η_s, and for each year, λ_t, and an (i.i.d.) error term, μ_{ist}. Robust standard errors are computed, where we correct for potential heteroscedasticity and for potential correlation of the error term across observations (see Moulton, 1986). See the Appendix for the definition and sources of all variables.

We also interact the macro-variables with personal characteristics that the theory predicts are important:

$$\text{HAPPINESS}_{ist} = \alpha \text{MACRO}_{st} + \beta \text{MICRO}_{ist} + \delta \text{INTERACT}_{ist} + \eta_s + \lambda_t + \mu_{ist} \quad (3)$$

An example is the interaction of SOx emissions with the age of the respondent as there is a large literature suggesting that the young are especially hurt by environmental degradation. In these regressions a concern with omitted variable bias is reduced by our focus on the happiness of a group *relative* to that of another group. This approach uses the base group as a way to control for other aggregate shocks than the ones we are capturing with our macroeconomic controls (see Di Tella and MacCulloch, 2005; Gruber and Mullainathan, 2002).

Estimation of Eqs. (2) and (3) is constrained by the fact that we cannot directly observe the latent continuous variable, HAPPINESS_{ist}. We have data on the individual self-reported well-being from a "life satisfaction" question in Europe and a "happiness" question in the U.S. Since such proxies for each individual's level of utility are based on data that give us only an ordinal ranking, we are unable to use an Ordinary Least Squares regression. What we do observe are several discrete response outcomes that come from a well-being question like: "Are you Satisfied with the life you lead?". From these, we can define the following dichotomous variables: $\text{Happy}^1_{ist}=1$ if the person responds "Not at all satisfied" and 0 otherwise; $\text{Happy}^2_{ist}=1$ if the person responds "Not very satisfied" and 0 otherwise, $\text{Happy}^3_{ist}=1$ if the person responds "Fairly satisfied" and 0 otherwise; $\text{Happy}^4_{ist}=1$ if the person responds "Very satisfied" and otherwise. The ordered probit model that is consequently used to estimate Eqs. (2) and (3) assume that $\text{Happy}^1_{ist}=1$ if $\text{HAPPINESS}_{ist}<c_1$; $\text{Happy}^2_{ist}=1$ if $c_1<\text{HAPPINESS}_{ist}<c_2$; $\text{Happy}^3_{ist}=1$ if $c_2<\text{HAPPINESS}_{ist}<c_3$ and $\text{Happy}^4_{ist}=1$ if $\text{HAPPINESS}_{ist}>c_3$, where c_1, c_2 and c_3 are the thresholds that the latent variable must cross to change the value of the corresponding dichotomous variable.[11]

3. Results

3.1. Empirical results

Our basic set of results is reported in Table 1. We include two specifications, one for Europe plus the United States and the other just for Europe. The latter are reported to ensure consistency across the wording of the well-being question (which refers to 'Life satisfaction' in Europe but 'Happiness' in the US, as detailed in Section 2). After discussing the sign and size of the effects of the variables of interest, we then undertake a 'Happiness Accounting' exercise. This entails calculating the total change in utility from the beginning to the end of our sample period (i.e., from 1975 to 1997) and then

[11] For more discussion of the specification issues arising from estimation of this model, see Di Tella and MacCulloch (2005).

Table 1
Happiness equations for 12 OECD Nations from 1975 to 1997

Dependent variable: Life satisfaction		(1)		(2)	
		Europe and United States		Europe	
		Coefficient	Standard error	Coefficient	Standard error
Aggregate variables					
GDP per capita		**0.455**	0.179	**0.539**	0.235
GDP growth		**1.098**	0.575	1.138*	0.618
Life expectancy		0.032	0.021	0.034	0.022
SOx emissions		**−0.003**	0.001	**−0.003**	0.001
Hours worked		**−1.192**	0.337	**−1.352**	0.451
Crime rate		−0.029*	0.017	−0.023	0.018
Divorce rate		−0.056*	0.035	−0.050	0.038
Inflation rate		−0.755*	0.416	**−0.839**	0.438
Unemployment rate		**−2.797**	0.556	**−2.761**	0.652
Openness		−0.186*	0.105	**−0.265**	0.118
Unemployment benefits		**0.723**	0.167	**0.754**	0.168
Personal characteristics					
Personal income position		**0.453**	0.015	**0.464**	0.016
Employment state	Unemployed	**−0.491**	0.015	**−0.495**	0.016
	Self-employed	**0.031**	0.009	**0.026**	0.010
	Retired	**0.046**	0.013	**0.046**	0.013
	Keeping home	0.014*	0.008	**0.016**	0.008
	In school	**0.202**	0.016	**0.195**	0.017
Male		**−0.071**	0.006	**−0.069**	0.007
Age		**−0.029**	0.001	**−0.029**	0.001
Age squared		**3.3e−4**	1.0e−5	**3.3e−4**	1.1e−5
Education	Lower	**0.062**	0.008	**0.062**	0.008
	Higher	**0.167**	0.011	**0.167**	0.012
Marital status	Married	**0.144**	0.009	**0.132**	0.009
	Defacto	**0.030**	0.014	0.021	0.013
	Divorced	**−0.240**	0.012	**−0.262**	0.013
	Separated	**−0.333**	0.017	**−0.336**	0.019
	Widowed	**−0.157**	0.011	**−0.151**	0.011
Size of community	Middle	**−0.038**	0.007	**−0.039**	0.007
	Large	**−0.139**	0.009	**−0.140**	0.010
Year dummies		Yes		Yes	
Country dummies		Yes		Yes	
Number of observations		371,149		344,294	
Pseudo R^2		0.092		0.094	

Notes: [1] Regressions are ordered probits. Bold-face is significant at 5% level; * is significant at 10% level. [2] Log likelihood of reg. (1)=−370,982; Log likelihood of reg. (2)=−346,176. [3] Cut points (standard errors) are −41.3 (12.4), −40.4 (12.4), −38.7 (12.4) for reg. (1); −49.5 (17.8), −48.6 (17.8), −46.9 (17.8) for reg. (2). [4] Clustered standard errors. [5] The Dependent variable is the categorical response to the question "On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?".

decomposing the change into its' parts that derive from the changes in each of our explanatory variables.

3.1.1. Income I: levels

A key component of utility is income, from which consumption is derived. As explained above, it is possible to express individual income as the product of the individual's position relative to the country mean income times the country mean income. Applying logs, we can express the logarithm of income as $\log r_{ist} + \log GDP_{st}$. These two terms are included in our regression (called Personal income position and GDP per capita respectively). This is useful because it allows us to distinguish the effect of an increase in income that takes place in the context of a general increase in income in the population, from an increase in income relative to the rest of the population.

Both the Personal income position and the level of absolute income seem to matter, as both coefficients are positive and significant at conventional levels. Interestingly, we cannot reject equality of the coefficients (both

are approximately equal to 0.5). This means that we *can reject* the hypothesis that relative income matters, at least in the sense that it means something more than just a concern for income.[12] If we repeat exactly the same specification as in column (1) but with the two dimensions of income variation combined into a single measure of a person's absolute level of income given by log y_{ist} (where log y_{ist}=log r_{ist}+log GDP_{st}) then we can get a rough feel for the absolute size of the effect of an increase in income on happiness. If a person on the mean level of income experiences an increase in their income by 5% then he/she should also be 1 percentage point more likely to declare him/herself as being in the top happiness category. Finally, we experimented with a linear measure and a squared term (i.e., by the inclusion of y_{it} and its square).[13] The results show a strong positive effect of the linear term and negative effect of the squared term. Using the specification in column (1) the coefficient on the linear term is 5.4e−5 (t-stat=20.1) and on the squared term is −7.0e−10 (t-stat=−12.4).

3.1.2. Income II: GDP growth

Changes in income may affect happiness beyond a level effect. The effect of higher income may be only temporary as individuals gradually adapt to their better standard of living, leading to differential short and long-run effects. Also, expectations for the future should affect present levels of well-being. A simple indicator of how bright or bleak the future looks, both in terms of likely employment status as well as income, is provided by the rate of growth of the economy. The results show, as expected, a positive and significant effect of GDP Growth. We can estimate the size of these effects in terms of individual income. A 1-percentage point increase in the GDP growth rate (say from 2 to 3 percentage points per annum) is equivalent to increasing an individual's present level of income by 2.4%.[14] Looking at the size of the effect a different way, an increase in GDP Growth of 3 percentage points is predicted to move 1 extra percentage point of the population up to the top happiness category.[15]

It is often a claimed effect that some people are more likely to be affected by the opportunities presented by economic growth. The group that should be especially affected is the group of employed workers whose incomes may rise. We can test for this effect by interacting GDP Growth with an employment dummy, whose coefficient turns out positive and significant, at the 5% level. The sub-group of employed who may be expected to benefit the most from higher growth in the economy are the Self-employed. This is also where our data show the biggest (positive) effects on happiness of economic growth to be concentrated. When an interaction is included, the coefficient on Self-employed is 0.003 (statistically insignificant) while the interaction of the Self-employed dummy with GDP Growth equals 1.31 (significant at the 1% level). As a reference, note that the coefficient on being divorced is equal to −0.24 (most coefficients presented in Table 1 remain largely unchanged).

3.1.3. Life expectancy

Unless there is infinite discounting, individuals care about the number of years they expect to live. Economists have devised a variety of approaches to derive the value of a life. A simple and persuasive approach was taken in Thaler and Rosen (1975), based on the theory of compensating differentials. Since jobs that carry a higher risk of losing your life have higher wages, they were able to derive an implicit value of a life, as derived by individual employment choices in the free market, at approximately $175,000 in 1967. In 2000 dollars this equals approximately $772,000.[16] In general, more recent estimates have been higher. For example, using consumption activities that affect risk and hypothetical markets yields valuations of a life that range around $1–9 million (see Blomquist, 2001, and for a general review, Viscusi, 1993).[17] Valuing life is also an important aspect

[12] This is so because a finding that α and β have similar size in the regression, HAPPINESS$_{ist}$=α log r_{ist}+β log GDP$_{st}$+ε_{ist} suggests that HAPPINESS$_{ist}$=α log y_{ist}+ε_{ist} is a sufficient description of the role of income in preferences (since log y_{ist}=log r_{ist}+log GDP$_{st}$). This conclusion is subject to the usual constraints arising from using low precision personal income data derived from surveys, making measurement error issues non-trivial.

[13] Throughout the paper we report the results using variations in the basic specifications to deal with hypotheses that have been suggested in the literature. We do not include the tables but all results are available upon request.

[14] This calculation is made as follows. A 1 percentage point higher growth rate is equivalent to a 2.4% rise in one's Personal income position since $0.45 * \log(1.024) \approx 1.1 * 0.01$.

[15] Since $0.01 = \Phi(-39.4 + 0.03 * 1.1 - (-38.7)) - \Phi(-39.4 - (-38.7))$ where $\Phi(.)$ is the standard normal distribution, the top cut point of the ordered probit regression in column (1) of Table 1 equals −38.7 and the mean score is −39.4.

[16] Since (GDP deflator in 2000)/(GDP deflator in 1967)=4.41.

[17] Policymakers must regularly use estimates of how much is a human life worth. Viscusi (2002) explains that amongst government agencies, the Federal Aviation Authority places the lowest value on a human life ($3 million), while the Environmental Protection Agency uses the highest figures (up to $88 million). In February 2002, for example, the United States (EPA) used an estimate of $4.8 million in 1990 dollars for a life (see *Guidelines for Preparing Economic analyses*.)

of work that values medical research (see, for example, Murphy and Topel, 1999; Cutler and McClellan, 2001).

As in previous work, happiness is u-shaped in age (e.g., Clark and Oswald, 1994). Importantly, we find a positive coefficient on Life expectancy in columns (1) and (2), both significant at the 12% level. Care should be exercised when interpreting this coefficient for two reasons. First, life expectancy may be correlated with health conditions. Second, if we try a similar specification but control for some other plausible determinants of happiness (such as income inequality) then the size of the coefficient on Life expectancy increases by almost 50% and becomes significant at the 3% level (results available on request). Using the coefficients in Table 1, we can put a dollar value on the size of these effects. One more year of life is equivalent to an increase in the level of GDP per capita of 6.6 percentage points (= exp(0.032/0.5) − 1). In the United States, where GDP per capita was equal to $24,849 this is equivalent to valuing an extra life-year at $1640 (in 1990 values). In 2000 dollars it equals $2052. In other words, a person who expects to live one year longer due to a reduction in the risk of death is willing to pay $2052 in annual income in exchange. (This compares with a value of $3000 in annual income calculated by Murphy and Topel, 1999, for a 30 year old, corresponding to a total value over their remaining life of about $150,000). Auxiliary regressions suggest that the positive effect of longer life expectancy is weaker for older people, as in Murphy and Topel (to the extent that longer life expectancies have been associated with higher survival rates).[18] In terms of the unemployment rate, denying an individual one year of life expectancy has an equivalent cost to increasing the unemployment rate by 1.1 percentage point (=1 * 0.032 / 2.8).

3.1.4. The environment and pollution

Environmental degradation can have adverse effects on individual utility. Previous work has emphasized effects on human health and the destruction of natural resources. In this paper we focus on sulphur oxide emissions measured in kg per capita (SOx emissions), a type of pollutant with non-local effects that is the focal point of most acid-rain legislation.[19] We concentrate on SOx emissions as this type of pollution has been a central preoccupation of policymakers and there is readily available data going back two decades. Economic methods for measuring the value of the environment that depend on observed behavior, such as those based on hedonic property values or travel costs, have somewhat limited scope. Methods based on hypothetical variations, namely contingent valuation studies based on surveys, have thus been the main approach in the literature (Hanemann, 1994, provides a survey; see also the collection of papers in Stavins, 2000). A serious concern with these studies is the classic problem of question framing and that respondents may bias their answers to influence their preferred outcome (this is sometimes called strategic bias).[20]

Our approach based on happiness data (see also Welsch, 2002) suggests that the level of SOx emissions has an adverse effect on reported well-being in column (1) of Table 1, significant at the 1% level. A one standard deviation increase in SOx emissions, equal to a rise of 23 kg per capita, has a decrease on well-being equivalent to a 15% drop in the level of GDP per capita (= exp (23 * 0.003 / 0.5) − 1). This is also equivalent to 40% of a one standard deviation change of GDP per capita across the sample. Since the drop in SOx emissions in the United States (as well as most other leading industrialized nations) has been similar to the above magnitude (from 100 kg per capita in 1975 down to 70 kg in 1997 for the US) these numbers suggest there are substantial corresponding gains to average well-being. Note that this is over and above any health effects captured in life expectancy.

The literature suggests that the negative effects of a bad environment are felt more by the young than the old, and by the rich rather than the poor. When the interaction term, SOx emissions * Age, is included in the specification in

[18] Murphy and Topel (1999) indicate "that increases in life expectancy are worth more when survival rates are higher. This is perhaps our most interesting result and has many implications. It accounts for the relatively low value placed on even large reductions in death rates at very old ages. At old ages the expected remaining length of life is so low that marginal increases in life have relatively low value". Improvements in life expectancy in their model have their greatest values at around age 40 years for women and between 40 to 55 years old for men (see pp 20–21).

[19] SOx emissions is widely considered the best single proxy for local and non-local effects. Coal powered electricity generating plants produce most SOx (and about 1/2 of NOx gasses). This type of gas is related to the first recorded event of pollution-related deaths — the 1952 London smog that led to more than 12,000 deaths. For an interesting study of the environment (noise) using happiness data, see van Praag and Ferrer-i-Carbonell (2004).

[20] Tietenberg (2000) lists two other types of bias present in such studies: that occurring when respondents are asked to value attributes with which they have little experience (information bias), and the bias introduced by respondents who treat a hypothetical survey in a casual manner (hypothetical bias). Diamond and Hausman (1994) describe these and other problems with such studies and conclude that "contingent valuation is a deeply flawed methodology for measuring nonuse values, one that does not estimate what its' proponents claim to be estimating" (see pg 62).

column (1), the coefficient on SOx emissions becomes more negative whereas the interaction term is positive and significant at the 1% level. Its' size indicates that the negative effect of SOx emissions on the happiness of a 20 year old is more than twice the size of the effect on a 70 year old (i.e., −0.038 for the former compared to −0.018 for the latter). The negative effect is also concentrated in those countries that have a high level of income. The interaction term, SOx * GDP per capita, is negative and significant at the 1% level. For example, in Spain in 1990 where average per capita income was equal to $12,662 (in 1990 dollars) there was no effect of SOx emissions on happiness. However in that year in the US where per capita income equalled to $22,224 (in 1990 dollars) there was a significant negative effect of SOx emissions on happiness that was 1.6 times bigger than the average effect measured across the whole sample of countries (i.e., −0.005 compared to −0.003). The effect is also more negative for richer individuals. For a person on the highest income in our sample ($49,724), a one standard deviation increase in pollution (23 kg/capita) is equivalent to a 17% reduction in income, in terms of lost happiness.

3.1.5. Unemployment rate

Individuals may care about the unemployment rate as this is an indicator of the employment risk that they run, as well as the length of time they may expect to be unemployed if they do fall unemployed. Here, as well as in the next section on inflation, we keep the discussion short as Di Tella et al. (2001, 2003) and Di Tella and MacCulloch (2005) already discuss some of these effects and the related literature. As column (1) shows, being unemployed rather than employed has as bad an effect on happiness as being divorced or separated (rather than married). More precisely, becoming unemployed reduces happiness by 1.3 times the amount due to going from married to divorced (= 0.49/(0.14+0.24)) and by 1.04 times the amount due to going from married to separated (= 0.49/(0.14+0.33)).

Unemployment affects a fairly small number of people at any one time, so that a higher unemployment rate has a fairly small *direct* effect on the average level of happiness. However unemployment may have a much bigger *indirect* effect, through an increased sense of 'fear' at losing one's job, spread throughout the whole population (see Blanchflower, 1991, for survey evidence). This increased sense of insecurity has been well documented (OECD 1997). The effect of a 1 percentage point rise in the unemployment rate has the same effect on happiness as a drop in GDP of 5.7 percentage points (= exp (0.01 * 2.8/0.5) − 1). This rises to 6.8 percentage points once the personal costs of unemployment are added (= exp(0.01 * (2.8+0.5)/0.5) − 1).

In order to probe this channel further we focused on the groups that should be less vulnerable to high rates of unemployment, namely the retired and those at school. For these groups, the unemployment rate has a less negative effect than for those in the labor force. More formally, the interaction term on Retired * Unemployment rate is positive and significant at the 5% level (equal to 0.60) and the coefficient on In school * Unemployment rate is also positive and significant at the 5% level (equal to 0.75). There is also some (weak) evidence that a higher rate of unemployment further decreases the happiness of an individual who is presently unemployed (the interaction term is negative, quantitatively large, and significant at the 17% level). Higher unemployment may increase the expected duration of the unemployment spell for someone who is currently out of work, although this effect may be offset by unemployment becoming less of a stigma.

3.1.6. Inflation rate

The literature has found it difficult to isolate the theoretical reasons behind the public's strong aversion to inflation, at least as reported in public opinion polls. Some have argued that inflation is positively associated with relative price oscillations, and that this increases uncertainty. Others have argued that inflation may reduce the ability to save, including holding real money balances, as some instruments may not be fully indexed. Individuals living on fixed income, such as the retired may be particularly affected. Others have argued that inflation may not be fully anticipated, so that reductions in the real incomes may result. According to column (1), a one-percentage point rise in the level of inflation reduces happiness by as much as a 0.3 percentage point increase in the unemployment rate (= 0.01 * 0.8/2.8). This calculation ignores the personal costs of unemployment incurred by those people who actually lose their jobs. Adding in these costs implies a smaller increase in unemployment of 0.2 percentage points (=0.01 * 0.8/(2.8+0.5)).

We also tested for whether high inflation affected different groups differently. For example, the earlier discussion suggested that the retired may find inflation particularly difficult to cope with. There is no evidence that this group is affected worse by inflation, compared to the employed, since inflation interacted with Retired yields a negative but insignificant coefficient (equal to −0.2 with a *t*-stat of −1.0). However those people with a relatively high Personal income position are affected less negatively than those on low incomes in their country, possibly due to less reliance on fixed incomes. The

coefficient on Inflation rate * Personal income position equals 0.61 and the coefficient on the Inflation rate equals −0.76. Hence a rise from the bottom to the top of the income scale in a country changes the marginal cost of a higher inflation rate from −1.1 to −0.38 (=−0.76–0.61*0.62 to −0.76+0.61*0.62, respectively, since the range of log r_{it} is −0.62 to 0.62).

3.1.7. Unemployment benefits

A standard assumption in economics is that individuals prefer to smooth income. The presence of a system paying out benefits to the unemployed may allow them to do so more easily than in its' absence. The unemployed are expected to have a special need for benefits, but the employed who understand that they may also gain from the system in the future should also experience a welfare improvement from having the system in place. Models of unemployment benefit determination show how they trade off the benefits of more insurance with the tax costs of more generous systems, as well as the incentive costs in terms of higher unemployment (see, for example, Wright, 1986). The desirability of a more generous benefit system can be expected to be higher at times of more employment volatility, something that suggests a line of causality going from unemployment risks to benefits.

Table 1 shows that, keeping the unemployment rate, income, and individual employment status constant, more generous benefits increase happiness. One can calculate how much benefits should increase to compensate people for an increase in the unemployment rate: if the unemployment rate increased by 1 percentage point then a rise in the level of benefit replacement rate of 4 percentage points would be sufficient to keep happiness constant (= 0.01*2.8/0.7). This is equivalent to an increase in the level of benefit generosity from the Irish level of 0.28 to the French level of 0.32. Alternatively, a drop in the replacement rate of 1 percentage point would need to be compensated by a 1.6% increase in GDP per capita in order to keep well-being the same (=exp(0.01*0.7/0.5)−1).

One group who may especially gain from higher benefits is the unemployed. The coefficient on benefits is 7% higher for the unemployed compared to the employed, although the difference is not significant (see also Di Tella et al., 2003). The evidence suggests that another group who may gain from higher unemployment benefits, in terms of happiness, is people with the lowest level of education in the sample (i.e., up to 15 years old). The coefficient on Benefits is 8% larger for the lowest educated than for those with the next highest level of education (although this effect is only significant at the 13% level). The Self-employed enjoy a significantly lower level of happiness when unemployment benefits are high than other groups (at the 5% level) although the size of the effect is quantitatively small (the coefficient on Benefits is 0.6 for the Self-employed and 0.7 for the rest of the sample). The reason could be that they are more self-reliant on informal insurance arrangements than others, despite possibly facing a higher risk of losing their jobs (see also the section on GDP Growth where the Self-employed are found to be more affected by changes in the growth rate).

3.1.8. Crime rate

Opinion polls show that people regularly rank crime as one of their main preoccupations. At the very least, crime against property introduces variations in income when insurance is not complete while living in fear of crime reduces the enjoyment of leisure time, as well as introduces a concern for the safety of family and friends while at work. Although rich households may invest in observable crime-deterring devices, they may also be more desirable targets. Becker (1968) originally argued that one could define a "demand for crime" by showing that potential victims can affect the marginal returns to offenders by changing their behavior (e.g., buying locks, altering traveling patterns).

We study the effect of the sub-category of crime given by serious (violent) assault. Increases in this type of crime reduce happiness. For example, the rise in violent crime from 242 to 388 assaults per 100,000 people in the United States (i.e., a 60% rise) during our sample period would be equivalent to a drop of approximately 3.5% in GDP per capita (or approximately 0.029*0.6/0.5 since both these variables are measured in logs) other things equal. One's personal circumstances may also play a role since those who are not married with a family and who don't live with others may feel the most insecure. As noted above, the effect of personal income on exposure to crime appears ambiguous. We are able to test for some of the effects outlined in the theoretical work by interacting Crime with Personal income position, as well as with Age and whether the respondent is married rather than being single (although we do not know for sure whether the single people in our sample are living alone or in short relationships). One's income group does not have a significant differential effect on the unhappiness that one experiences from more crime. Being older weakly offsets some of the adverse impact of crime (but only at the 16% level of significance). For those who are married, higher crime rates have a significantly less negative impact on happiness compared to single people (at the 1% level). For a study of crime and happiness in South Africa, see Powdthavee (2005).

3.1.9. Divorce rate

Psychologists have emphasized that a dense network of family and friends can lead to a more fulfilling life (see Myers, 1999, for a discussion). Beyond this, a network of family and friends may provide some forms of insurance.[21] Becker (1974) provides a discussion of how marriage may affect equilibrium incomes for the partners through changes in leisure and "power". There is a public debate concerning the break up of families and the substitution of family life for work. If the divorce rate is a good indicator of these type of problems there is indeed a source of concern as divorce rates have increased quite drastically in some of the countries in our sample. Our study treats this issue differently than previous studies by controlling for marital status as well as including a variable, Divorce rate, which is the number of divorces per 1000 people, and attempts to measure family instability in society. Its' coefficient is negative and significant at the 5% level. To measure the size of these effects, in France the divorce rate has risen from 1.2 per 1000 people in 1975 to 2 per 1000 people in 1997. This rise in family instability over the past quarter century has "cost" the country, in monetary equivalent terms, 10 percentage points of GDP per capita (= $\exp(0.8*0.056/0.46)-1$). It is also equivalent to a rise in the unemployment rate of 1.6 percentage points (= $0.8*0.056/2.8$). These costs are in addition to the high (continuing) costs to those individuals who remain divorced.

For those people who declare themselves divorced, their drop in well-being is half the magnitude of the drop experienced by falling unemployed (the coefficients on Divorced and Unemployed are −0.24 and −0.49, respectively). The division of work in the household may depend on the social and legal acceptability of divorce as this may affect the bargaining power of each member. A small literature has studied this aspect of marriage (see, for example, Chiappori et al., 2002; Stevenson and Wolfers, 2001). By interacting a year time trend with a dummy reflecting whether the respondent is a married woman, we can check if marriage has become more beneficial to women, something that is expected if their bargaining power has improved. The interaction term is positive and significant at the 5% level, indicating that women have been becoming happier in marriage. The effect is quantitatively large. The amount of this improvement is equivalent to moving up from the bottom to the middle category of Education. Married women are, however, unhappier on average than married men and the gain in happiness from being married has, on average for both men and women, been declining between 1975 and 1997. The happiness gap between men and women has also been falling over this period.

3.1.10. Working hours

Leisure is a positive argument of the utility function. Becker (1965), for example, argued that resources had to be measured by what he calls "full income" which is the sum of money income and the income lost by the use of time in the pursuit of utility. Empirically, this may be an important modification to standard measures of GDP, as there are large variations in the number of working hours, both across and within countries over the last 20 years. In the US for example, Hammermesh and Rees (1993) report that average full-time hours of work per week in manufacturing in 1900 was 55, whereas in 1990 it was 37. More recent time series show increases in hours worked in the US, as well as decreases in other OECD countries (notably France). In the conventional GNP measurement, commuting to work is given a positive value. This is clearly a shortcoming and Nordhaus and Tobin (1973) propose that GNP be corrected to measure this as a welfare loss. The correction for hours worked is particularly important given the possibility, raised by a number of authors, that people may be working "too much" in capitalist economies (see Akerlof, 1976; Schor, 1992; Hammermesh and Slemrod, 2004).

Hours worked has a significant and negative effect on happiness. Both this variable, as well as GDP per capita, are measured in logarithms so the estimates suggest that a 1% increase in working hours would have to be compensated by a 2.4% rise in GDP per capita ($\approx 0.01*1.2/0.5$). This is related to measuring the marginal rate of substitution between work and leisure. Whilst Americans are working harder than before, Europe has experienced the opposite trend. We are able to calculate which group has done better in terms of well-being. Annual hours of work declined in France from 1865 hours in 1975 down to 1605 hours in 1997. Over the same period annual working hours rose in America from 1890 up to 1966 hours. In other words, whereas hours worked fell by 260 in France they increased by 76 in America. Has this widening of the gap by 336 hours been worth it for Americans? It corresponds to 18% of the mean number of annual hours worked for Americans in 1975 (=336/1890). The monetary compensation required is a rise in the level of GDP per capita equal to 49% (since $\ln 1.49 = 1.2/0.5 * \ln 1.18$). Since GDP per capita rose by 46% in America between 1975 and 1997 ($17,000 to $24,849) this increase in wealth would have approximately compensated Americans for their longer

[21] For exchange (i.e., not based on altruism) models of family insurance, see Kotlikoff and Spivak (1981).

working hours provided there had not been any such comparable increase in French GDP per capita. However incomes in France increased by 42% over the same period (i.e., from $15,738 to $22,308). Consequently these results suggest that the higher incomes of Americans compared to the French have not been sufficient to compensate for the longer working hours in happiness terms. We can calculate the increase in GDP per capita required in America to match the rise in happiness in France arising from their shorter working hours and higher GDP per capita between 1975 and 1997. The increase in American GDP per capita that would have been needed equals 124% of the level in 1975 (since $0.5\ln(1+1.24)-1.2\ln(1966/1890)=0.5\ln(1+0.42)-1.2\ln(1605/1865)$). Hence the shortfall in American GDP compared to the level in France amounts to approximately 78% of 1975 GDP per capita (=1.24–0.46), or approximately $13,260 in 1990 dollar values.

We can also try and see where the effects of longer working hours are concentrated. As may be expected, the employed are the ones who experience a significantly larger decrease in happiness due to longer working hours compared to those who are not working (i.e., the unemployed, retired, at home and in school). The fact that there remain negative effects even for some of the groups who are not employed suggests that, for example, the person keeping the house may also suffer a loss of happiness due to more hours at work of other family members. (The negative effect of Hours worked on happiness is 50% larger for those actually employed compared to those who are not). One exception to the adverse effect of longer working hours comes from the self-employed group, who experience no significant happiness drop from the changes in more time spent working.

3.1.11. Openness

We attempt to capture the variability of income in the economy, something that is important in standard specifications of preferences. We have so far controlled for income and, to some extent, variations in employment status through the inclusion of the unemployment rate, but for little else on this front. A rough and basic measure of the exposure of the economy to external shocks is Openness, the sum of imports and exports over GDP.[22] Again, note that any presumed impact of openness on income (e.g., through more efficient use of resources) has been taken into account in the income effect. Controlling for country and year fixed effects, the partial correlation coefficient between openness and GDP is 0.23, and between openness and GDP Growth is 0.18. These positive associations imply that opening up an economy could lead to a net happiness gain via higher output, despite the possibility of costs due to greater output variability.

Regarding the actual existence of these costs, the effect of Openness is negative although only significant at the 8% level. An increase in openness from 20% to 30% would have to be compensated by an increase in the benefit replacement rate (i.e., benefits/wages) of 10 percentage points. We again test for interaction effects. The coefficient on Openness * Personal income position is positive (equal to 0.05) and significant at the 1% level. This implies that the negative effects on happiness of more openness are stronger for those on lower incomes in each country. An individual at the bottom of the income distribution is hurt 40% more by a higher level of openness compared to an individual at the top end of the income distribution. There are also some differential effects in terms of educational attainment. Compared with people in the bottom education category, those in the middle level are significantly less affected by exposure to more openness.

3.1.12. Government consumption and inequality

We deal with two potential objections to our basic specification. If the measure of income reported in the surveys is net of taxes and we fail to include what those taxes are buying, then we may be underestimating the movements in happiness that we can explain. As a very rough measure of what citizens buy with their taxes, we add a measure of government consumption. This may include the provision of public goods, like defense spending, building infrastructure and enforcing the law. Higher levels of government consumption may also help stabilize the economy. Government consumption is positively related to happiness, at the 5% level of significance. As an example of the size of this effect, if Openness were to rise from 20% to 30% then a 3 percentage point increase in government consumption would be sufficient to compensate the individuals in our sample. Because higher government consumption must (ultimately) be financed through higher taxation, this does not necessarily imply that bigger government is better. Greater taxation may depress GDP (as well as GDP Growth rates) via work incentive problems. Private sector investment could be crowded out. Controlling for country and year fixed effects the (partial) correlation

[22] The literature on the determinants of the welfare state uses Openness for similar purposes. For example, Rodrik (1998) uses it to see if countries with greater exposure to foreign shocks make larger welfare payments and hence have bigger governments. Di Tella and MacCulloch (2002) use it to study the determinants of the parameters of the UI system.

coefficient between government consumption and GDP is −0.62, between government consumption and GDP Growth is −0.44, and between government consumption and Hours worked is −0.28. Higher levels of government consumption are also positively correlated with the unemployment rate. To work out whether big government makes people happier, these kinds of indirect channels must also be taken into account.[23]

3.2. Accounting for happiness

Table 2 shows the actual proportions of people who declare themselves in the bottom two happiness categories (i.e., "not at all satisfied" and "not very satisfied") as well as the top two categories (i.e. "fairly satisfied" and "very satisfied") between 1975 and 1997 in Europe. The last column takes the predicted happiness scores from our ordered probit regression in column (2) of Table 1 whose units of happiness we now refer to as 'utils':

$$\text{PRED HAPPINESS}_{ist} = \alpha \text{MACRO}_{st} + \beta \text{MICRO}_{ist} + \eta_s + \lambda_t \quad (4)$$

and reports the changes, $\Delta\overline{\text{PRED HAPPINESS}}_t = \overline{\text{PRED HAPPINESS}}_t - \overline{\text{PRED HAPPINESS}}_{t-1}$, where the averages are calculated across all the individuals, i, and countries, s, in our sample for each year, t.[24] It is these average happiness scores that we may define as 'gross national happiness'. The total change in the average happiness scores from the beginning of the sample period to the end equals −0.11 utils. In other words, there has been a slight decline in well-being. This decline is also reflected in a drop in the proportion of people declaring themselves in the top two happiness categories, from 83.3% in 1975 to 78.7% in 1997.

Table 2
Actual and explained changes in happiness in Europe from 1975 to 1997 (11 nations and 344,294 observations)

YEAR	Actual		Predicted
	"Unhappy" (not at all satisfied or not very satisfied)	"Happy" (satisfied or very satisfied)	Δ "Happiness": Year t − Year $(t-1)$
1975	16.7	83.3	
1976	18.0	82.0	−0.011
1977	17.8	82.2	0.031
1978	16.8	83.2	0.032
1979	17.9	82.1	−0.030
1980	17.0	83.0	0.005
1981	21.3	78.7	−0.103
1982	17.1	82.9	0.094
1983	20.4	79.6	−0.146
1984	20.2	79.8	0.039
1985	22.3	77.7	−0.083
1986	21.6	78.4	0.009
1987	21.7	78.3	−0.006
1988	25.2	74.8	−0.054
1989	17.2	82.8	0.202
1990	15.6	84.4	0.109
1991	17.3	82.7	−0.080
1992	19.0	81.0	−0.065
1993	21.3	78.7	−0.069
1994	19.7	80.3	0.038
1995	19.6	80.4	−0.015
1996	18.7	81.3	−0.009
1997	21.3	78.7	−0.003
			Total = −0.11

Note: The last column measures the average changes in the value of the underlying continuous variable between years from the ordered probit happiness regression in column (2) of Table (1). See also Section 3.2 for precise definitions.

Table 3 shows what happens when we decompose this overall change in happiness into the parts deriving from changes in each of the explanatory variables reported in Table 1 between 1975 and 1997.

$$\Delta\overline{\text{PRED HAPPINESS}}_{1975-97} = \alpha\Delta\overline{\text{MACRO}}_{1975-97} + \beta\Delta\overline{\text{MICRO}}_{1975-97} + \Delta\lambda_{1975-97} \quad (5)$$

The rise in GDP per capita over the sample period increased average happiness by 0.15 utils. The drop in the inflation rate by 12 percentage points (on average across the sample) led to a rise in happiness of 0.10 utils. The decline in SOx emissions contributed 0.12 utils more to happiness and shorter Hours worked in Europe added 0.11 utils. Increased Life expectancy increased happiness the most, equal to 0.16 utils. Smaller gains came from the more generous welfare state (proxied by Unemployment benefits) that added 0.03 utils and also the higher growth rate between the beginning and end of the sample period

[23] Another objection is that the level of income inequality in society ought to be included. A simple reason is that some people view inequality as an expression of fairness. A second possibility is that inequality is a proxy for the amount of social mobility and that a very unequal society may be symptomatic of few opportunities for progress. Alesina et al. (2004) explore these hypotheses using happiness surveys. Including inequality in our regressions using the available data, we find that it has a negative effect, although its' size and significance level are both low. The effect is weaker than in previous work, in part because the data have been interpolated and in part because there is some degree of co-linearity between the included variables. For example, if we do not include unemployment benefits, a variable that is highly correlated with inequality, we find that the coefficient on inequality becomes negative and significant (results available on request). See Senik (2005) for a review.

[24] By averaging across different individuals, we are implicitly assuming that happiness scores are interpersonally comparable (i.e., cardinal).

Table 3
Accounting for changes in happiness in Europe from 1975 to 1997 (11 Nations)

Dependent variable: Life satisfaction		(1)	(2)	(1)*(2)	
		Coefficient	Δ Explanatory variable (from 1975 to 1997)	Δ Happiness (from 1975 to 1997)	
Aggregate variables					
GDP per capita		0.539	0.274	0.147	
GDP growth		1.138	0.036	0.042	
Life expectancy		0.034	4.636	0.158	
SOx emissions		−0.003	−39.420	0.118	
Hours worked		−1.352	−0.079	0.107	
Crime rate		−0.023	0.588	−0.014	
Divorce rate		−0.050	0.414	−0.021	
Inflation rate		−0.839	−0.117	0.099	
Unemployment rate		−2.761	0.052	−0.144	
Openness		−0.265	0.125	−0.033	
Unemployment benefits		0.754	0.045	0.034	Sub-total=0.50
Personal characteristics					
Personal income position		0.464	0.009	0.004	
Employment State	Unemployed	−0.495	0.066	−0.033	
	Self-employed	0.026	−0.014	−3.7e−4	
	Retired	0.046	0.046	0.002	
	Keeping home	0.016	−0.108	−0.002	
	In school	0.195	0.028	0.005	
Male		−0.069	0.011	−0.001	
Age		−0.029	0.110	−0.003	
Age squared		3.3e−4	2.040	0.001	
Education	Lower	0.062	−0.033	−0.002	
	Higher	0.167	0.174	0.029	
Marital Status	Married	0.132	−0.138	−0.018	
	Defacto	0.021	0.058	0.001	
	Divorced	−0.262	0.029	−0.008	
	Separated	−0.336	0.008	−0.003	
	Widowed	−0.151	−0.012	0.002	
Size of community	Middle	−0.039	0.052	−0.002	
	Large	−0.140	−0.038	0.005	Sub-total=−0.02
Year dummies (1975–97)			22		−0.59
Number of observations		344,294			Total=−0.11

Note: The coefficients in column (1) are taken from Table 1, column (2).

that added 0.04 utils onto happiness. These positive influences contributed, in total, to a rise in happiness of 0.7 utils (= 0.15+0.10+0.12+0.11+0.16+0.03+0.04).

On the negative side, the largest adverse effect derived from the rise in unemployment in Europe. It subtracted 0.14 utils from happiness. This could be thought of as the 'fear' effect that hurts everyone in the economy when there is downturn. It does not include the costs to the individuals who have actually lost their jobs (which is calculated below). The rise in unemployment has exactly offset the gains in happiness from higher GDP per capita. It has also more than cancelled out the gains in happiness experienced due to lower inflation rates. Rising family instability, proxied by the Divorce rate, lowered happiness by 0.02 utils. Higher crimes rates lead to a fall of 0.01 utils and increasing Openness cut 0.03 utils. These negatives combined led to a total drop in happiness of 0.2 utils (= −0.14–0.02–0.01–0.03). The net effect of all the positive and negative influences of the aggregate variables was to increase happiness by 0.5 utils (= 0.7–0.2). Changing personal characteristics of respondents in our sample between 1975 and 1997 have had smaller effects on well-being. Two of the largest effects come from the costs to the individuals who are actually unemployed and the lower proportion of the population who are now married (as opposed to single, or living as married, divorced, separated or widowed). The higher proportion of unemployed people in the sample lowered happiness by 0.03 utils, due to the direct costs of joblessness to these people. The lower proportion of married people led to a decline of 0.02 utils. On the positive side, more people with higher educations added

0.03 utils. The net effect of all the personal characteristics was to lower happiness by 0.02 utils.

Combining all the above effects from our explanatory variables (i.e., both aggregate variables and personal characteristics) we would have expected happiness to rise across nations by 0.48 utils (= 0.50–0.02). This is a sizeable number. It corresponds to lifting 17 percentage points of the population from the lower three happiness categories ("not at all satisfied", "not very satisfied", and "fairly satisfied") into the top category ("very satisfied"). This is equivalent to increasing the predicted proportion of the population in the top happiness category from 26% to 43%.[25] However overall happiness across the 344,294 people in the sample actually dropped by 0.11 utils, due to an unexplained time trend that reduced happiness by 0.59 utils.

4. Conclusion

There is something fundamentally plausible in the idea that the difference in happiness between primitive-man and us is not proportional to the differences in our incomes. The Easterlin–Paradox illustrates this: over time average happiness levels do not change in countries that experience large increases in income. This evidence is enough to reject the hypothesis that absolute income is the only argument of the utility function. One way to explain the paradox is through a more general utility function, for example, one that displays adaptation or other forms of relative income effects (see, for example, Easterlin, 1974). Indeed, Di Tella, MacCulloch and Oswald (2003) show that GDP per capita enters positively in a country panel with fixed effects, but that the effects wear off over time. An alternative approach points to omitted variables. For example, the paradox could be produced by ignoring the role of variables that could be expected to vary positively with income and negatively with happiness, such as working hours.

In this paper we pursue this view further. We start with an estimate of the effect of income in a country panel and show that, for around 350,000 people across 12 OECD countries during 23 years, the probability that people declare themselves happy is increasing in income. Happiness data are also correlated with variables that enter a standard utility function in the way predicted by theory. For example, happiness responses are positively correlated with Life expectancy and measures of the generosity of the welfare state. They are negatively correlated with the average number of hours worked, environmental degradation (measured by the level of Sulphur Oxide emissions), the rate of divorce, the crime rate, the level of openness to trade as well as the rate of inflation and the unemployment rate. Most of these correlations reach statistical significance. A standard utility function can rationalize these correlations. Furthermore, when the effects are allowed to vary across groups, they do so in a way that is consistent with the theory. For example, environmental degradation adversely affects the happiness levels of the young and rich. These results lend some support to those that have advocated the use of more comprehensive and less materialistic measures of progress than GDP. The Measure of Economic Welfare proposed by Nordhaus and Tobin (1973) is one example.

We then estimate the part of the change over time in reported happiness that can be accounted for by changes in each variable, based on their actual change and their estimated impact on happiness. In relative terms, the increase in income per capita has been one of the biggest contributors to raising happiness. In absolute terms, however, the size of the effect is small and almost fully compensated by the negative impact of the increase in unemployment. Interestingly, the rest of the other variables have moved favorably over our sample period. For example, changes in life expectancy, hours worked and SOx emissions are also net contributors to happiness levels. This means that adding the actual impact of other variables besides income leads one to expect happiness levels that are even higher, making the unexplained trend in happiness data larger, than when just changes in income are considered. In other words, introducing omitted variables only worsens the income-without-happiness paradox.

In brief, there is some evidence that people care about other variables besides income. This may provide some support to the idea that GDP is not a good measure of welfare and that we should develop broader indicators of gross domestic happiness. Although this idea appears related to the Easterlin paradox, our broader measures do not help explain why happiness is stationary since they have moved, on average, in a favorable way. Since the paradox is present in most countries for which long time-series exist (although there are notable exceptions within groups like the happiness of black Americans which has risen since the early 1970s counter to the general US trend) the explanation is probably to be found in a factor that has been affecting the majority of people in the world in a similar way. Maybe adaptation to income, increased anxiety and job insecurity caused by globalization, stress at work, or the rise of television that has become

[25] Since $0.15 = \Phi(-47.6 + 0.48 - (-46.9)) - \Phi(-47.6 - (-46.9))$ where $\Phi(.)$ is the standard normal distribution, -47.6 is the mean score and -46.9 is the top cut point from regression (2) in Table 1.

addictive, have led to flat happiness in the face of sharply rising average incomes.

Appendix A. Data sources and definitions

A.1. Sources

A.1.1. The Euro-Barometer Survey Series [1975–1997]

The Euro-Barometer Surveys were conducted by various research firms operated within European Community nations under the direction of the European Commission. Either a nationwide multi-stage probability sample or a nationwide stratified quota sample of persons aged 15 and over was selected in each nation. The cumulative data file used contains 36 attitudinal, 21 demographic and 10 analysis variables selected from the European Communities Studies, 1970–1973, and Euro-Barometers, 3–38.

A.1.2. The United States General Social Survey

The General Social Surveys have been conducted by the National Research Center at the University of Chicago since 1972. Interviews have been undertaken during February, March and April of 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1980, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1993 and 1994. There were no surveys in 1979, 1981 and 1992. There were a total of 32,380 completed interviews (1613 in 1972, 1504 in 1973, 1484 in 1974, 1490 in 1975, 1499 in 1976, 1530 in 1977, 1532 in 1978, 1468 in 1980, 1506 in 1982, 354 in the 1982 black oversample, 1599 in 1983, 1473 in 1984, 1534 in 1985, 1470 in 1986, 1466 in 1987, 353 in the 1987 black oversample, 1481 in 1988, 1537 in 1989, 1372 in 1990, 1517 in 1991, 1606 in 1993 and 2992 in 1994).

A.2. Definitions

A.2.1. Aggregate variables

Life satisfaction: The individual responses to the Euro-Barometer Survey question that reads: On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?". Accordingly, four categories were created. For the United States the data come from the US General Social Survey which has a "happiness" question that reads, "Taken all together, how would you say things are these days — would you say that you are very happy, pretty happy, or not too happy?".

GDP per capita: Log of Real GDP per capita at the price levels and exchange rates of 1990 in U.S. dollars (measured in thousands) obtained from OECD National Accounts (various years).

GDP growth: The year-to-year change in GDP per capita (= GDP per capita(t) − GDP per capita ($t-1$)).

Unemployment rate: Unemployment rates from OECD Employment Outlook.

Inflation rate: The rate of change in the CPI from OECD Historical Statistics.

Unemployment benefits: The average level of benefit generosity, measured by the replacement rate, from the OECD. This index of (pre-tax) unemployment insurance benefit entitlements divided by the wage, is calculated as the unweighted mean of 18 parameters based on all combinations of the following scenarios: (i) three unemployment durations: the first year, the second and third years, and the fourth and fifth years of unemployment. (ii) three family and income situations: a single person, a married person with a dependent spouse, and a married person with a spouse in work. (iii) two different levels of previous earnings: average earnings and two-thirds of average earnings. These parameters are all measured for persons with a long record of previous employment. See the OECD Jobs Study.

Government consumption: The logarithm of government final consumption expenditures as a proportion of GDP, from OECD National Accounts Data.

Crime rate: The logarithm of the total number of serious assaults per 100,000 people, from Interpol's International Crime Statistics (various issues).

SOx emissions: Total sulphur oxide emissions (i.e. SO, SO_2 and higher derivatives) in kilograms per capita from OECD Health Statistics. Values prior to 1980 for each country in the sample were interpolated using the 1980 values.

Life expectancy: Average Life expectancy at birth for males and females, measured in years, from OECD Health Statistics. A linear interpolation was used to obtain the life expectancies in 1975–76 for Ireland and 1975–1979 for Britain.

Divorce rate: Number of divorces per 1000 people from the United Nations' Demographic Yearbook and Eurostat's Demographic Statistics (various issues).

Hours worked: The logarithm of average annual hours worked, from OECD Employment Outlook (various issues).

Openness: The logarithm of the sum of exports and imports as a proportion of GDP, from OECD National Accounts Data.

A.2.2. Personal characteristics (all from Eurobarometer and GSS surveys)

Employment status: A set of dummy variables taking the value 1 depending on the respondent's employment status: unemployed, retired, housewife, in school or the

military and self-employed. The base category is employed.

Male: A dummy taking the value 1 if the respondent is male and 0 otherwise.

Age: The respondent's age in years.

Age squared: The square of the respondent's age in years.

Personal income position: The logarithm of the income of an individual relative to the mean income. It is approximated using data on individual income quartiles and the standard deviation of income. The latter is calculated assuming a lognormal distribution for income and using the 90/10 ratio from the Luxembourg Income Study.

Education: This heading refers to a set of dummy variables which take the value 1 depending on the age at which the respondent finished full-time education: up to 15–18 years old or up to more than 18 years old. The base category is education up to 14 years old.

Marital status: A set of dummy variables taking the value 1 depending on the respondent's marital status: married, living as married, defacto married, divorced, separated or widowed. The base category is never married.

Size of community: A set of dummy variables taking the value 1 depending on whether the respondent lives in a small or middle sized town, or a large city. The base category is a rural area or village.

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