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The Share of Satisfied Individuals: A Headcount Measure of Aggregate 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). I argue for the adoption of sufficientarianism as the guiding principle for aggregate measures of SWB, as opposed to the widely used average utilitarianism. I construct measures of the share of sufficiently satisfied individuals using reported life satisfaction data from the World/European Values Surveys across a range of sufficiency thresholds. A Beta-regression approach is employed to explore the empirical relationships between these measures and objective indicators of well-being. 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 from analysis relying on conventional average measures of SWB. For example, I find no significant link between national income and the share of satisfied individuals when cultural controls are included (except when the sufficiency threshold is very high), which suggests that the SWB benefit of higher average incomes is limited from a sufficientarian point of view.

Keywords. Subjective Well-Being; Cognitive Dissonance Theory; Beta-regression.
JEL classifications: O1, I3, B4.

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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, 2013; 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, 2017; Maggino, 2009), but there has been little effort within economics to develop normative frameworks and analysis methods for aggregate measures of SWB. The economics literature to date is largely limited to one single measure of national life satisfaction[1], namely the mean (Blanchflower and Oswald, 2005; Deaton, 2008; Lawless and Lucas, 2011; Leigh and Wolfers, 2006; Ovaska and Takashima, 2006). Non-mean based aggregation procedures have been used for simple descriptions of datasets (Oswald, 1997) but not as key measures of interest in international accounts of development. Easterlin (1974) takes into account some distributional considerations[2], though his main cross-country analysis 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

[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, but does use the terms 'happiness' and 'happy' to refer to SWB in general.

[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')

sophisticated alternatives for aggregating self-reported well-being, but they nevertheless rely on average SWB and are utilitarian in nature.

However, considering the characteristics of SWB data, mean based measures have substantial shortcomings as metrics of aggregate satisfaction. Mean measures assume cardinality across the full range of the underlying SWB scale, even though reported SWB data are ordinal and arbitrary in nature. Furthermore, they assume that interpersonal comparisons based on this (imposed) cardinality are possible. Bond and Lang (2019) 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). In a recent working paper, Chen et al. (2019) propose the use of the median instead of the mean. They draw attention to the fact that ranking countries using the median does not violate the stochastic dominance conditions described in Bond and Lang (2019), and point out that the median is known to be the preferred measure of central tendency for ordinal data (though rarely used as such).

But perhaps more critical than the properties of the underlying SWB scales 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 considering social SWB because, unlike income or other economic assets, SWB is measured using bounded scales. Given that SWB depends on many life dimensions – some of which governments cannot or should not have control over – it is perhaps more ethically 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. This approach aligns well-being research with growing interest in economic concepts that promote sufficiency principles, as well as widely accepted policies that are guided (at least in part) by such principles. For example, the aim of minimum/living wages is to ensure that workers earn at least enough to be able to live out of poverty. Similarly, one argument underlying the concepts of social welfare and universal basic income is the idea that everyone should have access to financial resources that are adequate to live on.

In this paper, I propose the use of headcount measures that identify the proportion of individuals who are sufficiently satisfied with life as a sufficientarian alternative to mean SWB. This is a methodological contribution to the measurement of aggregate SWB. 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. Although the share of 'very happy' or 'very unhappy' individuals

used by Easterlin (1974), and the median proposed by Chen et al. (2019), are also easy to interpret, and they address some of the distributional concerns associated with ordinal data, they do not directly challenge the underlying normative framework used to assess aggregate SWB. This is not to say that these alternative measures are not valid indicators of aggregate SWB do, but they are not measures of sufficiency (at least not as they have been developed so far).

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 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.

Normative concerns aside, headcount measures are also less informationally demanding than mean measures because they do not impose cardinality. A headcount based on the sufficiency principle only requires an ordinal comparison around the cut-off point that differentiates those who are sufficiently satisfied from those who are not. Although this class of measures does not utilize the full range of information contained in SWB scales, the resulting aggregate information it provides is arguably more reliable (relative to mean measures). In the words of philosopher and logician Carveth Read, "it is better to be vaguely right than exactly wrong" (Read, 1914 p. 352). In this case, since we cannot be sure about the accuracy of SWB data, it is better to be 'vaguely right' and rely on headcount measures based on binary information, than to rely on more informationally rich mean measures which may be vastly inaccurate and misleading.

The principal challenge with headcount measures in general is identifying a relevant and meaningful cut-off value. In this paper, I consider a range of thresholds for reported life satisfaction data from the World Values Survey (WVS) and the European Values Survey (EVS) to construct a set of indicators that quantify the share of individuals who are sufficiently satisfied with life. I further suggest that Cognitive Dissonance Theory (Akerlof and Dickens, 1982) is a useful framework for thinking about cut-off selection, which provides real-world relevance. This mixed approach 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.

A further 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 distribution of the proposed headcount measure.

This paper is intended as a starting point for discussion about best methods of aggregating subjective information and approaches for developing headcount measures of SWB. It highlights 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 proposed headcount measure and the choice of a meaningful cut-off value; Section 3 presents an empirical application using data from the World Values Survey and the European Values Survey; and Section 4 concludes.

2 A headcount measure based on sufficientarian welfaresim

Crisp (2003) proposed 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 rather for as many of its citizens as possible. Applying this sufficiency principle to the construction of national SWB translates to an aggregate measure that is based on a dichotomous reduction of self-reported SWB and can be expressed formally as follows:

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

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 obvious question arises regarding what is a *sufficient* level of SWB – I will return to this later on in this Section.

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[3]. We are only concerned with comparing satisfaction levels around z so

[3] 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

that all reported satisfaction levels below the threshold are assumed to denote lower SWB than all satisfaction levels above the threshold.

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 focus on life satisfaction in this paper.

The range of SWB data is another important consideration for constructing the share of satisfied individuals. National and international surveys typically use satisfaction scales ranging from 4 to 11 points[6]. 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.

I use self-reported life satisfaction data from World Values Surveys (WVS, 2009) and European Values Surveys (EVS, 2011). These two initiatives are conducted independently but are designed to be compatible and comparable across countries and time, and are available in an integrated dataset that is well-documented. Most importantly for cross-country analysis, these surveys cover a wide range of countries over time. 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"[7].

I now return to discuss the challenge of defining a sufficient level of SWB. Looking at the distribution of life satisfaction responses from WVS and EVS covering the period 1999-2010 (Figure 1), it is clear that a large number of people report relatively high levels of satisfaction, with the median being 7. The most prevalent value is 8 with almost a fifth of individuals reporting this satisfaction level. Overall, the distribution appears to be increasing as we move from level 1 up to level 10, but is not

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).

[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] For a more detailed summary of the various SWB questions and scales used in a variety of surveys see Diener (1994).

[7] Except for wave 2005-2007 of the WVS in which 1 means "completely dissatisfied" and 10 means "completely satisfied".

smooth. There are three peaks that stand out at satisfaction levels 5, 7 and 8. It may be that there is something inherently special about these three levels and one might argue that they can therefore potentially be meaningful cut-off values for a headcount measure of aggregate life satisfaction.

There are currently no established theoretical reasons for choosing any of these values as the one meaningful cut-off. I therefore consider a range of thresholds (z values). Comparing differences in SWB across thresholds allows us to make economic interpretations that have a wider policy scope. In particular, Section 3 will examine how the relationship between SWB and objective indicators of well-being changes across thresholds and discuss the relevant policy implications. I focus on satisfaction levels 3-7 for two reasons. First, it is unlikely that higher levels could constitute a breaking point between people who are sufficiently satisfied and those who are not. They may well constitute important cut-off points for measuring high SWB, but it would be difficult to argue that people who report below level 8 have such low SWB that they can reasonably be considered to be not sufficiently satisfied with life (and similarly for levels 9 and 10). Second, there is very little variation in the share of satisfied individuals across countries when z=2 (about three quarters of the observations in the sample have at least a 95% rate of people reporting levels 2 and above). This makes comparisons cross countries difficult and greatly limits statistical power.

[Figure 1 about here]

I further suggest that Cognitive Dissonance Theory (CDT), pioneered by Hirschman (1965), provides a useful framework for identifying a satisfaction level which most people are psychologically inclined to regard as an important and meaningful threshold for sufficiency. To understand this connection it is important to remember that reported satisfaction reflects the interplay between one's life and one's feelings about that life. CDT recognizes this underlying 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.

Assuming a positive relationship between life conditions and SWB means that poorer life conditions decrease life satisfaction. When life conditions are acceptable, individuals have no problem correctly reporting their true 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 (remember, we like to think of ourselves as satisfied/happy). 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 peaks around this resistance threshold and we should expect to observe a pile-up of responses in life satisfaction data at this point.

Looking back to Figure 1, there is some indication that satisfaction level 5 constitutes this resistance threshold. We can see a pronounced data-cliff between levels 4 and 5. Satisfaction levels 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, 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[8]. One could then compute SWB_{share} by setting $z = 5$, where 5 is the lowest point at which people are sufficiently satisfied.

As mentioned in the Introduction, 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} (using a number of thresholds), and several development measures.

[8] It is not possible to distinguish between individuals who truly experience life satisfaction at level 5 as well as those who report level 5 but in fact experience lower levels of satisfaction. As such, SWB_{share} includes both of these groups of people, so it is essentially a measure of the proportion of individuals who (i) are truly at level 5 or higher, or (ii) are experiencing levels of satisfaction below 5 but are not doing so badly as to report below level 5.

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

3.1 Data

As in the previous section, self-reported life satisfaction data from WVS and EVS are used to construct SWB_{share} at the national level. These data support a rich cross-country analysis of SWB since they cover a large and representative set of countries ranging from underdeveloped to fully industrialised economies, representing all continents and major sub-regions. 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)[9] 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[10]. 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[11]. The distribution of life satisfaction responses for the sample used in the regression analysis is shown in Table 1 for each constructed period separately (counts have been adjusted using sampling weights provided with the survey data).

[Table 1 about here]

The proceeding 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

[9] 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.
[10] See Table A1 in the Appendix for a list of countries and their availability in each wave.
[11] 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).
[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.

development and social progress. HDI has a strong international influence on how development is viewed currently and so it is important to understand the relationships between its components and SWB. Some previous studies of national SWB relied on variations of these measures to help explain 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

[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/).

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 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 2 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 2 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 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 with a cut-off value of 5 ranges from 39% to 98% and it is on average higher in 2005-2010 (85%) than in 1999-2004 (79%). This pattern is similar across thresholds. The mean of SWB_{share} is highest when z=3 (0.93) and lowest when z=7 (0.59). The inverse is true for variability, the standard deviation when z=3 is very low (0.08) compared to when z=7 (0.2). 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]

[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 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.

3.2 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:

$$SWB_i = \alpha + \beta' X_i + \varepsilon_i, \quad i = 1, \dots, N \tag{2}$$

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_{share} 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 3 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 3 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. (Kieschnick and McCullough, 2003) also evaluate quasi-likelihood models for use with proportional dependent variables, but recommend Beta models for smaller sample sizes. The following Beta-regression model with a Logit link function is estimated using the data described in Section 3.1:

$$E(SWB_{it}|X_{it}) = \frac{e^{\beta' X_{it}}}{1 + e^{\beta' X_{it}}} \tag{3}$$

[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).

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:

$$f(SWB_{share};\mu,\phi) = \frac{\Gamma(\phi)}{\Gamma(\mu\phi)\Gamma((1-\mu)\phi)}(SWB_{share})^{\mu\phi-1}(1-SWB_{share})^{(1-\mu)\phi-1} \qquad (4)$$

where $\mu = E(SWB_{share})$ 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.

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

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.

3.3 Results

I will focus first on regressions using SWB_{share} where z=5 in order to consider different model specifications, and then extended the analysis to include all five sufficiency thresholds discussed in Section 2. Table 4 reports the marginal effects from estimating Equation 3[23] setting z=5 evaluated at the sample means of the regressors[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.

[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 its mean logged value of 10,543[25] is associated with an increase of approximately 0.005396 (or 0.54 percentage points) in the share of satisfied individuals[26]. A more accurate and easier to interpret estimate can be obtained by computing the predicted share of satisfied individuals at specific values of *PER CAPITA GNI*. For example,

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

[24] 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 D, the marginal effect is the discrete change in the share of satisfied individuals as D changes from 0 to 1 given by $E(SWB_{share}|X, D=1) - E(SWB_{share}|X, D=0)$.

[25] 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.

[26] For linear-log models, the expected change in the dependent variable given a 10% increase in a logged independent variable is the marginal effect multiplied by 0.095.

increasing *PER CAPITA GNI* by 10% from its mean value of 16,454 to 18,099 increases the predicted value of SWB_{share} from 0.8658 to 0.8705. This 0.0047 difference is small in magnitude, just over 3.6% of the standard deviation of SWB_{share} when z=5.

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 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; 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.

Including the Inglehart-Welzel indices as cultural controls (column 2) improves the model fit (the BIC value is reduced by 63 points[27]), 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 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, 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)[28] 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

[27] 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.

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

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, a hypothesis that 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. In order to maximize the number of observations, I will from now on primarily focus on the specification in column 2 (which I will refer to as the preferred specification).

One 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' 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 specification, it may be the case that it is significant at lower levels of income, which would support the satiation point theory. Figure 4 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 statistically not significant across all levels of income, so there is no evidence of a satiation point.

[Figure 4 about here]

Coefficients from OLS models (Table 5) are similar to the Beta-regression marginal effects in terms of sign, but there are important differences in magnitude and statistical significance. The OLS results are for the most part larger in magnitude; and more notably, the coefficient of *PER CAPITA GNI* is statistically significantly associated with the share of satisfied individuals in the preferred specification (column 2, Table 5). The equivalent marginal effect from the Beta-regression is not significant (column 2, Table 4). This suggests that linear models may overestimate the relationship between objective indicators of well-being and SWB_{share}, and can lead to misleading conclusions about the role of income in determining aggregate SWB.

[Table 5 about here]

I now consider the robustness of the Beta-regression results to different thresholds for identifying individuals who are sufficiently satisfied with life. Table 6 presents Beta-regression results for the preferred specification (from column 2 in Table 4) where each column contains the marginal effects at means obtained from regressing different measures of SWB_{share} constructed using the five cut-off values discussed in Section 2 from the smallest in column 1 (z=3) to the largest in column 5 (z=7). For ease of comparison, column 3 replicates the results from column 2 in Table 4. The marginal effect of *PER CAPITA GNI* is positive for all alternative thresholds and increases as we move from the lower to the higher thresholds. However, this effect is only statistically significant when the cut-off is 7 (column 5) with a magnitude of 0.0392, meaning that an increase of 10% in *PER CAPITA GNI* from its mean logged value is associated with approximately a 0.0037 increase in the share of individuals reporting satisfaction level 7 or above (this is less than 2% of the standard deviation of SWB_{share} when z=7). This suggests that average income is not an important determinant of SWB for individuals who experience very low levels life satisfaction. One explanation is that very low levels of life satisfaction are driven mainly by non-financial factors, such as poor mental and physical health. However, this may be due (at least in part) to the fact that there is less variation in the share of satisfied individuals for the lower cut-off levels. The standard deviation of SWB_{share} when z=3 is 0.08, it is more than double that (0.2) when z=7. It may also be the case that most countries have already reached a level of development that minimises the number of individuals who are extremely dissatisfied with life due to low income, which is supported by the fact that the share of individuals who report at least a 3 on the life satisfaction scale is on average very high at 93% (Table 3).

In contrast, the positive marginal effect of *LIFE EXPECTANCY* is statistically significant for all alternative thresholds (though the level of significance drops from 1% when z={3,4,5} to 5% when z=6 and to 10% when z=7). The increase in the share of satisfied individuals associated with a one year increase in life expectancy is anywhere from 0.0021 (when z=3) to 0.0043 (when z=6). The marginal

effects of *MEAN YEARS OF SCHOOLING* and *EXPECTED YEARS OF SCHOOLING* are less robust to threshold choice. The former is only significant when z=3 or z=5 (at the 10% level), while the latter is significant when z=6 or z=7 (at 5% and 10% levels respectively).

[Table 6 about here]

Further insights emerge by comparing the relationship between SWB_{share} and income with the relationship between mean satisfaction and income. This is because the latter association is 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[29]. Consistent with previous studies, regressing mean life satisfaction (SWB_{mean}) 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[30] (Table 7). 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.

[Table 7 about here]

There are two more notable differences in the preferred specification of the mean model compared to the headcount model. The marginal effect of *MEAN YEARS OF SCHOOLING* is not statistically significant in the mean model, while the index of traditional/secular-rational values is (this is in opposition to the results in Table 4). This further emphasizes the importance of choosing suitable aggregate measures for policy analysis. If we want to know what objective measures we should focus on to improve national SWB, we must first carefully consider what we want these aggregate measures to capture.

[29] 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).

[30] 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).

It is interesting to note that the wave dummy is strongly significant and large in magnitude (relative to the other covariates) across all models[31]. 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 8 (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 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 further below.

[Table 8 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 developed and developing countries. 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 a binary indicator for

[31] 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.

developed/developing nations (as recognized by the United Nations) interacted with all covariates and find contradictory evidence (results are shown in Table 8, columns 3 and 4). 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 from Table 4 (column 2) 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 8. 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 8, columns 1 and 2) with the corresponding marginal effects from the restricted sample including only countries that are observed in both waves (Appendix Table A3). 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_{share} in either wave, which suggests that the positive association identified in wave 2 in the full sample (Table 8) 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 9 reveal that the share of satisfied individuals (z=5) 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 9 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 specification 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.

4 Concluding Remarks

This paper aims to contribute to the well-being debate that is vital to the study of economics by developing a normative framework for measuring aggregate SWB based on the principles of sufficientarianism – namely, we should be concerned with maximizing the number of people who are sufficiently satisfied with life. In particular, I propose the use of headcount measures of national SWB based on the share of individuals who are sufficiently satisfied with life. This differs from the standard mean measures of life satisfaction widely used in the literature, which reflect a commitment to average utilitarianism. The intent has been to expand the instruments 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.

Since SWB scales are not based on a set, measurable standard, choosing the appropriate cut-off value for individuals who can be considered sufficiently satisfied with life is not straightforward. I address this challenge in two ways. First, I consider a range of sufficiency thresholds. Second, I make the case that Cognitive Dissonance Theory (CDT) could provide a useful framework for defining sufficiency in the context of life satisfaction, and suggest a salient CDT threshold using self reported life satisfaction data from the World Values Survey and the European Values Surveys. These approaches offer a practical starting point, but additional research is necessary to establish the policy relevance of different thresholds. It may also be viable to evaluate whether the CDT threshold correctly identifies individuals who are sufficiently satisfied with life given individual level data. The CDT argument assumes that individuals are reluctant to report life satisfaction levels below 5 in response to negative changes in socio-economic conditions and other life circumstances, which means that the relationship between life satisfaction and objective indicators of well-being may be weaker at this point than at other points on the satisfaction scale. One could use individual level analysis to test whether individuals who report level 5 or higher are less responsive to decreases in life conditions compared to individuals who report other levels of satisfaction. This analysis could also be used to identify which life conditions (i.e. income/health/etc) are driving the mass of responses at 5 and whether these differ significantly across countries and population groups (e.g. males/females, old/young, urban/rural, etc.).

The empirical application of the paper expands on previous cross-country studies using regression analysis to explore the link between the proposed headcount measures 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. The econometric analysis further contributes to this literature

by using Beta-regression which is better suited to model skewed, naturally bounded dependent variables. An additional advantage of non-linear Beta-regression models is that they 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. The principal finding is that the share of satisfied individuals is not associated with *PER CAPITA GNI* in all specifications that control for cultural differences except when the share of satisfied individuals is computed using the highest sufficiency cut-off 7 (i.e. only individuals who report level 7 or higher are considered to be sufficiently satisfied with life). This indicates that the potential SWB benefit of policy aimed at improving average income is limited, especially when it comes to improving the SWB of individuals with low levels of satisfaction. On the other hand, I find a strong positive relationship between mean satisfaction and income, which is consistent with previous cross-country studies. These varying results highlight the importance of the aggregation approach used to measure national SWB and indicate that economic policy can have potentially differential SWB benefits. In particular, increasing average income may have limited potential for improving very low levels of life satisfaction.

It is important to note that the cut-off values used to identify sufficiently satisfied individuals should not simply be dictated by the stability of econometric results or model fit. Rather, we should take into account normative considerations regarding what we want to ultimately measure. If one is interested in maximizing the share of individuals with very high levels of life satisfaction, then I would recommend setting the threshold level at 7 or 8. In fact, the distribution of reported life satisfaction reveals that there is a prominent peak at satisfaction level 8. While this additional information can potentially enrich our understanding of SWB broadly speaking, the application of 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) can be interpreted as the level below which individuals may be considered to be dissatisfied. A lower cut-off is more sensible for measuring the share of (sufficiently) satisfied individuals. One might also 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.

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, especially when considering different thresholds. 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. Distribution of life satisfaction responses (1999-2010 pooled data)

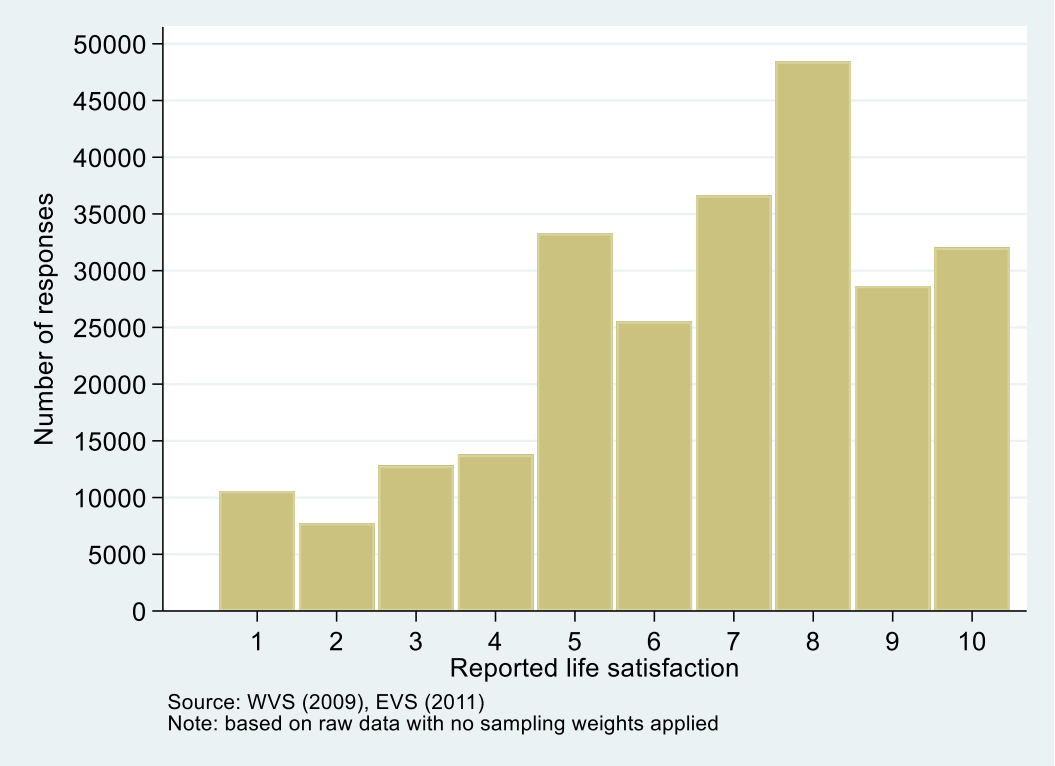


Figure 2. Cultural map (1999-2010 average).

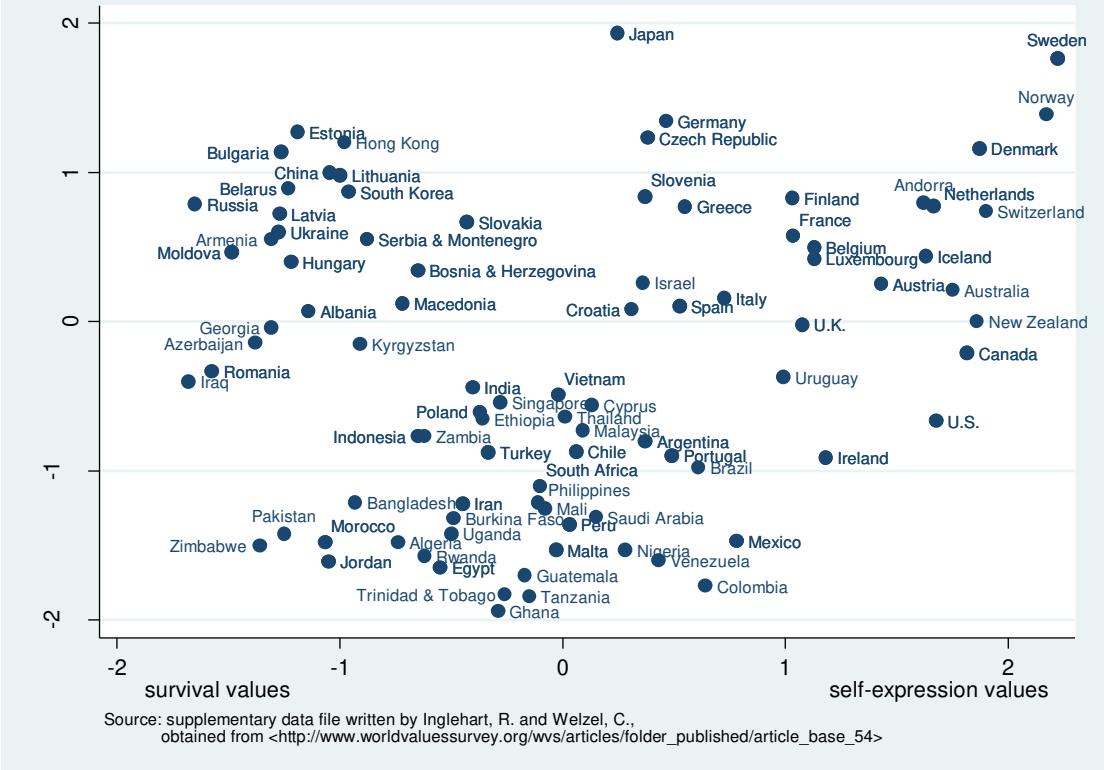
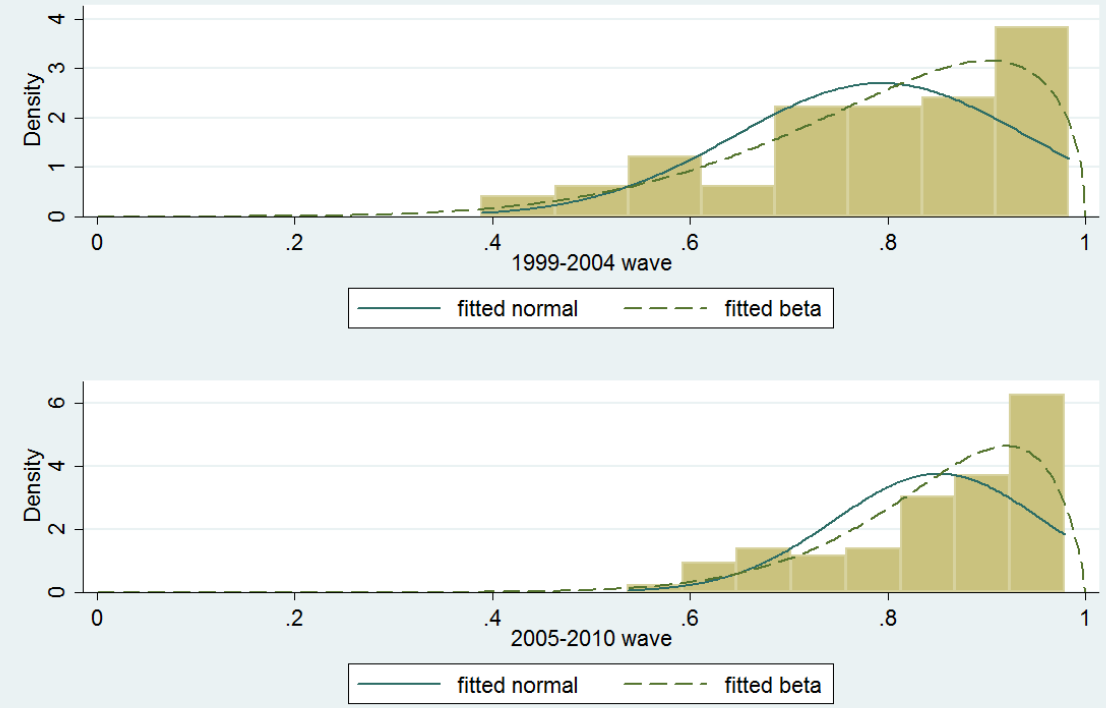
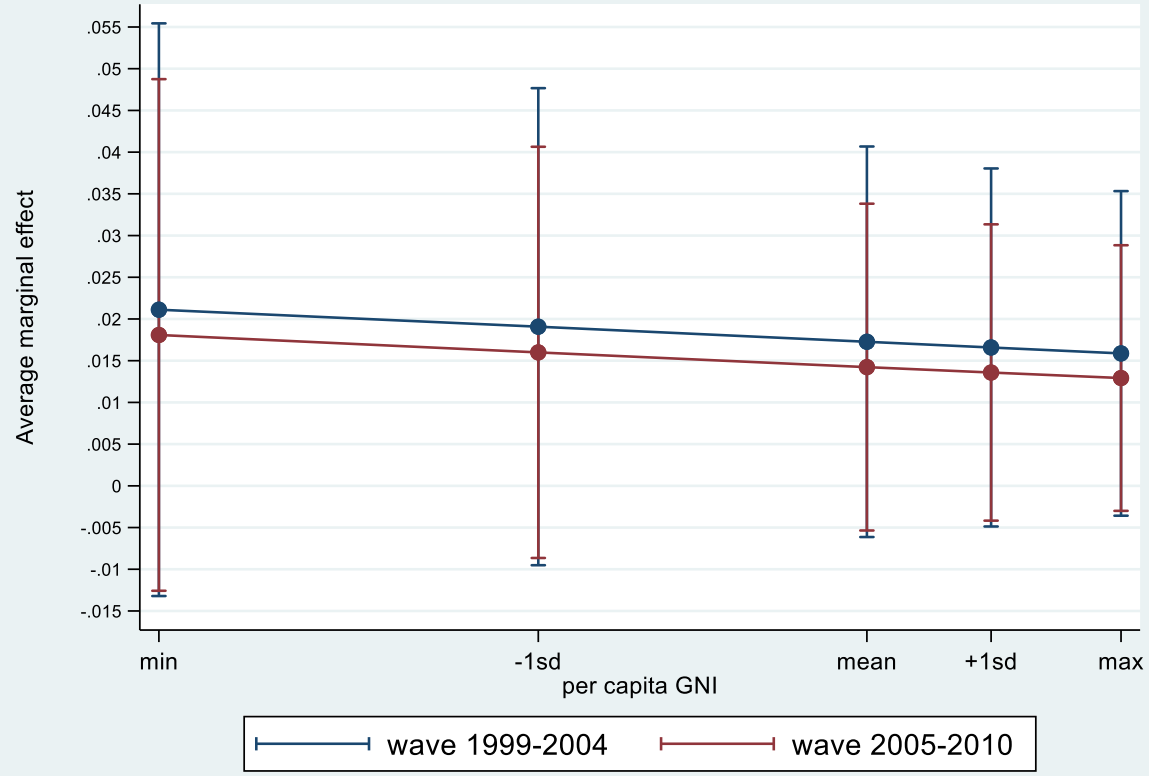


Figure 3. Distribution characteristics of the proportion of satisfied individuals, by wave.



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

Figure 4. Average marginal effects on SWB_{share} with 95% CIs (model: column 2, Table 4)



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). Counts constructed using sampling weights.

Table 2. Variable definitions.

Variable	Variable description	Source
SWB_{share}	Proportion of survey respondents who reported satisfaction level z or above (ranging from 0 to 1), where $z = \{3,4,5,6,7\}$. Computed using sampling weights provided with the raw data.	WVS (2009), EVS (2011)
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 (2013)
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 (2013)
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 (2013)
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 (2013)
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)
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.

	1999-2004 (N=63*)		2005-2010 (N=78*)		Total (N=141*)
	mean (sd)	min/max	mean (sd)	min/max	mean (sd)
SWB_{share} *(z=3)*	0.91 (0.10)	0.52/1.00	0.95 (0.05)	0.74/1.00	0.93 (0.08)
SWB_{share} *(z=4)*	0.86 (0.13)	0.44/0.99	0.90 (0.07)	0.66/0.99	0.88 (0.10)
SWB_{share} *(z=5)*	0.80 (0.15)	0.39/0.98	0.85 (0.11)	0.54/0.98	0.83 (0.13)
SWB_{share} *(z=6)*	0.65 (0.20)	0.24/0.95	0.73 (0.16)	0.31/0.95	0.69 (0.18)
SWB_{share} *(z=7)*	0.55 (0.21)	0.10/0.90	0.62 (0.18)	0.19/0.90	0.59 (0.20)
SWB_{mean}	0.61 (0.13)	0.32/0.80	0.65 (0.10)	0.38/0.82	0.63 (0.11)
Mean satisfaction (original scale 1-10)	6.49 (1.13)	3.87/8.24	6.85 (0.90)	4.46/8.36	6.69 (1.02)
GNI PER CAPITA (PPP constant 2005 $)	15,100 (12,417)	608/53,204	17,548 (13,244)	809/53,763	16,454 (12,894)
LIFE EXPECTANCY (years)	71.89 (7.68)	44.70/81.20	73.81 (7.70)	46.94/82.86	72.95 (7.72)
MEAN YEARS OF SCHOOLING	8.38 (2.43)	3.30/13.00	9.03 (2.69)	1.30/12.66	8.74 (2.59)
EXPECTED YEARS OF SCHOOLING	13.20 (2.78)	5.40/18.00	13.82 (2.64)	5.64/18.00	13.54 (2.72)
Unemployment	9.16 (5.44)	2.32/26.08	8.62 (5.68)	1.23/34.37	8.86 (5.56)
Inflation	8.93 (23.22)	-0.49/174.21	5.23 (4.02)	-0.11/17.25	6.87 (15.76)

* Due to missing data, there are 75 observations for Unemployment in 2005-2010, 61 observations for Inflation in 1999-2004, and 77 observations for Inflation in 2005-2010. All SWB statistics computed using sampling weights.

Table 4. Beta-regression of the share of satisfied individuals (marginal effects at means).

dependent variable: share of satisfied individuals (SWB_{share} where z=5)

	(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. OLS of the share of satisfied individuals (coefficients).

dependent variable: share of satisfied individuals (SWB_{share} where z=5)

	(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 6. Beta-regressions across thresholds (marginal effects at means)

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

	(1) z=3		(2) z=4		(3) z=5		(4) z=6		(5) z=7	
ln(GNI)	0.0065		0.0088		0.0154		0.0276		0.0392	**
	(0.0053)		(0.0080)		(0.0112)		(0.0173)		(0.0187)	
life expectancy	0.0021	***	0.0028	***	0.0034	***	0.0043	**	0.0032	*
	(0.0006)		(0.0008)		(0.0011)		(0.0017)		(0.0018)	
mean years in school	-0.0049	*	-0.0059		-0.0085	*	-0.0040		0.0006	
	(0.0026)		(0.0037)		(0.0048)		(0.0073)		(0.0078)	
expected years in school	0.0014		0.0050		0.0076		0.0142	**	0.0149	*
	(0.0033)		(0.0042)		(0.0050)		(0.0063)		(0.0079)	
wave dummy	0.0171	***	0.0260	***	0.0313	***	0.0521	***	0.0472	***
	(0.0049)		(0.0070)		(0.0091)		(0.0141)		(0.0156)	
index of traditional/secular-rational values	0.0031		-0.0037		-0.0077		-0.0230		-0.0338	**
	(0.0040)		(0.0061)		(0.0086)		(0.0145)		(0.0152)	
index of survival/self-expression values	0.0237	***	0.0433	***	0.0617	***	0.0964	***	0.1114	***
	(0.0047)		(0.0062)		(0.0075)		(0.0098)		(0.0104)	
BIC	-553		-455		-384		-278		-246	
Observations	141		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 7. Beta-regression of mean satisfaction (marginal effects at means).

dependent variable: mean life satisfaction (SWB_{mean})

	(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). Mean satisfaction constructed using sampling weights.

Table 8. Beta-regression of the share of satisfied individuals (marginal effects at means by wave, level of development, and gender).

dependent variable:	SWB_{share} *(z=5)*		SWB_{share} *(z=5)*		SWB_{share} *for women (z=5)*	SWB_{share} *for men (z=5)*
	(1)	(2)	(3)	(4)		
	wave 1	wave 2	developed	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 9. T-tests for differences in aggregate SWB between EVS and WVS samples for countries surveyed under both initiatives in wave 2†

	difference in SWB_{share} *(z=5)*		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 parentheses.
† 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 (2005-2010)
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 when z=5 (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. 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} when z=5)				
	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.