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Happier Than Them, but More of Them Are Happy: Aggregating Subjective Well-Being

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Abstract
This paper proposes the use of headcount-based indicators for the measurement of national Subjective Well-Being (SWB). It provides a methodological contribution to the challenge of threshold selection for headcount measures using Cognitive Dissonance Theory operationalised using life satisfaction data from World/Eurpean Values Surveys. A Beta-regression approach is employed to explore the empirical relationships between national SWB and objective measures of well-being contributing to the empirical literature on social indicators. The use of this model is novel in this context. The findings reveal relationships between objective measures of development and SWB that are not apparent when average national SWB is used. For example, I find no significant link between national income and the share of satisfied individuals.

Keywords. Subjective Well-Being; Cognitive Dissonance Theory; Beta-regression.
JEL classifications: O1, I3, H1.

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1 Introduction

Subjective measures of well-being have recently motivated a great deal of research within economics. Mounting evidence suggests that subjective well-being (SWB) data are reliable and valid sources of information (Diener, 1994; Kesebir and Diener, 2008) that can effectively supplement standard objective indicators (Frey and Stutzer, 2014; Graham, 2008). Several studies highlight the benefits of constructing and maintaining national accounts of SWB for use in conjunction with objective measures (Bruni et al., 2008; Cummins, 2016; Diener and Seligman, 2004; Diener and Suh, 1997; Fleurbaey, 2009; Stiglitz et al., 2010), while some go as far as to advocate the use of SWB as the one single measure of progress (Layard, 2009). Furthermore, there are several attempts to build fundamental guidelines for potential measures of national SWB (Cummins et al., 2003; Diener, 2006).

The operationalization and construction of aggregate measures of SWB is currently a subject of considerable interest in sociology and statistics (e.g. Casacci and Pareto, 2018; Maggino, 2009), but there has been little effort within economics to develop normative frameworks and analysis methods for aggregate measures of SWB. The economic literature to date has generally relied on traditional methods (which have previously been used for conventional income-based aggregate indicators of development) and is largely limited to one single measure of national life satisfaction, namely the mean. However, the simple mean is not a suitable metric of aggregate satisfaction considering the characteristics of SWB data, which are captured by scales that are arbitrary, ordinal and bounded. Bond and Lang (2014) have recently criticized the mean-based approach to comparing satisfaction (or happiness)[1] across countries, and more generally across groups of people.

Given the nature of subjective data, the construction of aggregate measures of subjective well-being requires careful balance between accuracy and the level of detail. Headcount measures may prove to be more suitable indicators of overall well-being since they are less informationally demanding. While average measures impose strong assumptions on the underlying SWB scale (e.g. cardinality), headcount measures require only an ordinal comparison below and above a certain cut-off point. Although this class of measures does not utilize the full range of information contained in SWB scales, this paper puts forth the argument that the resulting aggregate information it provides is more reliable relative to mean measures. Specifically, it is potentially preferable to rely on an indicator based on binary information than one based on a higher resolution scale when that scale is potentially inaccurate and misleading.

[1] The terms 'satisfaction' and 'happiness' are generally considered to measure different aspects of SWB, though they are sometimes used interchangeably (Diener, 2006; Easterlin, 2004). However, the terms 'happiness' and 'happy' are often used to refer to SWB broadly (as in Happiness Economics) and do not imply any specific aspect of SWB. This paper focuses specifically on reported life satisfaction as opposed to reported levels of happiness (see Section 3), but does use the terms 'happiness' and 'happy' to refer to SWB in general.

The principal challenge with headcount measures is identifying a relevant and meaningful cut-off value. The foremost aim of this paper is to develop a methodological approach for constructing a headcount measure of the proportion of individuals who report above a specific threshold value of SWB. The approach applies Cognitive Dissonance Theory (Akerlof and Dickens, 1982) to survey data from the World Values Survey and the European Values Survey to identify a meaningful threshold above which individuals are considered to be (sufficiently) satisfied with life. This provides both a theoretical framework and real-world relevance, and contributes to the economics literature on cross-country analysis of well-being and to measurement theory. It can also be applied outside of economics where the focus has been primarily on multidimensional indices of well-being (see for example Fattore et al., 2015; Mauro et al., 2016), not on threshold selection. Compared to more complex statistics, the proposed headcount has the practical advantage that it is easy to understand and relate to for policy-makers and the public.

The second contribution of this paper is to identify an appropriate empirical model for estimating the relationships between the proposed headcount measure and standard objective indicators of development. I extend the econometric analysis in previous studies of national SWB, which generally relies on Ordinary Least Squares (OLS) (such as Deaton, 2008; Ovaska and Takashima, 2006; Stevenson and Wolfers, 2008), by using a Beta-regression model which takes into account the skewed and naturally bounded nature of the distribution of reported SWB data. Beta-regression is shown to be more suitable given the distinct properties of SWB data. The emphasis on standard objective indicators is deliberately chosen because of the strong influence they exert on how we view development. The concern is that these conventional accounts help create a shared view that may be easily misguided if the measures it relies on do not adequately reflect overall well-being.

The paper is intended as a starting point for discussion about best methods of aggregating subjective information and theory-based approaches to headcount measures of SWB. It shows that different national measures of SWB can convey diverse stories about development and well-being. Choosing the appropriate aggregation method is therefore crucial for effective policy design.

The remainder of the paper is structured as follows: Section 2 discusses the relevant literature; Section 3 describes the methodology for constructing the proposed alternative aggregate of SWB; Section 4 presents an empirical application using data from the World Values Survey and the European Values Survey; and Section 5 concludes.

2 Literature

Initial studies at the national level focused on simple correlations between income and SWB (Easterlin, 1974). These were soon followed by a growing body of literature encompassing various objective accounts of well-being, including development measures beyond income-based indicators, such as life

expectancy, educational attainment, health indicators, female labour participation, economic and political freedoms, to name a few (Blanchflower and Oswald, 2005; Deaton, 2008; Lawless and Lucas, 2011; Leigh and Wolfers, 2006; Ovaska and Takashima, 2006).

The SWB literature relies heavily on simple average measures, lacking consideration for alternative non-utilitarian approaches to national SWB. Non-mean based aggregation procedures, such as the headcount measure of the share of satisfied individuals proposed in this paper, have been used for simple descriptions of datasets (Oswald, 1997) but not as key measures of interest in international accounts of development. While Easterlin (1974) does take into account some distributional considerations[2], his main cross-country result is based on average happiness, as are subsequent studies concerned with national SWB, including Easterlin's more recent work on the happiness paradox (Easterlin et al., 2011) and Stevenson and Wolfers's treatment of Easterlin's findings (Stevenson and Wolfers, 2008).

Notable exceptions are the 'happy life expectancy' measure proposed by Veenhoven (1996) and a measure of satisfaction with life that is not explained by personal characteristics (Di Tella et al., 2001). The former is defined as the product of standard life expectancy and average happiness (transformed on a scale ranging from 0 to 1); the latter is the average of the residuals obtained by regressing individual-level life satisfaction on personal characteristics. These measures show more sophisticated alternatives for aggregating self-reported well-being, but they nevertheless rely on average SWB and are utilitarian[3] in nature.

A direct reference regarding a headcount measure of national SWB can be found in Helliwell and Huang (2008), who briefly mention using "the share of respondents above or below particular cut-off points in the numerical distribution of responses" (p. 609). The aim of their paper is to assess the effect of the quality of government on national life satisfaction. The share is used as a robustness check for differences in the shape of the distribution of satisfaction responses due to cultural differences. This differs in intent from the current study, which aims to explicitly develop a methodology for creating a headcount measure as a national indicator of aggregate SWB. Helliwell and Huang (2008) find no significant changes in the key findings when using the share measure, but the relevant results are not reported in the publication, and no specific cut-offs are discussed.

[2] Summary statistics of the distribution of SWB are considered, but only for happiness questions with qualitative scales involving limited categories (e.g. 'very happy', 'fairly happy', 'not very happy')

[3] In general, utilitarian approaches refer to utility maximization. Mean measures are linked specifically to average utilitarianism, where average utility is maximized.

3 A Headcount aggregate of national subjective well-being

Mean measures of individual-level SWB information require precise interpersonal comparisons, but the ordinal and arbitrary nature of reported SWB scales makes it difficult to compare answers across individuals. Bond and Lang (2014) show that cross-country comparisons of average SWB are virtually impossible when reported SWB scales are ordinal (without imposing strong assumptions about the underlying distributions of SWB). Furthermore, SWB scales are naturally bounded, which limits the growth of average SWB measures since individuals who have reached the highest level cannot improve further.

Perhaps more critical than data structure and interpretation are normative considerations. Mean measures promote average utilitarianism, and this may be a misguided social aim. Frankfurt (1987) reasons that what is most important morally in terms of the distribution of economic assets is "that each [person] should have *enough*" (p. 21, italics in original). This principle is even more salient when measuring SWB because its complex nature makes it unreasonable to expect perpetual increases in average levels. Given that SWB depends on many life dimensions – some of which governments cannot or should not have control over – it is perhaps more appropriate for governing bodies to target some reasonable standard of SWB for all citizens, rather than seek to continually increase the well-being of all.

A sufficientarian welfarist approach provides a fitting alternative to the utilitarian-based mean measures of SWB, and is well suited for use with SWB information. Unlike average utilitarianism, which seeks to maximize average welfare, sufficientarianism is primarily concerned with providing a 'sufficient' level of welfare. Crisp (2003) proposes that "compassion for any being B is appropriate up to the point at which B has a level of welfare such that B can live a life which is sufficiently good" (p. 762). In terms of subjective welfare, development can accordingly be viewed as a nation's ability to support such a sufficient level of SWB for its citizens, or (crucially) for as many of its citizens as possible. The obvious question arises regarding the *sufficient* level of SWB. This is the main challenge of this paper and will be addressed later in this section after introducing the general form of the proposed headcount ratio and the underlying SWB information.

Applying the sufficiency principle to SWB data translates to an aggregate measure that is based on a dichotomous reduction of self-reported well-being and can be expressed formally as follows:

$$SWB_{share} = \frac{1}{n}\sum_{j=1}^{n} I(swb_j \geq z) \qquad (1)$$

Where n is the total number of individuals in a country, swb_j is individual j's reported level of SWB, z is a threshold level of welfare and *I(.)* is an indicator function that is 1 when individual j's reported SWB is above the threshold level z and 0 otherwise. The threshold level, z, separates individuals who

have a reasonably high level of SWB from those who do not. SWB_{share} therefore represents the proportion of individuals in the country with a sufficiently high level of SWB.

The scale and scope of swb_j can vary depending on the data source. There are several types of questions currently used in various surveys, broadly classified into two groups: happiness and satisfaction[4]. Happiness questions are considered measures of emotional states, whereas satisfaction measures are viewed as cognitive evaluations (Ovaska and Takashima, 2006). The former can be problematic because they tend to elicit more hedonic evaluations that reflect mainly current (recent) mood. On the other hand, life satisfaction questions are more appropriate for national measures of well-being – Helliwell and Barrington-Leigh (2010)[5] argue that they are "more reflective of overall and continuing life circumstances and hence are more suited to capture long-term and international differences in policies and institutions" (p. 732). This is key for the construction of SWB_{share}, which is intended as an overarching measure that can capture broad evaluations about life in general across countries. I therefore construct SWB_{share} based on reported life satisfaction data, such that:

$$swb_j = s_j$$

where s_j is the reported life satisfaction of individual j. SWB_{share} is suitable for use with bounded and ordinal scales, and more importantly, has limited sensitivity to small differences in reported life satisfaction so it addresses to some degree the problem of interpersonal comparisons by reducing the number of comparisons made between adjacent points on the satisfaction scale[6]. We are only concerned with comparing satisfaction levels around z so that all reported satisfaction levels below the threshold are assumed to denote lower SWB than all satisfaction levels above the threshold. As such, the value of SWB_{share} as a measure of overall national SWB hinges on the choice of z, which separates individuals who are sufficiently satisfied from those who are not.

The range of SWB in another important consideration for constructing the share of satisfied individuals. National and international surveys typically use satisfaction scales ranging from 4 to 11 points[7]. It is generally accepted that questions with finer scales are more reliable (Diener et al., 2009; Helliwell and Barrington-Leigh, 2010). The proposed headcount measure should therefore be based on SWB questions with a high resolution scale. As such, subsequent analysis in this paper is based on a 10-point scale (see Section 4.1).

[4] See Bruni and Porta (2007) for further discussion on the different aspects of SWB.
[5] There are also questions regarding specific aspects of life (e.g. satisfaction with the freedom to choose how to live one's life, satisfaction with the educational system, satisfaction with the quality of air, etc.) but these do not adequately reflect life in general.
[6] This level of interpersonal comparison is supported by Diener and Tov (2012): "For example, a person reporting an '8' on a 10-point happiness scale is virtually always happier than someone who reports a '3', and the latter is much more likely to suffer from clinical depression. However, a person who reports a '7' might not invariably be less happy than a person who reports an '8'" (p. 12).
[7] For a more detailed summary of the various SWB questions and scales used in a variety of surveys see Diener (1994).

I now return to discuss the challenge of choosing the level of sufficiency. The answer lies in finding a point which holds special meaning for most individuals, one which we are psychologically inclined to regard as an important and meaningful threshold. In order to find such a point, it is important to remember that reported satisfaction values reflect the interplay between one's life and one's feelings about that life. A theory that recognizes this underlying relationship is necessary to understand the satisfaction profile of individuals.

Cognitive Dissonance Theory, first proposed by Hirschman (1965), provides an intuitive framework for understanding this relationship. According to Hirschman, dissonance occurs when our view of ourselves does not match the reality of our actions. It is uncomfortable and undesirable, and we aim to minimize the level of dissonance in our lives. The central significance of Hirschman's theory is that it suggests that dissonance is more easily reduced by changing views rather than changing actions. Sometimes, it is only possible to alter views if the actions in question have already taken place.

Akerlof and Dickens (1982) later proposed that dissonance often occurs because our view of ourselves as "smart, nice people" is challenged by the reality of past actions or new information. In the context of SWB, I propose that we like to think of ourselves as being satisfied/happy with our lives, at least on some basic level. There are two opposing forces at work: (i) a strong resistance against admitting a less than some acceptable level of satisfaction because we seek to uphold this view of ourselves as satisfied; while (ii) cognitive dissonance pushes us to admit our true level of satisfaction.

To clarify, let us consider the implications along the SWB path. A positive relationship between life conditions and SWB means that poorer life conditions lead to lower life satisfaction since we seek to minimize dissonance between reported satisfaction and life conditions. When life conditions are acceptable, we have no problem correctly identifying the appropriate satisfaction level. However, this relationship breaks down temporarily around a threshold that we consider to represent a 'basic' level of happiness because there is a reluctance to admit satisfaction levels below this point. In terms of the distribution of reported life satisfaction, we should see a pile-up of responses at this threshold. This is where dissonance builds up as the disparity between life conditions and SWB increases, eventually forcing individuals to adjust their view of themselves as happy/satisfied and thus report levels of satisfaction below this key threshold. Dissonance therefore peaks around this resistance threshold as shown in Figure 1.

[Figure 1 about here]

This approach requires the use of survey data in order to examine the distribution of satisfaction levels. The next section demonstrates how this can be done in practice and applies the proposed headcount measure of SWB to analyse the relationships between national SWB and standard objective indicators of development. As outlined in Section 2, studies typically assess the cross-country associations of mean life satisfaction with Gross Domestic Product (Easterlin et al., 2011) and various

social indicators (Blanchflower and Oswald, 2005; Deaton, 2008; Lawless and Lucas, 2011; Leigh and Wolfers, 2006; Ovaska and Takashima, 2006). The next section extends this literature by exploring the association between the proposed headcount measure, SWB_{share}, and several development measures.

4 Application: life satisfaction and objective well-being across countries

4.1 Data

Self-reported life satisfaction data from World Values Surveys (WVS, 2009) and European Values Surveys (EVS, 2011) are used to construct SWB_{share}. These initiatives are conducted independently but are compatible and comparable across countries and time, and are available in an integrated dataset that is well-documented. In general, WVS and EVS cover different countries but there is some overlap. There are a total of 6 WVS and 4 EVS waves (each conducted over multiple years)[8] based on repeated cross-sections of stratified random samples of around 1,500 individuals per country on average. Early waves are limited in their coverage and do not include representative samples for some countries. Since this is a cross-country examination, the analysis is restricted to waves 3 and 4 of WVS and waves 3 and 4 of EVS to maximize country coverage. To construct a national-level panel dataset with comparable country sets and similar time frames, waves 3 of WVS and EVS are combined into one 6-year period covering 1999-2004, and waves 4 are combined into another 6-year period covering 2005-2010[9]. Over these two periods, there are a total of 253,010 respondents from 99 countries; of which 14,768 are excluded due to incomplete information (either pertaining to life satisfaction or to the country-level explanatory variables introduced below). The analysis is based on a sample of 141 observations (136 for one of the specifications) for a total of 90 countries, with 78 country-observations in period one and 63 in period two[10].

Respondents are asked "*All things considered, how satisfied are you with your life as a whole these days?*" and are instructed to choose a number between 1 and 10, where 1 is labeled "dissatisfied" and 10 is labeled "satisfied"[11]. WVS and EVS data are suitable for implementing a practical proxy for the share of satisfied individuals: the high-resolution scale is more reliable compared to coarser alternatives, and they support rich cross-country analyses of SWB since they cover a large and

[8] WVS waves were conducted in 1981-84, 1989-1993, 1994-1999, 1999-2004, 2005-2007 and 2010-2014. EVS waves were conducted in 1981-1984, 1989-1993, 1999-2004 and 2008-2010.
[9] See Table A1 in the Appendix for a list of countries and their availability in each wave.
[10] Previous country-level studies on SWB have used samples ranging from 44 to 166 observations (Deaton, 2008; Di Tella et al., 2001; Leigh and Wolfers, 2006; Ovaska and Takashima, 2006; Stevenson and Wolfers, 2008).
[11] Except for wave 2005-2007 of the WVS in which 1 means "completely dissatisfied" and 10 means "completely satisfied".

representative set of countries ranging from underdeveloped to fully industrialised economies, representing all continents and major sub-regions. The distribution of life satisfaction responses for the sample used in the regression analysis is shown in Table 1 for each period separately (counts have been adjusted using sampling weights provided with the survey data).

[Table 1 about here]

I use these reported life satisfaction data to identify a meaningful satisfaction threshold z and construct SWB_{shar} . The distribution of responses is characterized by a pronounced data-cliff between levels 4 and 5 (Figure 2). Satisfaction levels of 5 or higher are consistently more prevalent than levels below 5 in each of the two periods. This pattern is also observed for most of the countries individually (graphs not shown but available upon request). Moreover, satisfaction level 5 is more prevalent than the adjacent level 6. Taken together with the sharp data-cliff described above, this suggests a pile-up effect at 5 and a marked reluctance to report below this point. This pattern matches the cognitive dissonance argument presented in Section 3, indicating level 5 may be a meaningful threshold for interpreting satisfaction responses as the point where dissonance is highest. In this framework, individuals reporting below level 5 can be interpreted to have such poor life conditions that they cannot overcome the instinct to deny that they are indeed not within the acceptable range of satisfaction. As such, level 5 may be set as z, the lowest point at which people are sufficiently satisfied, and the proposed alternative headcount measure of national SWB from equation 1 can be more precisely defined as:

$$SWB_{share} = \frac{1}{n}\sum_{j=1}^{n} \theta_j I(s_j \geq 5) \qquad (2)$$

where s_j is individual j's life satisfaction response (in this case) ranging from 1 to 10, and θ_j is respondent j's sample weight included in order to obtain results representative of the whole population.

[Figure 2 about here]

The analysis is based on regressing SWB_{share} on the individual components making up the current formulation of the Human Development Index (HDI)[12]: per capita Gross National Income (GNI), life expectancy, mean years of schooling, and expected years of schooling. The choice of these components is motivated by the HDI's widespread popularity within the current discourse on development and social progress. Some previous studies of national SWB relied on variations of these measures to help explain

[12] For more details on the HDI components see Technical Notes of the Human Development Report (UNDP, 2016) available at http://hdr.undp.org/sites/default/files/hdr2016_technical_notes.pdf.

mean reported life satisfaction (Deaton, 2008; Easterlin et al., 2011; Leigh and Wolfers, 2006; Stevenson and Wolfers, 2008).

Data for the HDI components are taken from the online database maintained by the United Nations Development Programme (UNDP, 2013)[13]. Matching these indicators to satisfaction data by specific year is not possible since the Values Surveys are conducted in waves that span multiple years. Additionally, yearly UNDP data are not available prior to 2005. For countries surveyed in the period 1999-2004, I use UNDP data for year 2000. For countries surveyed in the period 2005-2010, I use averages of UNDP data over those years. Period-averages are considered to produce results that reflect a more long-term relationship with subjective measures (McGillivray, 2005); this method has been used previously in order to minimize seasonal deviations from the long-term trend (Ovaska and Takashima, 2006). The current study is concerned mainly with international comparisons and therefore with fundamental differences in the economic organization of the countries, which are slow to change, so measures capturing a long-term trend are ideal. All development indicators and additional control variables are defined in Table 2.

[Table 2 about here]

Per capita GNI is expected to have a strong positive effect on the share of satisfied individuals. Economists often rely on the assumption that income and well-being are directly linked: "there is a clear presumption that changes in economic welfare indicate changes in social welfare in the same direction, if not in the same degree" where national product "is taken to be the objective, measurable counterpart of economic welfare" (Abramovitz, 1959, p. 3). Previous studies find a positive relationship between national income and SWB measured using mean life satisfaction (Diener and Oishi, 2000; Easterlin et al., 2011; Ouweneel and Veenhoven, 1991; Stevenson and Wolfers, 2008). The effect of life expectancy on SWB is ambiguous. Living longer can reflect a society in good health, which boosts life satisfaction, but this effect can be reduced or reversed if the quality of life for the old is low. Previous evidence is contradictory – Ovaska and Takashima (2006) find a positive relationship between life expectancy and life satisfaction, while Deaton (2008) estimates a negative link. We should also see a positive association between national satisfaction and mean/expected years of schooling. According to the human capital model, education is positively linked to increased welfare through a positive effect on wages. However, the empirical evidence is mixed. A number of studies find a positive association between education and reported life satisfaction (Blanchflower and Oswald, 2004; Easterlin, 2001; Ferrer-i-Carbonell, 2005; Graham and Pettinato, 2002), while others find a negative or statistically insignificant relationship (Blanchflower and Oswald, 2005; Flouri, 2004; Powdthavee, 2008; Shields et

[13] Available online at http://hdr.undp.org/en/statistics/data/ (accessed on Sept. 4, 2012). UNDP does not directly collect data; their database is constructed using various sources (list of sources available at http://hdr.undp.org/en/statistics/understanding/sources/).

al., 2009). Powdthavee et al. (2015) argue that there are a number of non-financial channels through which education effects well-being. These channels can mitigate the effect of education on well-being independently of income gains. They find a negative direct association between years of education and life satisfaction, but positive indirect associations through income, employment, marital status and health. This suggests that the overall relationship between education and life satisfaction may be positive or negative depending on which channels have a stronger impact on personal well-being. Bjornskov et al. (2008) propose that the relationship between education and SWB is stronger in low-income countries where the income gains of extra schooling are larger. This suggests that there may be considerable variation in the way populations react to gains in knowledge across the countries analysed in this paper.

Cultural norms and social systems vary widely across nations and they can be systematically and significantly related to individuals' assessment of their own life satisfaction. A concern is that many cultural dimensions tend to be highly correlated with standard objective measures of well-being, especially with income (e.g. individualistic, democratic countries also tend to be the richest and most developed). I control for cultural differences using the Inglehart and Welzel (2010) two-dimensional index. The index is constructed using responses to attitudinal questions from WVS and EVS. Nations are scored along a traditional vs. secular-rational value scale, and also along a survival vs. self-expression value scale. Both scales revolve around zero so that cultures that emphasize traditional and survival values are assigned negative scores, while those with emphasis on secular-rational and self-expression values are given positive scores. Figure 3 shows the position of each country in the sample along these two cultural dimensions. Cultural profiles vary greatly across the nations in the sample, spreading across much of the bi-dimensional value plane.

[Figure 3 about here]

Cultural value scores are averages between available country scores from 1999-2004 and 2005-2010 (i.e. if scores are available for both waves, then the average is used, otherwise a single score value is used)[14]. This ensures that all countries in the sample are assigned one score (for each dimension) that does not change over time[15].

There are several advantages to using the Inglehart-Welzel indices to control for cultural effects[16]. Firstly, they are directly relevant to the SWB data used here given they are themselves based

[14] Except for Armenia, Azerbaijan, Georgia, and Uganda, for which no score data are available between 1999-2010. Earlier information prior to 1999 is used for these countries.

[15] The decision to average across both time-periods for those countries for which both data points are available was made because few countries are given scores in both time periods and also to reduce bias stemming from large differences in cultural profiles for countries that significantly change their values and attitudes between wave 1 and 2.

[16] Alternative cultural controls have been used in the literature. For example, Deaton (2008) uses a binary indicator variables to identify eastern European and sub-Saharan countries. Ovaska and Takashima (2006) single-out Asian

on information collected by the WVS and the EVS. Secondly, they are systematically constructed using Factor Analysis of responses to questions explicitly designed to capture cross-national differences in value-systems and to gain a better understanding of cultural distinctions. Lastly, the two dimensions provide simple, reduced-form controls that capture wide-ranging aspects of values and beliefs.[17]

I also consider an extended model that includes unemployment and inflation data from the World Development Indicators database (WDI, 2014) to control for macroeconomic forces. Both national unemployment and inflation rates are known to have a strong negative affect on life satisfaction (Blanchflower et al., 2014; Di Tella et al., 2003). Moreover, unemployment has been shown to mitigate the benefits of attained education on life satisfaction (Powdthavee et al., 2015) so a high unemployment rate is likely to have an impact on the relationship between mean years of schooling and the share of satisfied individuals.

Summary statistics for all the variables used in the analysis are presented in Table 3. The share of satisfied individuals ranges from 39% to 98% and it is on average higher in 2005-2010 (85%) than in 1999-2004 (79%). All of the objective well-being indicators are also higher in period two on average: per capita GNI rises from 15,100 to 17,548, life expectancy increases from 71.89 to 73.81, mean years of schooling increases from 8.38 to 9.03, and expected years of schooling increases from 13.20 to 13.82. Lastly, the average unemployment and inflation rates are 8.86 and 6.87. It is worth noting that there are large country differences across all of these indicators.

[Table 3 about here]

4.2 Econometric Model

The baseline econometric model commonly used in the literature to explore the relationship between objective and subjective indicators of well-being can be expressed as:

$$SWB_i = \alpha + \beta' X_i + \varepsilon_i, \quad i = 1, \dots, N \tag{3}$$

countries and include religion controls for Islam and Christianity. Helliwell (2003) classifies countries into six groups: industrial, former Soviet Union, other Eastern European countries, Latin American, Asian, other developing countries and Scandinavian. These approaches do not have any underlying value systems and thus have no intuitive interpretation other than to identify differences between groups of countries.

[17] Detailed information regarding the variables used to construct the two dimensions and their correlations is available online as a supplementary material to Inglehart and Welzel (2010) at http://journals.cambridge.org/pps2010020.

where SWB_i is typically average life satisfaction for country i, but can also be an alternative measure such as mean happiness or annual change in life satisfaction (Easterlin, 2013), and X is a vector of objective well-being measures[18]. In this paper, SWB_i is SWB_{shar} for country i.

This can be estimated using Ordinary Least Squares; however, OLS regression can produce fitted values that are outside the bounds of SWB_{share}, and does not address the non-normal distribution of this SWB_{share}. Figure 4 shows that the proportion of satisfied individuals is left-skewed in each of the two constructed waves, with most countries concentrated at the upper end of the distribution and with long left tails. Under the OLS normality assumption this asymmetry can lead to misleading inference about the statistical characteristic of the estimates[19].

[Figure 4 about here]

Ferrari and Cribari-Neto (2004) and Smithson and Verkuilen (2006) independently propose a Beta-regression model for skewed, naturally bounded dependent variables. They specifically develop these models for use with bounded scales from survey responses and proportions. The Beta function allows great flexibility in modelling asymmetric distributions, and Beta models perform well with small datasets (Kieschnick and McCullough, 2003). The following Beta-regression model with a Logit link function is estimated using the data described in Section 4.1:

$$E(SWB_{it}|X_{it}) = \frac{e^{\beta' X_{it}}}{1 + e^{\beta' X_{it}}} \tag{4}$$

where SWB_{it} is SWB_{share} in country i at time period t, and X includes the following explanatory and control variables: *PER CAPITA GNI*, *LIFE EXPECTANCY*, *MEAN YEARS OF SCHOOLING, EXPECTED YEARS OF SCHOOLING*, a binary time indicator that equals 1 for observations in the second wave and 0 for observations in the first wave. Additional extensions also include the two Inglehart and Welzel cultural indices, unemployment and inflation as controls. *PER CAPITA GNI* is measured in constant 2005 international dollars and is logarithmically transformed[20]. $E(SWB_{it}|X_{it})$ is the conditional mean of SWB_{share}, and β is a matrix of parameter vectors to be estimated. Following the notation in Ferrari and Cribari-Neto (2004), SWB_{share} is assumed to be distributed with a beta density given by:

[18] This simple model has been largely applied to cross-sectional data (Deaton, 2008; Leigh and Wolfers, 2006); in some cases a cross-section is constructed by averaging across a number of waves to minimize seasonal deviations from the long-term trend (Ovaska and Takashima, 2006). Stevenson and Wolfers (2008) use a wide range of data sources and waves to analyze both cross-section and panel datasets.

[19] More precisely, the normality assumption refers to the conditional distribution of the dependent variable (i.e. conditional on the regressors). Smithson and Verkuilen (2006) point out that linear regression is often robust to violations of this assumption, but they emphasize that this is not always the case, especially in small samples, and is particularly misleading for "survey responses with bounded response sets or proportions" (p. 54).

[20] The relationship between income and SWB is better captured by a logarithmic scale (Helliwell, 2003).

$$f(SWB_{share};\mu,\phi) = \frac{\Gamma(\phi)}{\Gamma(\mu\phi)\Gamma((1-\mu)\phi)}(SWB_{share})^{\mu\phi-1}(1-SWB_{share})^{(1-\mu)\phi-1} \quad (5)$$

where $\mu = E(SWB_{shar}\ )$ is the mean, ϕ is a precision parameter, $\Gamma(\cdot)$ is the gamma function, and $0 < SWB_{share} < 1$. The model is estimated using Maximum Likelihood with panel-robust standard errors to control for heteroskedasticity and serial correlation within countries.[21]

The explanatory variables are collectively taken as proxies of human development, they are each intended to capture different objective aspects of development. However, there has been some criticism regarding the high internal correlation between these measures (Kovacevic, 2010), which can result in multicollinearity and lead to inflated standard errors with potentially biased estimates. It is not clear that multicollinearity is a serious concern in this case. Firstly, Kovacevic (2010) discusses this issue in detail and presents several sources that defend the choice of HDI components despite high correlations observed among them. Secondly, the Variance Inflation Factors (VIFs) are well below 10[22]. *PER CAPITA GNI* has the highest VIF value at 5.66, while the VIF values for *LIFE EXPECTANCY*, *MEAN YEARS OF SCHOOLING*, and *EXPECTED YEARS OF SCHOOLING* are 3.44, 2.78, and 4.44 respectively. These values indicate that correlations between the explanatory variables do not cause serious problems of multicollineartiy.

The model does not establish causation, although there is some evidence that SWB is affected by education (Oreopoulos, 2003), and Frey and Stutzer (2002a) argue that it is affected by income, not vice-versa. However, Powdthavee (2010) finds evidence of endogeneity between income and life satisfaction. As in previous cross-country studies of SWB, the estimated marginal effects are interpreted as partial correlations between the covariates and the dependent variable. Nevertheless, establishing the presence of associations between SWB and objective measures of development is important for cross-country comparisons as it helps us evaluate whether countries that are considered highly developed economically also exhibit high levels of SWB.

[21] Given the panel structure of the data, a Fixed-Effects (FE) model was considered but not used due to the small sample. While minimizing bias, FE can be inefficient in small sample unbalanced panels. Furthermore, it is difficult to obtain consistent FE estimates in non-linear specifications such as the Beta-regresssion model proposed here (Cameron and Trivedi, 2009, p. 232). Consistency is also problematic in short panels (Cameron and Trivedi, 2009, p. 231). This problem is amplified here due to the panel being unbalanced with a considerable portion of countries appearing only in one of the waves. Of the total 90 countries included in the analysis, 12 only appear in the 1999-2004 wave and 27 only appear in the 2005-2010 wave, which leaves only 51 countries with enough information to compute the average values necessary for the FE estimators. Lastly, FE models are not a good choice when within-unit variance is much smaller than between-unit variance (Cameron and Trivedi, 2009), which is the case here (see Table A2 in Appendix). The Inglehart and Welzel (2010) cultural controls are used instead to control for country differences. This allows more degrees of freedom compared to the FE model. Helliwell (2003) use a similar approach in order to preserve degrees of freedom.

[22] VIF values below 10 are considered to denote a degree of collinearity that is acceptable (e.g. Hair et al., 2006).

4.3 Results

Table 4 reports the marginal effects evaluated at the sample means of the regressors[23] estimated using Equation 4[24]. The model presented in column 1 is the most parsimonious including only the individual HDI components and a wave dummy; cultural controls are added in column 2; and unemployment and inflation are added in column 3. The Bayesian Information Criterion (BIC)[25] is significantly lower than in the equivalent OLS specifications (shown in Appendix Table A3), which suggests that Beta-regression is superior at explaining the variation in the proportion of satisfied individuals than the standard OLS, as expected given the skewed distribution of SWB_{share}.

[Table 4 about here]

The parsimonious model in column 1 shows significant associations between the share of satisfied individuals and all objective measures of development. The marginal effects of *PER CAPITA GNI*, *MEAN YEARS OF SCHOOLING*, and *EXPECTED YEARS OF SCHOOLING* are all significant at the 1% level, while *LIFE EXPECTANCY* is significant at the 10% level. *PER CAPITA GNI* is positively linked with the share of satisfied individuals for the average country, but this relationship is small in magnitude. The marginal effect of 0.0568 indicates that a ten percent increase in *PER CAPITA GNI* from 10,543[26] is associated with an increase of approximately 0.00568 percentage points (pps) in the share of satisfied individuals. A more accurate estimate can be obtained by computing the share of satisfied individuals at GNI=$10,543 and at GNI=$11,597, which is 0.8422 and 0.8475 respectively (a 0.0053 pps change). The marginal effect is smaller at the mean of *PER CAPITA GNI* – a 10% increase from $16,454 is associated with an increase of 0.0047 pps in the share of satisfied individuals. These differences are just under 4% of the standard deviation of the share of satisfied individuals.

[23] For a given continuous covariate x, the marginal effect at means is the partial derivative of the share of satisfied individuals with respect to x given by $\partial E(SWB_{share}|X)/\partial x = \partial\left(\frac{e^{X\beta}}{1+e^{X\beta}}\right)/\partial x$, evaluated at mean values of all the covariates in X. For a dichotomous covariate x, the marginal effect is the discrete change in the share of satisfied individuals as x changes from 0 to 1 given by $\frac{dE(SWB_{share}|X)}{dx} = E(SWB_{share}|X, x = 1) - E(SWB_{share}|X, x = 0)$.

[24] Average marginal effects are generally larger in magnitude, but the results remain qualitatively the same (results available upon request).

[25] BIC is used because it allows for comparison across models with different dependent variables and different structural specifications. A lower value signals a better model fit. Following Kass and Raftery (1995), differences in BIC values that are less than 2 points constitute "very little" evidence to support the use of the model with the lower BIC value, while differences between 2 and 6 points constitute "some positive" evidence, differences between 6 and 10 constitute "strong" evidence, and differences larger than 10 present "very strong" evidence.

[26] This corresponds to the mean of ln(*PER CAPITA GNI*). Note that this is different from mean *PER CAPITA GNI* (which is 16,454). The mean of ln(*PER CAPITA GNI*) is used because the results reported in Table 3 are the marginal effects at the means of the covariates.

The marginal effects of the remaining objective indicators are as follows: a one year increase in *LIFE EXPECTANCY* from its mean value of 73 years is associated with an increase of 0.0029 pps in the share of satisfied individuals; a one year increase in *MEAN YEARS OF SCHOOLING* from its mean value of 8.7 years is associated with a decrease of 0.022 pps; and a one year increase in *EXPECTED YEARS OF SCHOOLING* from its mean value of 13.5 is associated with an increase of 0.013 pps.

Including the Inglehart-Welzel indices as cultural controls (column 2) improves the model fit (the BIC value is reduced by 63 points), and changes the significance of the marginal effects, though only the index of survival/self-expression values is statistically significant (at 1%). Countries that emphasize self-expression over survival values have a higher share of satisfied individuals. Most notably, *PER CAPITA GNI* is no longer significant at standard levels. The relationship between income and mean satisfaction is by comparison commonly found to be positive and statistically significant in cross-country analysis (e.g. Stevenson and Wolfers, 2008), which is a crucial part of the well-known Easterlin paradox[27]. Consistent with previous studies, regressing mean life satisfaction using the same sample and models presented in Table 4 results in a positive marginal effect of *PER CAPITA GNI* that is statistically significant across all three specifications[28] (results shown in Appendix Table A4). The prominent role of income-based measures of development, both within and without economic studies, makes GNI a particularly important key measure of well-being. The non-significant marginal effect in column 2 may offer a novel perspective. The income-satisfaction relationship can be judged to be very different when national satisfaction is constructed to directly reflect the perceptions of the unsatisfied. This finding suggests evidence against the existence of trickle-down benefits – if trickle-down effects are strong then we might expect to see the same strong relationship between income and the share of satisfied individuals as we observe between income and mean satisfaction, but we do not, implying weak trickle-down effects on SWB. The cultural controls also decrease the marginal effects of *MEAN YEARS OF SCHOOLING*, and *EXPECTED YEARS OF SCHOOLING*, making the latter non-significant at standard levels, while increasing the marginal effect of *LIFE EXPECTANCY*.

The negative relationship between *MEAN YEARS OF SCHOOLING* and the proportion of satisfied individuals raises questions about the role of education within a SWB framework. It implies that adopting an account of progress based on SWB may lead to policies that do not support investing in education. This can be particularly detrimental for efforts to integrate SWB into accounts of well-being because it suggests an unpopular development agenda that would discourage education. However,

[27] Although the initial Easterlin paper found a weak and ambiguous relationship between income and happiness across countries (Easterlin, 1974), subsequent analysis shows a positive relationship and specifies that the paradox is characterized by the conflicting findings of (i) a positive income-happiness relationship *across and within* countries at a point in time, and (ii) a negative relationship across time within a given country (Easterlin et al., 2011).

[28] Beta-regression requires the dependent variable to be continuous and constrained on (0, 1). While the share of satisfied individuals naturally falls in this interval, mean satisfaction does not and is instead defined on (1, 10). Mean life satisfaction is therefore transformed such that $SWB'_{mean} = (SWB_{mean} - a)/(b - a)$, where a and b are the theoretical boundaries on SWB_{mean} (not the minimum and maximum observed in the sample).

this conclusion may be misguided, as there are likely to be many channels through which education can effect well-being. As discussed previously, Powdthavee et al. (2015) show that, despite a negative direct relationship, education and life satisfaction are positively associated indirectly through higher income, higher likelihood of employment, and better health. The negative marginal effect found here reflects the combined direct and indirect association between education and SWB, which potentially hides these benefits. For example, macro-economic conditions can reduce or even reverse any existing positive effects of education on satisfaction. Including unemployment rate and inflation (column 3)[29] gives a marginal effect of *MEAN YEARS OF SCHOOLING* that is non-significant at standard levels, while both macro controls are found to be statistically significant and negatively associated with the level of satisfaction. This result is consistent with the theory of adaptive expectations (Burchardt, 2005). A population that expects to achieve a high level of education is more likely to have increased expectations if people believe that better education will bring better opportunities and higher disposable income. If opportunities are subsequently not available, individuals are likely to feel let down after investing in education. This line of reasoning can explain the negative relationship between *MEAN YEARS OF SCHOOLING* and the proportion of satisfied individuals, which disappears when including the unemployment rate. These findings suggest that the potential benefits to education are closely linked to the availability of adequate post-education opportunities. This hypothesis resonates particularly well with the current economic conditions – large numbers of the educated youth (in both developed and developing nations) are underemployed and unhappy with their available employment prospects (House of Lords Committee EU, 2014).

Including unemployment and inflation has no substantial impact on the marginal effect of *PER CAPITA GNI* but does decrease the marginal effect of *LIFE EXPECTANCY* and increases that of *EXPECTED YEARS OF SCHOOLING*, making the latter statistically significant at the 10% level. There is no change in the sign or statistical significance of either of the cultural controls. It is worth noting that the significance of *EXPECTED YEARS OF SCHOOLING* is not contradictory to the non-significance of *MEAN YEARS OF SCHOOLING*. The latter measures the current stock of education, while the former measures the education of future generations. It is possible that current generations in countries with a higher level of education do not enjoy the direct well-being benefits due to, say, bad labour market conditions, but derive indirect benefits from a progressive education profile.

An advantage of the non-linearity of the Beta-regression model is that it can be used to compare marginal effects across different levels of the regressors which can offer valuable insights. For example, we can exploit this feature to test the presence of an income satiation point. Some scholars have suggested that there is a threshold level beyond which income does not improve well-being. This threshold may be relatively low, representing the amount of money required to secure a 'decent'

[29] This model includes 136 observations due to missing unemployment and/or inflation data for Andorra, Chile, Mali, Rwanda and Venezuela.

standard of living. Frey and Stutzer (2002b) find evidence that a threshold level exists at $10,000, while Layard (2003) places it at $15,000, though he more recently proposes $20,000 (Layard, 2011). We can investigate how the relationship between *PER CAPITA GNI* and SWB_{share} differs across income levels by looking at the marginal effect path. Although the marginal effect is non-significant at the mean of *PER CAPITA GNI* in the preferred model (2), it may be the case that it is significant at lower levels of income, which would support the satiation point theory. Figure 5 shows that the marginal effect of ln(*PER CAPITA GNI*) diminishes only slightly as we move from countries with the lowest incomes to countries with the highest incomes. However, it is not statistically significant across all levels of income, so there is no evidence of a satiation point.

[Figure 5 about here]

It is interesting to note that the wave dummy is strongly significant and large in magnitude (relative to the other covariates) across all models in Table 4[30]. It is associated with a 0.0313 pps increase in the share of satisfied individuals in the preferred specification (column 2). This indicates that reported SWB is improving over time, which presents a somewhat optimistic outlook for the future of social progress. More individuals seem to be happy with their lives more over time. While this does not help explain the process of improvement, it does suggest that we are moving toward a world-state that is more valuable to individuals. A positive interpretation is that these results reflect improved life circumstances in a progressive world. A more pessimistic view is that they could instead reflect lower expectations. A longer time-horizon and additional measures as more data become available will help answer this ambiguity.

I further explore this time dimension with differential effects across waves, by interacting wave with all covariates in the preferred model from column 2 in Table 4. Although the estimated marginal effects discussed above already vary by wave due to the non-linearity of the Beta model, the interaction effect allows for further variation that may not be captured in the baseline model. The corresponding marginal effects at means for each wave are shown in the first two columns of Table 5 (significant differences between waves are indicated in bold and italic). This reveals there is a positive link between income and SWB_{share} that is statistically significant in wave 2 but not in wave 1 (and this difference

[30] It is possible that the marginal effect of the wave dummy is biased due to the unbalanced structure of that data. If countries appearing only in the second wave are on average happier than countries appearing only in the first wave (all other regressors being held constant), the marginal effect will be biased upward. The share of satisfied individuals is on average higher for countries appearing only in the second wave, but so is *PER CAPITA GNI*, *LIFE EXPECTANCY* and both education measures. Excluding the time indicator does not significantly change the point-estimates of the key measures of interest. As a further robustness check, model 2 was repeated only for the subsample of countries that appear in both waves. The wave coefficient remains very strongly significant and similar in magnitude, and the results generally support those obtained using the full sample (the only difference is that expected school years becomes non-significant). The unbalanced structure of the panel does not appear to drive the strong positive time trend. A more detailed discussion regarding unbalanced panel issues follows below.

between the waves is statistically significant). Inversely, the marginal effect of *LIFE EXPECTANCY* is significant only in wave 1, as is the marginal effect of *MEAN YEARS OF SCHOOLING* (though the latter is not significantly different from wave 2). While these findings may be due to unobserved individual or country characteristics changing over time, it is possible that they are driven by the unbalanced sample, which I discuss in more detail below.

[Table 5 about here]

While the general purpose of cross-country analysis is to understand the overall relationships between objective measures of well-being on SWB, it may also be helpful for policy design to note whether there are any differences between these two groups. For example, the evidence so far suggests that the relationship between average income and average SWB is substantially diminished or non-existent for developed countries (see discussion in Section 3.3 of Frey and Stutzer, 2002b). To explore this further I include in the preferred specification (Table 4, column 2) a binary indicator for developed/developing nations (as recognized by the United Nations) interacted with all covariates and find contradictory evidence. The marginal effect of income on SWB_{share} is significantly larger for developed nations (and this difference is statistically significant), while the marginal effect of income for developing nations is not significantly different from zero at standard levels. However, the opposite is true for *MEAN YEARS OF SCHOOLING*, which has a significant marginal effect only for developing nations. It is also worth noting that the marginal effect of *LIFE EXPECTANCY* is only significant for developing nations, while the marginal effect of *EXPECTED YEARS OF SCHOOLING* is only significant for developed nations, though these differences are not statistically significant between the two groups of countries.

Lastly, I consider gender differences. Women report higher life satisfaction on average than men despite being worse off in terms of income and other life dimensions, though the reverse is true in some developing nations (Helliwell et al., 2012). In the sample used here there is no clear gender pattern across countries, about 45% of country-wave observations have a higher share of satisfied women relative to the share of satisfied men and this is stable across developed as well as developing nations. Little is known about how the relationship between subjective and objective measures of aggregate well-being differs between genders, which may have important policy implications. I explore this by running the preferred model separately for men and women where the dependent variable is the share of satisfied men and the share of satisfied women respectively, $SWB^{g}_{share} = \frac{1}{n}\sum_{j=1}^{n}\theta_j I(s_j \geq 5 | \, g)$ where g=(female, male). The results are shown in columns 5 and 6 of Table 5. I find a positive relationship between income and the share of satisfied women but no significant relationship for men. This suggests that women may be the primary beneficiaries of economic growth, which is consistent with diminishing marginal returns to income given that women have lower incomes than men on

average. Another notable difference between the genders is that *EXPECTED YEARS OF SCHOOLING* is positively related to aggregate SWB for men but not for women. It is not clear why this may be the case, but one explanation may be that men are more optimistic about future prospects (e.g. the returns to their children's education) than women.

Unbalanced Panel Issues

Unbalanced panels are common and can provide accurate estimates if the missing information is randomly distributed across the sample of relevant units. Common sources of unbalanced panels are attrition in respondents for surveys that follow the same individuals over a period of time, and shifting samples in rotating panel surveys. In this case, the missing information is not due to attrition (as macro-level panels do not rely on the retention of the same individuals, attrition is not generally applicable), and there is no clear intention from the part of the WVS and EVS for a systematic rotating panel design.

To investigate the validity of this type of unbalanced data, I begin by exploring the characteristics of the 39 countries that appear only in one of the two waves (referred to as single-wave countries) and how they behave relative to the rest of the sample. In general, the 12 countries appearing only in the first wave (call these group A) have on average lower values of *PER CAPITA GNI*, *LIFE EXPECTANCY*, and education measures compared to the first wave observations of countries that appear in both waves (at 5% statistical significance). The same is observed for the 27 countries that appear only in the second wave (call these group B) when compared to the second wave observations of countries that appear in both waves. However, these differences are not necessarily problematic in this case because the countries are both lost and added to the sample. As long as each separate wave contains a representative sample of countries, the random addition or loss of a group of countries should not bias the regression results. In other words, if group A is not significantly different from group B, the unbalanced structure of the dataset should not invalidate the results.

Moreover, t-tests confirm that all measures of interest are on average not significantly different between group A and B (at standard confidence levels), except for *EXPECTED YEARS OF SCHOOLING* (which is significant at the 10% level). This indicates that the addition and loss of countries across waves does not appear to drastically change the sample properties (i.e. seemingly similar countries are lost and gained). However, countries in the two subsamples may still exhibit very different relationships between regressors and the satisfaction measures, which is enough to introduce bias in the estimates. Comparing the results of the full sample with those of the restricted subsample of countries that appear in both waves is not particularly useful in this context because countries in groups A and B taken together may be different from countries that are surveyed in both waves, which would affect the estimation results without necessarily causing bias. The question is whether the addition of B is more or less equivalent to the loss of A. One way to test for this is to run separate regressions for each of the groups A and B to compare the resulting coefficients, but the small sample sizes make it difficult to

obtain consistent estimates. Additional future waves will help settle this issue. However, it is possible to gain some insights by comparing the wave-specific marginal effects from the full sample (Table 5, columns 1 and 2) with the corresponding marginal effects from the restricted sample including only countries that are observed in both waves (Appendix Table A5). The results are qualitatively more consistent across waves in the balanced subsample with the exception of *EXPECTED YEARS OF SCHOOLING*, which is positively associated with SWB in wave 2 but not statistically significant in wave 1. In light of this, the full sample wave-specific results should be interpreted with caution as they may be biased due to the panel being unbalanced. In particular, there is no significant relationship between income and SWB_{sha} in either wave, which suggests that the positive association identified in wave 2 in the full sample (Table 5) is driven by countries that do not appear in both waves.

Data Comparability within Second Wave

There may be some concern about the general data comparability within the 2005-2010 period as some countries were surveyed prior to the 2008 recession, while others were surveyed after. If SWB is affected by the recession, aggregate measures of SWB in countries surveyed before 2008 may not be comparable with measures for countries surveyed after.

It is possible to explore the implications of this split sample using a subset of 20 countries surveyed by both initiatives in wave 2 using simple two-sample t-tests for the difference in the level of aggregate satisfaction between samples collected in 2005-2007 (by WVS) and those collected in 2008-2010 (by EVS). The results in Table 6 reveal that the share of satisfied individuals is significantly different between the EVS and WVS samples for 15 of the 20 nations, and mean satisfaction is significantly different for 13 nations, with both positive and negative differences. However, it is difficult to interpret these results as indicative of a recession effect because the changes observed by the t-tests may be caused by corresponding changes in other factors that are unaccounted for.

[Table 6 about here]

To gain further insight, a Chow test is performed on the baseline OLS model (for simplicity) to see how the estimates compare between the subsample of countries with WVS data and those surveyed only after the recession by EVS. The test reveals that the subsamples are significantly different at the 5% level, which is consistent with the above t-test results.

This issue can be further addressed by repeating the regressions using only the subset of 15 countries that are surveyed three times, once during the 1999-2004, once in 2005-2007, and again in 2008-2010. The use of the three periods allows for the estimation of a time trend before the recession, which helps to give relative meaning to the changes in satisfaction observed after the onset of the

recession. This country subset consists of a balanced panel with 45 country-period observations. Though this is a small subsample, it can help to get an impression of the impact of the recession. Regressing the share of satisfied individuals using model 2 from Table 4 and replacing the wave dummy with time indicators for 1999-2004 and 2008-2010 (the pre-recession period of 2005-2007 is omitted) shows an overall positive time trend. The marginal effect of the 1999-2004 period is -0.036 relative to 2005-2007 (significant at the 1% level), which means individuals are on average happier in 2005-2007 than in previous years. However, the positive marginal effects of 0.0013 for period 2008-2010 relative to 2005-2007 is not significant at standard levels. These findings indicate the presence of a negative recession effect on the life satisfaction of individuals which has substantially reduced the previously positive time trend. In light of this, the positive estimates presented above can be expected to be downwardly biased, while the negative estimates may be upwardly biased. For example, the positive estimate on *LIFE EXPECTANCY* may be significantly lower than it would otherwise have been in the absence of the recession.

5 Concluding Remarks

This paper aims to contribute to the well-being debate that is vital to the study of economics by developing a framework for measuring aggregate SWB. The approach employed applies Hirschman's Cognitive Dissonance Theory to widely available data on reported life satisfaction to construct a national headcount measure of national SWB. The intent has been to expand the tools available for SWB measurement in the context of economic growth and social progress, and to contribute to normative considerations regarding the social definition of SWB improvement.

The proposed headcount measure is based on a particular data-cliff between values 4 and 5 observed in the life satisfaction responses from the World and European Values Surveys. This cut-off point is interpreted to reflect the share of sufficiently satisfied individuals. However, the distribution of reported life satisfaction reveals that there are other notable points on the satisfaction scale that may be of interest for future research. In particular, there is a prominent peak at satisfaction level 8. While this additional information can potentially enrich our understanding of SWB, it is important to emphasize that the application of Cognitive Dissonance Theory to the sufficiency principle requires a level of satisfaction that is credibly low. It would be difficult to argue that level 8 (on a 1-10 satisfaction scale) should be interpreted as the level below which individuals may be considered to be *sufficiently* dissatisfied.

More generally, one concern regarding the use of threshold measures of SWB is their reliance on arbitrary cut-off values. Since subjective scales are not based on a set, measurable standard, choosing appropriate cut-off values is challenging. This paper offers a practical starting point, but additional research is necessary to establish the relevance of the chosen threshold by exploring the real-life

meaning behind the data-driven threshold value. In particular, one should consider what life conditions are driving the data-cliff and whether these differ significantly across countries and population groups (e.g. males/females, old/young, urban/rural, etc.). It addition, one might consider adopting different cut-offs across countries – while this approach can be used for monitoring changes over time within countries, it is problematic for international comparisons of SWB.

The empirical portion of the paper expands on previous cross-country studies using regression analysis to explore the link between national SWB and objective indicators of development. It aims to contribute to the better understanding of this relationship in order to help inform future development policy. It recommends a Beta-regression approach over the baseline OLS model, and offers new insights into the measurement of SWB. The Beta-regression model improves the goodness-of-fit over the standard OLS models when using the share of satisfied individuals. An important advantage of using the non-linear Beta-regression model is that it can be used to assess non-constant relationships between different levels of SWB and objective measures, revealing differences along the progression paths of key measures of development. This econometric model does not establish causality; nevertheless, associations between SWB and objective measures of development are a useful tool for evaluating the welfare relevance of economic indicators. The insights gained from this exercise can help guide research into how economic wealth translates into overall well-being.

A principal finding is that the proportion of satisfied individuals is not significantly associated with *PER CAPITA GNI* when controlling for cultural differences, which contrasts the strong positive relationship between mean satisfaction and income. This finding does not invalidate the observed relationship between mean satisfaction and income, but it does reveal the importance of the aggregation approach used to measure national SWB and its implications for development policies. In light of this result, we should be skeptical about the benefits of raising income without considering distributional issues and clear social aims.

Lastly, a noteworthy question arises from the dichotomization of life satisfaction scales – should we instead focus on yes/no questions regarding whether the individual is sufficiently satisfied with life? It would be a worthwhile exercise to include such questions in future questionnaires alongside the standard life satisfaction scales in order to compare the two and gain further insight about a meaningful cut-off value. However, high resolution life satisfaction scales are important for individual-level analysis and the full distribution over these scales should be continually and rigorously monitored for any substantial changes – changes that may well affect the aggregation method altogether. The availability of high-resolution satisfaction data is vital for improving on current aggregation methods. However, binary questions can be useful validation tools for indirectly identifying meaningful cut-off points if they are included alongside high resolution scales. Alternatively, it may be feasible to formulate a question that directly identifies a subjective cut-off for each individual akin to the Minimum Income Question used to derive the Subjective Poverty Line (introduced by Goedhart et al., 1977), which asks individuals what minimum household income is needed to make ends meet.

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Figures

Figure 1. Dissonance level across the SWB path

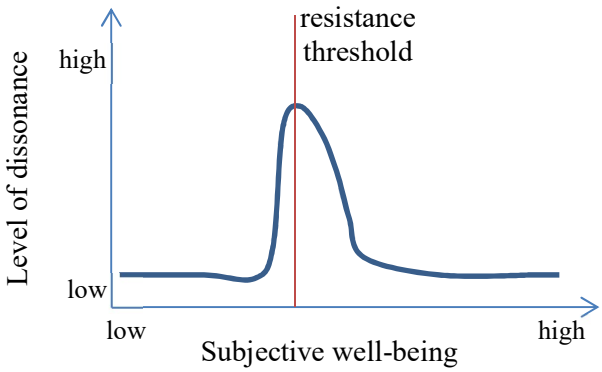
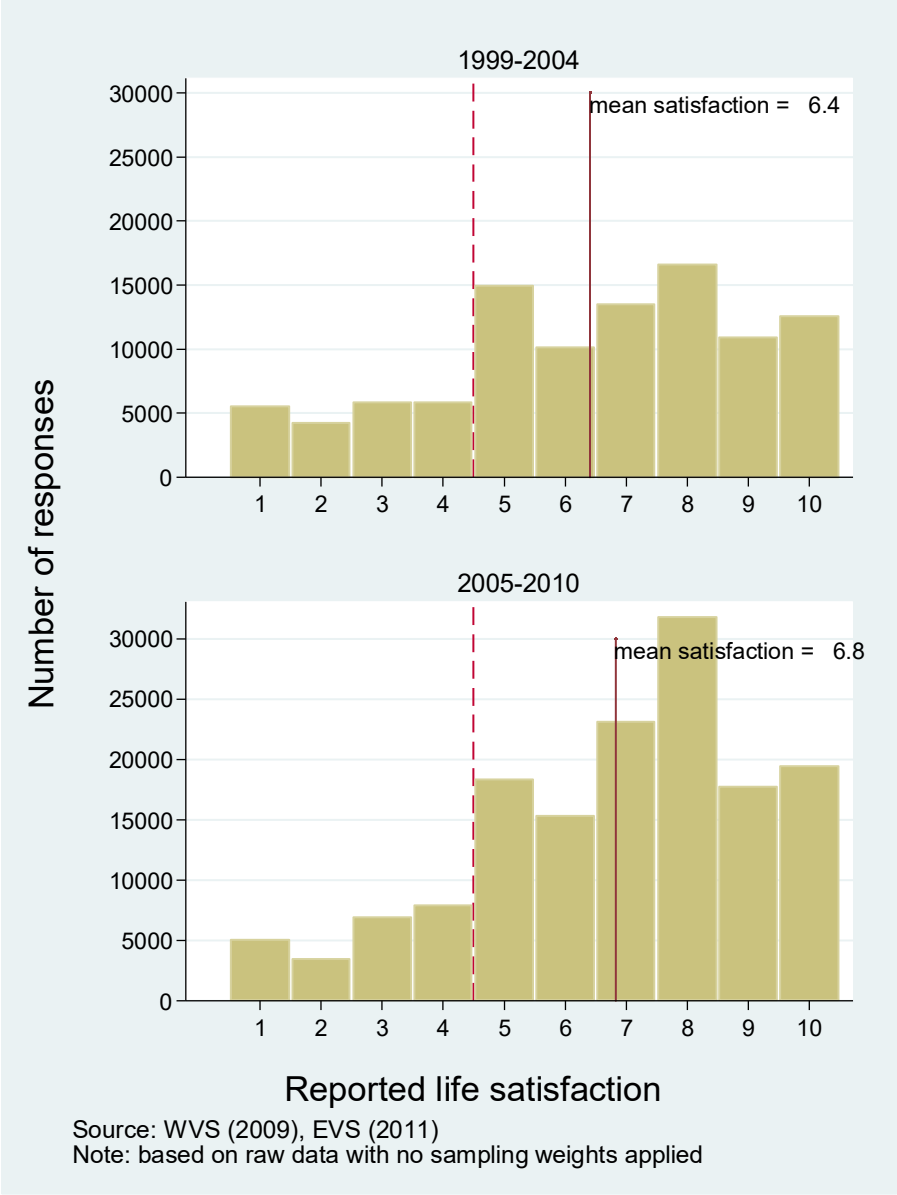
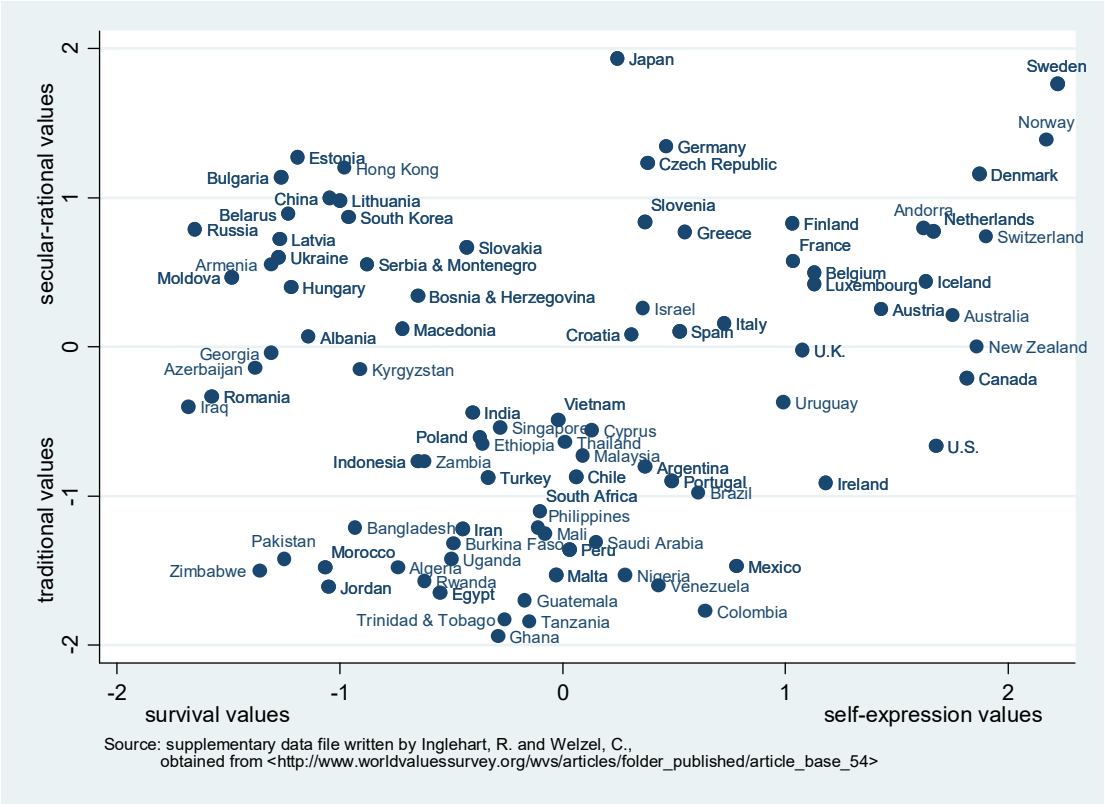


Figure 2. Distribution of life satisfaction responses, by wave



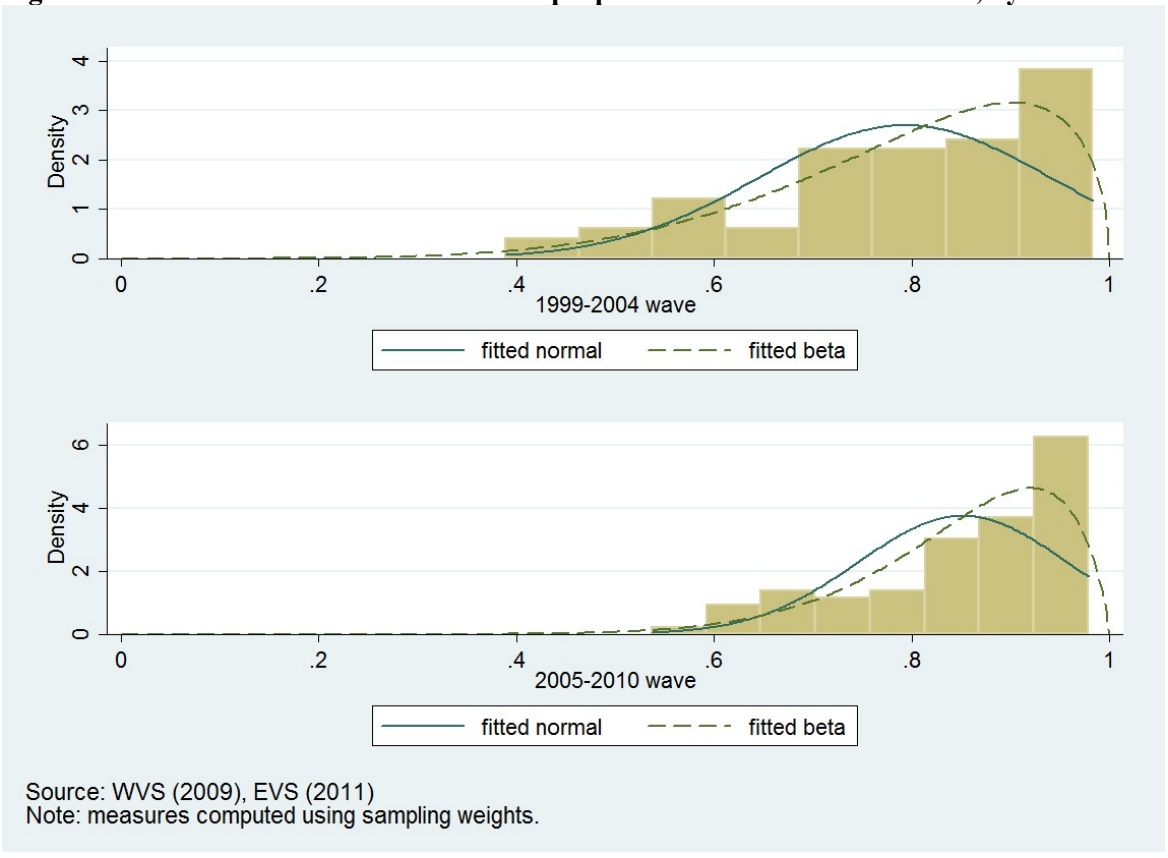
Source: WVS (2009), EVS (2011)
Note: based on raw data with no sampling weights applied

Figure 3. Cultural map (1999-2010 average).



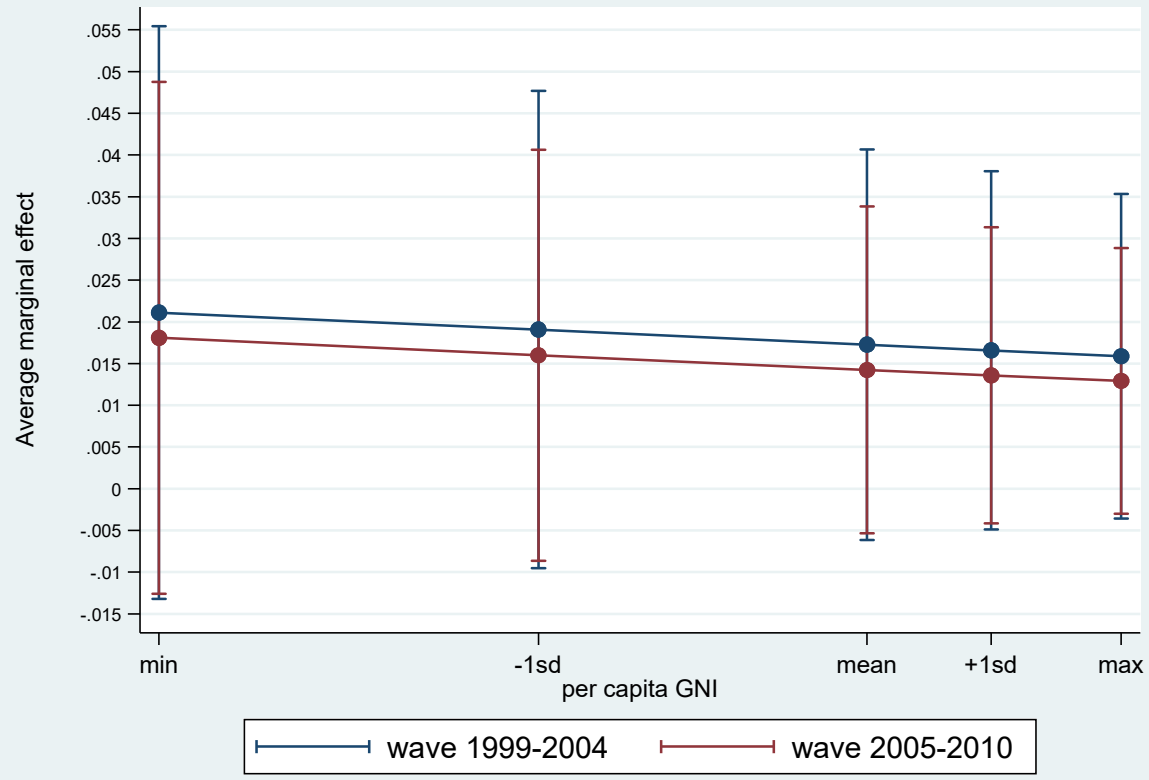
Source: supplementary data file written by Inglehart, R. and Welzel, C.,
obtained from <http://www.worldvaluessurvey.org/wvs/articles/folder_published/article_base_54>

Figure 4. Distribution characteristics of the proportion of satisfied individuals, by wave.



Source: WVS (2009), EVS (2011)
Note: measures computed using sampling weights.

Figure 5. Average marginal effects on mean satisfaction with 95% CIs (model 2)



Source: author's own regressions using WVS (2009), EVS (2011), UNESCO (2014), WDI (2014), Inglehart and Welzel (2010)

Tables

Table 1. Distribution of life satisfaction responses, by wave.

	constructed waves			
Overall Life Satisfaction	1999-2004		2005-2010	
1 - Dissatisfied	4,979	5.36%	4,809	3.34%
2	3,886	4.19%	3,286	2.28%
3	5,184	5.58%	6,511	4.52%
4	5,186	5.59%	7,465	5.19%
5	13,705	14.76%	17,521	12.17%
6	9,251	9.96%	14,637	10.17%
7	12,391	13.34%	22,134	15.38%
8	15,456	16.65%	30,545	21.22%
9	10,192	10.98%	16,943	11.77%
10 - Satisfied	11,576	12.47%	18,554	12.89%
missing	1,043	1.12%	1,515	1.05%

Source: WVS (2009), EVS (2011)

Note: Counts constructed using sampling weights.

Table 2. Variable definitions.

Variable	Variable description	Source
Dependent variable		
SWB_{share}	Proportion of survey respondents who reported satisfaction level 5 or above.	WVS (2009), EVS (2011)
Objective development indicators		
GNI PER CAPITA	Aggregate income of an economy generated by its production and its ownership of factors of production, less the incomes paid for the use of factors of production owned by the rest of the world, converted to (constant 2005) international dollars using purchasing power parity (PPP) rates, divided by midyear population.	UNDP (2011)
LIFE EXPECTANCY	Number of years a newborn infant could expect to live if prevailing patterns of age-specific mortality rates at the time of birth stay the same throughout the infant's life.	UNDP (2011)
MEAN YEARS OF SCHOOLING	Average number of years of education received by people ages 25 and older, converted from education attainment levels using official durations of each level.	UNDP (2011)
EXPECTED YEARS OF SCHOOLING	Number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life	UNDP (2011)
Cultural controls		
Index of traditional/ secular-rational	Constructed using several WVS and EVS attitudinal questions and measured as a continuous scale, where countries dominated by more traditional values are given negative scores, and countries with more secular-rational values are given a positive score. Larger negative (positive) scores reflect stronger traditional (secular-rational) values. Traditional values emphasize religion, national pride, obedience and respect for authority. Secular-rational values emphasize secularism, cosmopolitanism, autonomy, and rationality.	Inglehart and Welzel (2010)
Index of survival/ self-expression	Constructed using several WVS and EVS attitudinal questions and measured as a continuous scale, where countries dominated by survival values are given negative scores, and countries that value self-expression more are given a positive score. Larger negative (positive) scores reflect stronger survival (self-expression) values. Survival values emphasize order, economic security and conformity. Self-expression values emphasize the importance of self-expression, participation, subjective well-being, trust, tolerance, and quality of life.	Inglehart and Welzel (2010)
Macro-level controls		
Unemployment	Share of the labour force that is without work but available for and seeking employment (national estimate).	WDI (2014)
Inflation	Annual percentage change in the cost to the average consumer of acquiring a basket of goods and services, measured by the consumer price index.	WDI (2014)

Table 3. Summary statistics.

	mean	st. dev.	min.	max.	observations
SWB_{share} *(0-1)*					
1999-2004	0.80	0.15	0.39	0.98	63
2005-2010	0.85	0.11	0.54	0.98	78
total	**0.83**	**0.13**	**0.39**	**0.98**	**141**
GNI PER CAPITA (PPP constant 2005 $)					
1999-2004	15,100	12,417	608	53,204	63
2005-2010	17,548	13,244	809	53,763	78
total	**16,454**	**12,894**	**608**	**53,763**	**141**
LIFE EXPECTANCY (years)					
1999-2004	71.89	7.68	44.70	81.20	63
2005-2010	73.81	7.70	46.94	82.86	78
total	**72.95**	**7.72**	**44.70**	**82.86**	**141**
MEAN YEARS OF SCHOOLING					
1999-2004	8.38	2.43	3.30	13.00	63
2005-2010	9.03	2.69	1.30	12.66	78
total	**8.74**	**2.59**	**1.30**	**13.00**	**141**
EXPECTED YEARS OF SCHOOLING					
1999-2004	13.20	2.78	5.40	18.00	63
2005-2010	13.82	2.64	5.64	18.00	78
total	**13.54**	**2.72**	**5.40**	**18.00**	**141**
Unemployment					
1999-2004	9.16	5.44	2.32	26.08	63
2005-2010	8.62	5.68	1.23	34.37	75
total	**8.86**	**5.56**	**1.23**	**34.37**	**138**
Inflation					
1999-2004	8.93	23.22	-0.49	174.21	61
2005-2010	5.23	4.02	-0.11	17.25	77
total	**6.87**	**15.76**	**-0.49**	**174.21**	**138**

Note: Life satisfaction statistics computed using raw data with no sampling weights applied.

Table 4. Beta-regression marginal effects at means for share of satisfied individuals.

dependent variable: share of satisfied individuals (SWB_{share})

	(1)	(2)	(3)
ln(GNI PER CAPITA)	0.0568 ***	0.0154	0.0124
	(0.0146)	(0.0112)	(0.0110)
LIFE EXPECTANCY	0.0029 *	0.0034 ***	0.0026 **
	(0.0016)	(0.0011)	(0.0012)
MEAN YEARS OF SCHOOLING	-0.0218 ***	-0.0085 *	-0.0079
	(0.0050)	(0.0048)	(0.0052)
EXPECTED YEARS OF SCHOOLING	0.0132 ***	0.0076	0.0102 *
	(0.0044)	(0.0050)	(0.0052)
wave dummy	0.0266 **	0.0313 ***	0.0312 ***
	(0.0107)	(0.0091)	(0.0093)
index of traditional/secular-rational values		-0.0077	-0.0102
		(0.0086)	(0.0089)
index of survival/self-expression values		0.0617 ***	0.0573 ***
		(0.0075)	(0.0079)
unemployment			-0.0016 *
			(0.0008)
inflation			-0.0005 **
			(0.0002)
BIC	-321	-384	-363
Observations	141	141	136

*** p<0.01, ** p<0.05, * p<0.1, panel-robust standard errors in parentheses.

All regressions include a constant term (not shown here). Share of satisfied individuals constructed using sampling weights.

Table 5.

dependent variable:	*share of satisfied individuals*		*share of satisfied individuals*		*share of satisfied women*	*share of satisfied men*
	(1) wave 1	(2) wave 2	(3) developed	(4) developing	(5)	(6)
ln(GNI PER CAPITA)	***-0.0087***	***0.0327*** **	***0.0748*** ***	***0.0147***	0.0200 *	0.0111
	(0.0155)	(0.0129)	(0.0193)	(0.0157)	(0.0110)	(0.0120)
LIFE EXPECTANCY	***0.0068*** ***	***0.0009***	0.0009	0.0044 ***	0.0029 ***	0.0039 ***
	(0.0017)	(0.0011)	(0.0028)	(0.0013)	(0.0011)	(0.0011)
MEAN YEARS OF SCHOOLING	-0.0135 *	-0.0052	***0.0066***	***-0.0137*** *	-0.0087 *	-0.0086 *
	(0.0076)	(0.0042)	(0.0045)	(0.0082)	(0.0050)	(0.0048)
EXPECTED YEARS OF SCHOOLING	0.0129	0.0045	0.0085 **	0.0112	0.0073	0.0080 *
	(0.0087)	(0.0043)	(0.0034)	(0.0098)	(0.0053)	(0.0048)
index of traditional/secular-rational values	-0.0065	-0.0108	***-0.0211*** **	***0.0146***	-0.0101	-0.0054
	(0.0136)	(0.0073)	(0.0083)	(0.0161)	(0.0084)	(0.0089)
index of survival/self-expression values	***0.0787*** ***	***0.0504*** ***	***0.0198*** **	***0.1113*** ***	0.0603 ***	0.0624 ***
	(0.0139)	(0.0063)	(0.0081)	(0.0191)	(0.0073)	(0.0080)
wave dummy	yes		yes		yes	yes
development dummy	no		yes		no	no
interaction	wave interacted w/ all covariates		developed interacted w/ all covariates		none	none
BIC	-365		-368		-381	-372
Observations	141		141		141	141

*** p<0.01, ** p<0.05, * p<0.1, panel-robust standard errors in parentheses.

All regressions include a constant term (not shown here). Share of satisfied individuals constructed using sampling weights.

Table 6. T-tests for differences in aggregate SWB between EVS and WVS samples for countries surveyed under both initiatives in wave 2†

	difference in share of satisfied individuals		difference in mean satisfaction		
Bulgaria	0.073	(0.020) ***	0.611	(0.104)	***
Cyprus	-0.017	(0.013)	-0.008	(0.097)	
Finland	-0.008	(0.011)	-0.115	(0.080)	
France	-0.011	(0.013)	0.172	(0.082)	**
Georgia	0.098	(0.016) ***	0.528	(0.088)	***
Germany	-0.026	(0.011) **	-0.028	(0.069)	
Great Britain	-0.060	(0.010) ***	-0.101	(0.074)	
Italy	-0.034	(0.012) ***	0.256	(0.080)	***
Moldova	0.135	(0.018) ***	1.138	(0.097)	***
Netherlands	0.003	(0.005)	0.257	(0.054)	***
Norway	-0.015	(0.008) *	0.149	(0.074)	**
Poland	-0.008	(0.013)	0.187	(0.087)	**
Romania	0.105	(0.015) ***	1.028	(0.090)	***
Russia	0.036	(0.015) **	0.429	(0.088)	***
Slovenia	-0.019	(0.010) *	0.301	(0.083)	***
Spain	-0.036	(0.009) ***	-0.005	(0.064)	
Sweden	-0.055	(0.012) ***	-0.112	(0.084)	
Switzerland	-0.031	(0.009) ***	0.002	(0.071)	
Turkey	-0.137	(0.013) ***	-0.958	(0.087)	***
Ukraine	0.070	(0.021) ***	0.410	(0.111)	***

*** p<0.01, ** p<0.05, *p<0.1; standard errors in parantheses.
† t-test conducted using sample weights (a positive point estimate indicates an increase in aggregate SWB from 2005-2007 (the WVS sample) to 2008-2010 (the EVS sample).

Appendix

Table A1. Country availability (by wave).

	wave 1 (1999-2004)	wave 2 (2005-2010)		wave 1 (1999-2004)	wave 2 (2005-
Albania	✓	✓	Kyrgyzstan	✓	
Algeria	✓		Latvia	✓	✓
Andorra		✓	Lithuania	✓	✓
Argentina	✓	✓	Luxembourg	✓	✓
Armenia		✓	Macedonia	✓	✓
Australia	✓	✓	Malaysia		✓
Austria	✓	✓	Mali		✓
Azerbaijan		✓	Malta	✓	✓
Bangladesh	✓		Mexico	✓	✓
Belarus	✓	✓	Moldova	✓	✓
Belgium	✓	✓	Morocco	✓	✓
Bosnia-Herzegovina	✓	✓	Netherlands	✓	✓
Brazil		✓	New Zealand		✓
Bulgaria	✓	✓	Nigeria	✓	
Burkina Faso		✓	Norway		✓
Canada	✓	✓	Pakistan	✓	
Chile	✓	✓	Peru	✓	✓
China	✓	✓	Philippines	✓	
Colombia		✓	Poland	✓	✓
Croatia	✓	✓	Portugal	✓	✓
Cyprus		✓	Republic of Korea	✓	✓
Czech Republic	✓	✓	Romania	✓	✓
Denmark	✓	✓	Russian Federation	✓	✓
Egypt	✓	✓	Rwanda		✓
Estonia	✓	✓	Saudi Arabia	✓	
Ethiopia		✓	Serbia & Montenegro	✓	✓
Finland	✓	✓	Singapore	✓	
France	✓	✓	Slovakia	✓	✓
Georgia		✓	Slovenia	✓	✓
Germany	✓	✓	South Africa	✓	✓
Ghana		✓	Spain	✓	✓
Great Britain & N. Ireland	✓	✓	Sweden	✓	✓
Greece	✓	✓	Switzerland		✓
Guatemala		✓	Tanzania	✓	
Hong Kong		✓	Thailand		✓
Hungary	✓	✓	Trinidad & Tobago		✓
Iceland	✓	✓	Turkey	✓	✓
India	✓	✓	Uganda	✓	
Indonesia	✓	✓	Ukraine	✓	✓
Iran	✓	✓	U.S.	✓	✓
Iraq		✓	Uruguay		✓
Ireland	✓	✓	Venezuela	✓	
Israel	✓		Viet Nam	✓	✓
Italy	✓	✓	Zambia		✓
Japan	✓	✓	Zimbabwe	✓	
Jordan	✓	✓			

Table A2. Decomposed variance statistics for measures of interest

		Mean	St. Dev.
transformed mean satisfaction (ranges 0-1)	overall	0.633	0.114
	between		0.114
	within		0.033
share of satisfied individuals (ranges 0-1)	overall	0.828	0.128
	between		0.129
	within		0.039
*ln(*GNI PER CAPITA*)*	overall	9.263	1.098
	between		1.183
	within		0.129
LIFE EXPECTANCY	overall	72.954	7.720
	between		8.612
	within		0.918
MEAN YEARS OF SCHOOLING	overall	8.744	2.593
	between		2.754
	within		0.391
EXPECTED YEARS OF SCHOOLING	overall	13.542	2.716
	between		2.879
	within		0.500
total number of observations = 141			

Table A3. OLS coefficients for share of satisfied individuals.

dependent variable: share of satisfied individuals (SWB_{share})

	(1)	(2)	(3)
ln(GNI PER CAPITA)	0.0688 ***	0.0323 *	0.0271
	(0.0192)	(0.0167)	(0.0165)
LIFE EXPECTANCY	0.0041 *	0.0045 **	0.0029
	(0.0024)	(0.0020)	(0.0020)
MEAN YEARS OF SCHOOLING	-0.0247 ***	-0.0129 **	-0.0119 *
	(0.0060)	(0.0057)	(0.0061)
EXPECTED YEARS OF SCHOOLING	0.0132 **	0.0075	0.0114 *
	(0.0052)	(0.0054)	(0.0059)
wave dummy	0.0362 ***	0.0368 ***	0.0352 ***
	(0.0121)	(0.0112)	(0.0116)
index of traditional/secular-rational values		-0.0122	-0.0141
		(0.0095)	(0.0096)
index of survival/self-expression values		0.0522 ***	0.0468 ***
		(0.0089)	(0.0092)
unemployment			-0.0016
			(0.0013)
inflation			-0.0013 ***
			(0.0004)
BIC	-274	-306	-291
Observations	141	141	136

*** p<0.01, ** p<0.05, * p<0.1, panel-robust standard errors in parentheses.

All regressions include a constant term (not shown here). Share of satisfied individuals constructed using sampling weights.

Table A4. Beta-regression marginal effects at means for mean satisfaction.

dependent variable: mean satisfaction (SWBmean)

	(1)	(2)	(3)
ln(GNI PER CAPITA)	0.0613 ***	0.0215 *	0.0185 *
	(0.0146)	(0.0111)	(0.0109)
LIFE EXPECTANCY	0.0026	0.0032 **	0.0023 *
	(0.0017)	(0.0013)	(0.0013)
MEAN YEARS OF SCHOOLING	-0.0195 ***	-0.0041	-0.0036
	(0.0046)	(0.0046)	(0.0049)
EXPECTED YEARS OF SCHOOLING	0.0126 ***	0.0067	0.0083 *
	(0.0043)	(0.0046)	(0.0047)
wave dummy	0.0251 **	0.0267 ***	0.0284 ***
	(0.0105)	(0.0089)	(0.0091)
index of traditional/secular-rational values		-0.0218 **	-0.0216 **
		(0.0091)	(0.0093)
index of survival/self-expression values		0.0568 ***	0.0555 ***
		(0.0069)	(0.0072)
unemployment			-0.0007
			(0.0010)
inflation			-0.0007 ***
			(0.0002)
BIC	-305	-367	-348
Observations	141	141	136

*** p<0.01, ** p<0.05, * p<0.1, panel-robust standard errors in parentheses.

All regressions include a constant term (not shown here). Share of satisfied individuals constructed using sampling weights.

Table A5. Beta-regression marginal effects at means by wave for subsample of countries that appear in both waves.

dependent variable: share of satisfied individuals (SWB_{share})				
	wave 1		wave 2	
ln(GNI PER CAPITA)	0.0053		-0.0040	
	(0.018)		(0.017)	
LIFE EXPECTANCY	***0.0058***	***	***0.0012***	*
	(0.001)		(0.001)	
MEAN YEARS OF SCHOOLING	-0.0091		-0.0044	
	(0.007)		(0.005)	
EXPECTED YEARS OF SCHOOLING	0.0052		0.0110	**
	(0.007)		(0.005)	
index of traditional/secular-rational values	-0.0059		-0.0037	
	(0.013)		(0.008)	
index of survival/self-expression values	***0.0786***	***	***0.0522***	***
	(0.012)		(0.008)	
wave dummy	yes			
development dummy	no			
interaction	wave interacted w/ all covariates			
BIC	-264			
Observations	102			

*** p<0.01, ** p<0.05, * p<0.1, panel-robust standard errors in parentheses.
All regressions include a constant term (not shown here). Share of satisfied individuals constructed using sampling weights.