Misclassification Errors of Subjective Well-being: A New Approach to Mapping Happiness

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Abstract

The growth of subjective well-being (SWB) is among the most critical aims in human society. SWB is often used to make arguments related to economic policy implementation. While there is considerable perplexity about the accuracy of SWB measures, the vast previous literature on SWB relies on self-reported measures elicited through survey questions. However, self-reported happiness is potentially subject to significant misclassification errors. A new method from the measurement error literature is used to correct the reported happiness measures in 80 countries and to explore how country characteristics and demographic groups influence misclassification errors. Using the Integrated European and World Values Surveys, we find that reported happiness is subject to substantial misclassification errors. These misclassification errors are associated with religious beliefs and economic development stages of countries, along with other individual characteristics. We then utilize the corrected SWB to reexamine the Easterlin paradox and modified-Easterlin hypothesis. Our findings suggest that both of them are not supported in the aggregate country level analysis.

JEL Codes: C14, D31, I31

Keywords: misclassification error, income, subjective well-being

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" Happiness is the meaning and purpose of life, the whole aim and end of human existence. "

Aristotle, Nichomachean Ethics, book 1, section 7.

1 Introduction

The pursuit of happiness has been paramount for humankind throughout history. It has evoked the attention of philosophers from Epicurus and Aristotle to Jeremy Bentham and John Stuart Mill. The U.S. constitution declares that the pursuit of happiness is an unalienable right of every individual. But what is happiness and well-being? And how can it be measured? A recent and growing literature argues that income and consumption are not ideal measures of well-being (see Fleurbaey (2009) for a review).[1] In contrast, subjective well-being (SWB) can arguably be used as a standard for measuring social welfare and progress. SWB has become a critical subject in economic research and policy making. The contemporary literature related to the economics of happiness started with the pioneering work of Richard Easterlin (1974). The most frequently used method to elicit SWB consists of surveys to directly ask people about their feeling of happiness and overall life satisfaction (e.g. Frey and Stutzer, 2000, 2002, 2010a, etc.). However, self-reported happiness is subject to considerable measurement errors due to three main reasons. First, people may avoid reporting the extreme categories of happiness, such as "very happy" or "not at all happy" due to self-deception. For example, Hagedorn (1996) and Sheridan et al. (2015) document a potential correlation between reported well-being and a tendency for self-deception. People may also deceive themselves to believe they are more (or less) happy than they actually are. Second, individuals can be easily influenced by random shocks of recent events at the time of the survey. For example, dealing with health problems or the loss of a close relative may negatively impact the happiness measures. On the contrary, a recent job promotion or the birth of a child may positively influence self-reported happiness. Last but most importantly, it is difficult for some people to precisely evaluate

[1] For example, Nordhaus and Tobin (1973) introduced a measure of welfare that combines household labor with consumption and leisure. Becker et al. (2005) define a utility function to combine income and life expectancy into a measure of full-income. A recent study by Jones and Klenow (2016) develops a measure of well-being that incorporates consumption, leisure, life expectancy, and inequality.

their subjective well-being. For instance, using a hypothetical survey of SWB rankings under different scenarios, Benjamin et al. (2012) found systematic reversals in individual choices of reported happiness.

Although there is abundant evidence of misclassification errors in the self-reported measures of happiness in the psychology literature, this issue has been mostly ignored in the economics literature. As precise and traceable measurements of SWB are fundamental for understanding the economics of happiness, we believe it is important to understand the factors that are potentially correlated with the misreporting errors in order to correct SWB measures.

To address this concern, we apply a novel closed-form identification and measurement error estimation method first created by Hu (2008) and then developed in Feng and Hu (2013) [2]. In general, the methodology employs a eigenvalueeigenfunction technique to establish a closed-form identification for the misclassification matrix by using instruments (or repeated measures as noted in Hu (2008) and Hu and Schennach (2008)) of the underlying latent variables. Methods derived from this technique are becoming popular in recent empirical applications (An et al., 2010, 2015). Our identification strategy in this study is implemented mainly in the spirit of Feng and Hu (2013), in which they identify the misclassification distribution for the latent true unemployment rate in the United States by using individual-level CPS data.

In this article we employ the Integrated European/World Value Survey data (EVS/WVS) to uncover the underlying distribution for the latent SWB across 80 countries. We use the reported "feeling of happiness" in the EVS/WVS as the direct measurement of SWB, while "life satisfaction" and "freedom of choice and control in life" serve as two repeated measures of the SWB.[3] Under relatively weak assumptions described in Section 3, we impose a structure on the misclassification of reported happiness and obtain the latent SWB probability distributions for each country and demographic group. Based on these results, we further explore the

[2] In the seminal paper from Hu (2008), the author sets up the 2-measurement model (of the latent variable), while in the study of Feng and Hu (2013) they develop 3-measurements model (of the latent variable). In this paper, we employ the 3-measurement model to identify the underlying SWB.

[3] The relevant literature directly uses the stated status of SWB from survey questions since Easterlin (1974). Di Tella and MacCulloch (2006) discuss the use of happiness data. The related survey questions will be described in the next section.

characteristics of countries and specific groups with substantial misclassification errors.

Another motivation of our study is related to the well-known "Easterlin paradox" (Easterlin, 1974, 1995; Blanchflower and Oswald, 2004).[4] The Easterlin paradox posits that reported happiness is not significantly associated with *per capita* GDP, but at the same time there is a positive correlation between individual income and individual measures of subjective well-being.[5] However, recent studies have challenged the validity of the Easterlin paradox and argue that there is robust evidence of a positive relationship between SWB and income across countries and over time (e.g. Hagerty and Veenhoven, 2003; Deaton, 2008; Stevenson and Wolfers, 2008a; Sacks et al., 2010; Stevenson and Wolfers, 2013).

Meanwhile, a modified version of the Easterlin's hypothesis has also been proposed. The argument is that the correlation between income and SWB only exists among individuals with income below a certain threshold; after surpassing this threshold, income is no longer related to well-being (Frey and Stutzer, 2002; Clark et al., 2008; Di Tella and MacCulloch, 2008; Di Tella et al., 2010). For instance, Clark et al. (2008) argue that "greater economic prosperity at some point ceases to buy more happiness." They argue that after most basic needs are satisfied, further economic growth does not bring greater happiness. For example, Frey and Stutzer (2010b) argue that the correlation between income and SWB extends only to an average GDP *per capita* of about $15,000 per year. Kahneman and Deaton (2010) argue that wealthier people generally report greater life satisfaction, but subjective well-being only rises with earnings until a threshold of around $75,000 of yearly income. However, Stevenson and Wolfers (2013) and Lien et al. (2016) find no evidence of the existence of a satiation point.

The debate about the Easterlin paradox is likely to continue until SWB can be better measured and quantified. Our study makes the first attempt in this direction. Our analysis produced the following major findings. First, self-reported happiness elicited from survey

[4]See Kahneman and Krueger (2006); Frey and Stutzer (2002); Clark et al. (2008) for a more comprehensive review.

[5]Of course, some other factors also play an important role in reported happiness, such as employment (Andrew E. Clark, 1994; Helliwell and Huang, 2014), gender (Clark, 1997; Mookerjee and Beron, 2005; Stevenson and Wolfers, 2008b), inequality (Alesina et al., 2004), culture (Diener et al., 2003; Senik, 2014; Hajdu and Hajdu, 2016), religiosity (Mookerjee and Beron, 2005; Deaton and Stone, 2013; Gundlach and Opfinger, 2013; Campante and Yanagizawa-Drott, 2015), economic freedom (Spruk and Kešeljević, 2016), age and marriage (Blanchflower and Oswald, 2004), education (Soutter et al., 2011; Ross and Van Willigen, 1997), and environmental amenities (Ferreira et al., 2013; Brereton et al., 2008).

questions has substantial misclassification errors. Second, the misclassification errors of SWB are heterogeneous across countries with different religious beliefs; they tend to be particularly larger in Asian Confucian countries. Third, our analysis shows that religious beliefs and economic development have an impact on how the misclassification errors relate to demographic characteristics. Lastly, we apply the latent variable approach to the Easterlin paradox and modified-Easterlin hypothesis, and find no evidence to support them in the aggregate country level analysis.

The rest of this paper proceeds as follows. Section 2 documents the data. In section 3 we present the identification strategy. Section 4 reports the results. Section 5 concludes.

2 Data

The main data source for this study is the Integrated European/World Value Survey (EVS/WVS hereafter) from 1981 to 2014. There are four waves in EVS and six waves in WVS, providing a wide coverage of countries around the world.[6] The two surveys do not define the years waves in the exact same way. For a particular country, the data appears in either the EVS or WVS survey, and for most of the countries, the data is not continuously collected across waves. As a result, the country level data is unbalanced across different years. Previous literature such as Stevenson and Wolfers (2013) employed cross sectional analysis in wave-wise fashion, the potential concern for that method is that each estimation may include different countries. In this study, we attempt to make cross country comparisons feasible. Specifically, we implement the analysis by pooling available data for all waves for each country and identifying the latent SWB for each demographic group countrywide.

The three key variables selected as the measures for subjective well-being come from the following three survey questions.

- "*Taking all things together, would you say you are?*"

  1 Very happy

[6]The four waves of EVS data are from 1981-1984, 1990-1993, 1999-2001 as well as 2008-2010, and the six waves of WVS data are from 1981-1984, 1989-1993, 1994-1998, 1999-2004, 2005-2009, 2010-2014.

2 Rather happy

3 Not very happy

4 Not at all happy

- "*All things considered, how satisfied are you with your life as a whole these days?*"

  1 means you are "completely dissatisfied" and 10 means you are "completely satisfied".

- "*Please indicate how much freedom of choice and control you feel you have over the way your life turns out.*"

  1 means "no choice at all" and 10 means "a great deal of choice".

Since the three SWB questions use different scales, for the sake of identification strategy, they were recoded to guarantee that all three variables of interest share a common support. To achieve this end, we collapse some ranges of consecutive scales into one level. For instance, for the feelings of happiness, we collapse "Not very happy" and "Not at all happy" into one level. The new variable has three levels of happiness: "very happy", "quite happy" and "unhappy". Similarly, for the life satisfaction and life control variable, we collapse the range from 1 to 4 into the first level, the range from 5 to 8 as the second level and the range from 9 to 10 as the third level. After recoding the variables, the SWB measures are captured in three variables with three levels each. The percentage of observations for each variable are similar and around 14-19% for the first category, 51-57% for the second category, and 23-27% for the third category.

In addition to demographic characteristics (e.g. age, gender, family income) provided in the EVS/WVS dataset, country-level data are also used in the analysis. GDP *per capita* was obtained from the Penn World Table (Feenstra et al., 2015). The World Factbook was used to identify the major religion for each country.

3 Nonparametric Identification

In order to correct potential under/over-reporting in each category of self-reported subjective well-being, we apply the recently proposed closed-form identification and estimation method

in the spirit of Feng and Hu (2013) and Hu (2008) to recover an individual's latent true classification of SWB.

3.1 Basic Set-up and Assumptions

Let X be the reported status of SWB, and X^* be the underlying true status of SWB. We use the reported status for ***happiness*** in the EVS/WVS as the direct measurement of SWB. Y and Z represent two other indirect measurements for the SWB. Y and Z were obtained from the responses to the questions related to ***life satisfaction*** and ***freedom of choice and control in life***. We further control for several sociodemographic factors including age, gender and income, which in a simple OLS regression showed to contribute significantly to the direct measurement of SWB. Identification subsamples are defined based on these individual characteristic variables which are represented in the model as $\mathbf{C}$. We observe an i.i.d. data set with variables $\{X, Y, Z, \mathbf{C}\}_i$, where $i = 1, ..., N$. The three categorical levels for each SWB measurement variable are listed below:

$$X = \left\{ \begin{array}{ll} 1 & Unhappy \\ 2 & Quite\ Happy \\ 3 & Very\ Happy \end{array} \right\} \quad Y = \left\{ \begin{array}{ll} 1 & Most\ Dissatisfied \\ 2 & \cdots \\ 3 & Most\ Satisfied \end{array} \right\} \quad Z = \left\{ \begin{array}{ll} 1 & Not\ At\ All \\ 2 & \cdots \\ 3 & A\ Great\ Deal \end{array} \right\}$$

We next define the misclassification probabilities and distributions for the latent SWB status in a matrix form.

For each demographic group $\mathbf{c}$, the misclassification matrix is defined as,

$$\begin{aligned} \mathbf{H}_{X|X^*,\mathbf{c}} &\equiv \left\{ \begin{array}{lll} Pr(X=1|X^*=1,\mathbf{c}) & Pr(X=1|X^*=2,\mathbf{c}) & Pr(X=1|X^*=3,\mathbf{c}) \\ Pr(X=2|X^*=1,\mathbf{c}) & Pr(X=2|X^*=2,\mathbf{c}) & Pr(X=2|X^*=3,\mathbf{c}) \\ Pr(X=3|X^*=1,\mathbf{c}) & Pr(X=3|X^*=2,\mathbf{c}) & Pr(X=3|X^*=3,\mathbf{c}) \end{array} \right\} \\ &\equiv [Pr(X=i|X^*=k,\mathbf{c})]_{i,k} \end{aligned} \tag{1}$$

The diagonal matrix is defined as,

$$\mathbf{H}_{Y=3|X^*,\mathbf{c}} \equiv \left\{ \begin{array}{ccc} Pr(Y=3|X^*=1,\mathbf{c}) & 0 & 0 \\ 0 & Pr(Y=3|X^*=2,\mathbf{c}) & 0 \\ 0 & 0 & Pr(Y=3|X^*=3,\mathbf{c}) \end{array} \right\} \tag{2}$$
$$\equiv [Pr(Y=3|X^*=k,\mathbf{c})]_k$$

Similarly, the distribution matrices are defined as:

$$\mathbf{H}_{Y=3,X,Z|\mathbf{c}} \equiv [Pr(Y=3,X,Z|\mathbf{c})]_{i,k} \tag{3}$$

$$\mathbf{H}_{X,Z|\mathbf{c}} \equiv [Pr(X,Z|\mathbf{c})]_{i,k} \tag{4}$$

$$\mathbf{H}_{X^*,Z|\mathbf{c}} \equiv [Pr(X^*,Z|\mathbf{c})]_{i,k} \tag{5}$$

The assumptions required for the identification of the underlying subjective well-being status are provided below.

Assumption 1. $Pr(X|X^*,Z,\mathbf{c}) = Pr(X|X^*,\mathbf{c})$

This assumption implies that conditional on the individual's true SWB status and characteristics, the reported status does not rely on other measurements of SWB. The Z measure is only allowed to correlate with the misclassification errors through the latent true SWB status. The noise between the latent X^* and X is assumed to be independent with other measures, represented by Z.

Assumption 2. $Pr(Y|X^*,X,Z,\mathbf{c}) = Pr(Y|X^*,\mathbf{c})$

Similarly to Assumption 1, Assumption 2 indicates that reported SWB or measure Z affect the probability distribution of reported life satisfaction only through the latent true SWB status. Noted that in Feng and Hu (2013), by the first-order Markov restriction the author essentially assumed $Pr(Y^*|X^*,Z^*,\mathbf{c}) = Pr(Y^*|X^*,\mathbf{c})$, here in our case we impose the Assumption 2 following the Hu (2008).

Assumption 3. Full rank condition: $Rank(\mathbf{H}_{X,Z|\mathbf{c}}) = 3$.

We quantitatively test the rank condition by employing the method proposed by Robin and Smith (2000). The full rankness of $\mathbf{H}_{X,Z|\mathbf{c}}$ is tested in a sequential procedure. Specifically, we first test the null hypothesis of rank 1 against rank 2, and then rank 2 against rank 3.

Assumption 4. $Pr(Y = 3|X^* = i, \mathbf{c}) \neq Pr(Y = 3|X^* = j, \mathbf{c})$ for all $i \neq j$.

Assumption 5. Given measure Y and individual characteristics $\mathbf{c}$, the conditional probability $Pr(Y = 3|X^*, c)$ is strictly increasing in X^*.

Assumption 3 guarantees the invertibility of $\mathbf{H}_{X,Z|\mathbf{c}}$, and Assumption 4 indicates the three elements in the diagonal matrix $\mathbf{H}_{Y=3|X^*,\mathbf{c}}$ are different. Assumption 5 is equivalent to assume when the self-reported life satisfaction status is observed in level 3 (most satisfied with life), it is most likely that individuals make their judgement based on his/her latent SWB of level 3 as well. Similarly, it is less likely that a self-reported level 3 life satisfaction in an individual is based on a lower underlying SWB, say, level 2 or 1.

Following Theorem 1 in Hu (2008), Assumptions 1 - 5 guarantee the nonparametric identification and estimation of the misclassification matrix $\mathbf{H}_{X|X^*,\mathbf{c}}$ through eigen-decomposition.

3.2 Estimation Procedures

The identification procedure on the latent SWB is constructive, following the identification steps we obtain the estimates. In the first step, by the law of total probability and given assumptions, the following relationships among the misclassifications are satisfied.

$$\begin{aligned} Pr(Y, X, Z|\mathbf{c}) &= \sum_{X^*} Pr(Y, X, Z|X^*, \mathbf{c}) Pr(X^*|\mathbf{c}) \\ &= \sum_{X^*} Pr(Y|X, Z, X^*, \mathbf{c}) Pr(X|Z, X^*, \mathbf{c}) Pr(Z|X^*, \mathbf{c}) Pr(X^*|\mathbf{c}) \qquad (6) \\ &= \sum_{X^*} Pr(Y|X^*, \mathbf{c}) Pr(X|X^*, \mathbf{c}) Pr(X^*, Z|\mathbf{c}) \end{aligned}$$

$$Pr(X, Z|\mathbf{c}) = \sum_{X^*} Pr(X|X^*, \mathbf{c}) Pr(X^*, Z|\mathbf{c}) \qquad (7)$$

In matrix form, we have,

$$\mathbf{H}_{Y=3,X,Z|\mathbf{c}} = \mathbf{H}_{X|X^*,\mathbf{c}}\mathbf{H}_{Y=3|X^*,\mathbf{c}}\mathbf{H}_{X^*,Z|\mathbf{c}} \tag{8}$$

$$\mathbf{H}_{X,Z|\mathbf{c}} = \mathbf{H}_{X|X^*,\mathbf{c}}\mathbf{H}_{X^*,Z|\mathbf{c}} \tag{9}$$

$$\begin{aligned}\mathbf{H}_{Y=3,X,Z|\mathbf{c}}\mathbf{H}_{X,Z|\mathbf{c}}{}^{-1} &= \mathbf{H}_{X|X^*,\mathbf{c}}\mathbf{H}_{y=3|X^*,\mathbf{c}}\mathbf{H}_{X^*,Z|\mathbf{c}}\mathbf{H}_{X^*,Z|\mathbf{c}}{}^{-1}\mathbf{H}_{X|X^*,\mathbf{c}}{}^{-1} \\ &= \mathbf{H}_{X|X^*,\mathbf{c}}\mathbf{H}_{Y=3|X^*,\mathbf{c}}\mathbf{H}_{X|X^*,\mathbf{c}}{}^{-1}\end{aligned} \tag{10}$$

In the last equation, the right hand side misclassification matrix $\mathbf{H}_{X|X^*,\mathbf{c}}$ is estimated through eigen-decomposition.

In the second step, the distribution of the underlying true status is recovered by multiplying the inverse matrix of $\mathbf{H}_{X|X^*,\mathbf{c}}$ by the self-reported SWB vector. Reversibility is guaranteed by the property of eigen-vectors. Since the self-reported status is directly observed in the survey data, the distribution vector of the latent SWB is obtained by:

$$\begin{Bmatrix} Pr(X^*=1|\mathbf{c}) \\ Pr(X^*=2|\mathbf{c}) \\ Pr(X^*=3|\mathbf{c}) \end{Bmatrix} = \mathbf{H}_{X|X^*,\mathbf{c}}{}^{-1} \begin{Bmatrix} Pr(X=1|\mathbf{c}) \\ Pr(X=2|\mathbf{c}) \\ Pr(X=3|\mathbf{c}) \end{Bmatrix} \tag{11}$$

4 Results

4.1 Reported versus Corrected Happiness

In total, our study covers 80 countries around the world.[7] We first present a map in Figure 1 depicting the distribution for the average reported (Panel a) and corrected (Panel b) happiness for all 80 countries. A higher numerical value represents a higher level of happiness. This

[7]The list of countries is provided in Table 1. There are at most 18 demographic groups in each country, i.e., full factorials of two genders, three age groups, and three income groups. Due to sample size limitations for certain countries, not all demographic groups within those countries were identified. Following the assumptions in Section 3, over 18 demographic groups, 24 countries are fully identified, 18 countries are identified for 17 demographic groups, 25 countries are identified for 16 demographic groups, 9 countries are identified for 15 demographic groups and 2 countries are identified for 14 demographic groups. Binomial tests for the hypothesis that each identified group is chosen with equal probability (1/18) can not be rejected for all 18 demographic subsamples.

index is obtained as the summation of happiness measures weighted by the proportion of reported or corrected happiness at each level. Specifically, the observed proportions of people in country i who report "unhappy", "quite happy" and "very happy" are defined by the vector $\{\omega_{1i}, \omega_{2i}, \omega_{3i}\}$. The underlying latent distribution for the three levels which are estimated by the constructive identification procedures described in section 3 is represented by the vector $\{\omega^*_{1i}, \omega^*_{2i}, \omega^*_{3i}\}$.

$$\begin{aligned} \text{Reported Happiness} &= 1 * \omega_{1i} + 2 * \omega_{2i} + 3 * \omega_{3i} \\ \text{Corrected Happiness} &= 1 * \omega^*_{1i} + 2 * \omega^*_{2i} + 3 * \omega^*_{3i} \end{aligned} \tag{12}$$

By comparing panels (a) and (b), we find that while nations such as Russia, China (Mainland) and Brazil do not appear to have sizable differences between the reported and corrected levels of happiness, other countries show pronounced differences (e.g. Japan, United States, etc.).

The difference between reported and corrected SWB at each level of happiness measure can be either positive or negative, i.e., over-report or under-report the happiness status.[8] Simply comparing the aggregate level of SWB fails to account for the direction of the misclassification error. In order to further explore the discrepancies between reported and corrected happiness, we further calculate the misclassification errors taking into account the direction of the correction and the distance between the two vectors.

Specifically, we utilize the potential error at each level of happiness to construct the misclassification error of SWB in each country. We define **Level 1** bias as $\omega_{1i} - \omega^*_{1i}$ and **Level 3** bias as $\omega_{3i} - \omega^*_{3i}$, which represent the biases in reporting "unhappy" and "very happy" respectively. These two measures are further examined since they are more informative regarding the direction of misclassification errors of individual SWB. A positive **Level 3** (**Level 1**) bias implies a significant proportion of people reporting their feelings of happiness more extreme than they really are, that is, individuals tend to report "very happy" ("unhappy"), even if their underlying feelings are "quite happy". In contrast, a negative **Level 3** (**Level 1**) bias suggests that people are inclined to suppress the extreme feelings of "very happy" ("un-

[8] We use "over-report", hereafter, if the reported SWB (by level) is larger than the corrected SWB (by level), and we use "under-report", hereafter, if the reported SWB (by level) is smaller than the corrected SWB (by level). We define "upward (downward) shifting", hereafter, in situations where the SWB status is reported upward (downward) from the underlying true status of SWB.

happy"). For instance, an individual may overstate happiness due to self-deception, while others may understate SWB in the survey questions. In another example, as the "Doctrine of the Mean" is highly praised in Asian Confucian culture,[9] citizens in Confucian culture may be more likely to report "quite happy" and avoid the extreme categories.

Figure 2 summarizes the **Level 1** and **Level 3** biases across countries. A large amount of countries have substantial bias at both levels. Misclassification errors in countries such as the United States and Canada come mainly from **Level 1** bias. That is, American and Canadian respondents tend to avoid reporting that they are "unhappy". It is also observed that China (Mainland), Hong Kong and Germany have a negative bias at both levels simultaneously. Note that countries that have negative biases at both levels are not only restricted to confucian culture or Asian countries. Also, some countries present positive **Level 1** bias but negative **Level 3** bias, that is, they are more inclined to over-report being "unhappy", but under-report being "very happy". There are nine countries in total with this particular pattern in reported happiness, and five of them are from eastern Europe, including Belarus, Bulgaria, Georgia, Lithuania and Slovakia.[10] On the other hand, there are 38 countries displaying negative **Level 1** and positive **Level 3** biases, implying under-reporting being "unhappy" and over-reporting being "very happy". Out of the 38 countries sharing this reporting pattern, 13 countries have both **Level 1** and **Level 3** biases larger than 0.1 in absolute value. These countries include Cyprus, Ecuador, El Salvador, India, Mexico, Netherlands, Nigeria, Puerto Rico, Qatar, Rwanda, Singapore, Tanzania and Venezuela, most of which are located in tropical regions. As noticed, each of the four revealed patterns of happiness reporting is not limited to some specific climate or geographical regions. We argue that cultural factors such as major religious beliefs and demographic composition also play a role in the direction and magnitude of **Level 1** and **Level 3** biases.

We also explore the misclassification errors in vector distance, Euclidean distance and rectilinear distance (ℓ_1 norm) between the reported and corrected happiness vector, i.e., the

[9] As interpreted by James Legge in The Sacred Books of China, the principle of the "Doctrine of the Mean" is to guide the mind to a state of constant equilibrium, which recommends one should never act in excess. James Legge was a Scottish sinologist, missionary, and scholar, best known as an early translator of Classical Chinese texts into English.

[10] The other four are Colombia, Egypt, Macedonia, and Zimbabwe.

distances between $\{\omega_{1i}, \omega_{2i}, \omega_{3i}\}$ and $\{\omega^*_{1i}, \omega^*_{2i}, \omega^*_{3i}\}$. Specifically,

$$\begin{aligned} \text{Euclidean distance} &= \sum_{j=1}^{3} (\omega_{ji} - \omega^*_{ji})^2 \\ \text{Rectilinear distance} &= \sum_{j=1}^{3} abs(\omega_{ji} - \omega^*_{ji}) \end{aligned} \tag{13}$$

Figure 3 maps the two measurements of misclassification for Euclidean distance (panel a) and rectilinear distance (panel b). By integrating the three happiness levels, the Euclidean and rectilinear measures display similar ordering over the 80 countries. As seen in Figure 3, in both cases the first three countries which are subject to the smallest misclassification errors are Colombia, Russia and Moldova. The three countries with the largest errors in both measurements are Ecuador, H.K. (China) and Indonesia. For the rest of the countries, the detailed orderings are slightly different for the two measures. For the three most populous countries in the world, both measures indicate China (Mainland) has relatively small misclassification errors, while the United States experiences appreciable misclassification errors, and India is subject to moderate errors. To be more specific, we present the misclassification errors across all 80 countries in our sample in Table 1. The table summarizes the major religion, geographical location, development stage, reported/corrected SWB and the misclassification errors (by level and vector distance) for each country.

4.2 Determinants of Misclassification Errors in SWB

One of the main objectives of this paper is to understand why some countries display substantial misclassification errors of SWB while other countries do not. The next step after defining the misclassification errors of SWB is to take a closer look at the relationship between country or individual level characteristics and the magnitude of misclassification errors of SWB listed in Table 1.[11]

[11] Besides Table 1, in the Appendix we choose five representative countries, including China (Mainland), Germany, Iraq, Mali as well as the United States, to show the misclassification errors among different demographic groups. See the details in Tables A1—A3.

4.2.1 Correlation with Country-level Characteristics

We start by conducting regression analysis on the association between misclassification errors and country-level characteristics. Then, we examine the correlation between misclassification errors and demographic characteristics while controlling for country fixed effects.

The results from regressing various measures of misclassification errors on the log of GDP *per capita*[12], and religious beliefs are shown in Table 2. The first row suggests that none of the measurements of misclassification errors are correlated to the log of GDP *per capita*. In the following rows, we examine the correlation between misclassification errors and religious beliefs. In columns 2 and 4, the outcome variables are misclassification errors measured in vector Euclidean and rectilinear distance. Confucian countries show higher errors compared to other countries. Meanwhile, columns 6 and 8 implement the analogous estimations with the outcome variables focusing on **Level 1** and **Level 3** biases of the reported SWB, in order to explore the direction of the biases. Point estimates for **Level 1** bias suggest that compared to predominantly Christian countries which are the majority in our sample, "unhappy" people in Confucian countries tend to report being "quite happy", although the significance is relatively weak. With respect to **Level 3** bias, only the mixed religion category shows a statistically significant effect. That is, in countries with multiple dominant religions, more people who are "quite happy" report being "very happy".

4.2.2 Correlation with Demographic Characteristics

In order to investigate the contributors of the misclassification error of SWB in a more disaggregated way, we pooled the data from all countries and regressed misclassification errors on individual level characteristics (income, gender, age). The results are shown in Table 3.

Gender differences in the misclassification errors of SWB seem to be negligible. Male respondents have slightly greater misclassification errors measured by rectilinear distance. We do not observe significant variations in misclassification errors by age measured by Euclidean

[12]As mentioned in Section 2, each country-demographic group is identified with data from all available survey waves pooled together. On this account we use the average GDP *per capita* over years matching to the waves of identified data in each country.

or rectilinear distance. However, in columns 3 and 4, we observe that younger individuals are more inclined to over-report being "very happy" and under-report being "unhappy" compared to senior citizens. With respect to individual level income, we find that low-income individuals are more likely to report being "quite happy" when they are actually "unhappy", and they tend to report being "very happy" when they are in fact "quite happy". This finding indicates a pattern of overall upward shifting from the underlying SWB when low-income individuals respond to the happiness survey. Interestingly, relative to middle-income individuals, the high-income group shows a similar pattern to the low-income group, but with a smaller magnitude and lower significance in **Level 3** bias. With the purpose of capturing heterogenous correlations of misclassification errors of SWB and individual-level characteristics conditional on country-level features, we split the sample by religious beliefs and the developing stage of the country. These results are reported in Tables 4 and 5 respectively.

In Table 2, we show that confucianism affects a country's aggregate misclassification errors. It is also possible that religion, in general, may also affect how the misclassification errors of SWB relate to gender, age and individual income. In columns 1 and 2 of Table 4, males have a positive but small effect on the misclassification errors of SWB in Confucian countries, while in Islamic and Christian countries males have no significant differences with females. With respect to **Level 1** and **Level 3** biases, "unhappy" men from Christian countries tend to upwardly bias their underlying SWB when they report their happiness level. On the other hand, "very happy" men from Islamic countries are more likely to report being "quite happy" or "unhappy". We also find heterogeneous effects of age on misclassification errors. In line with the results for the overall sample, in predominantly Christian countries, younger people tend to express optimistic feelings when reporting SWB, generally over-rating their subjective well-being compared to senior cohorts. Young people from Islamic countries show a similar pattern. However, people from Confucian countries show an opposite pattern with regards to the association between age and misclassification errors of SWB. That is, they tend to shift their overall underlying SWB downwards when they report their happiness.

Regarding relative income level, people from countries with different religions show a

similar pattern. In general, low-income and high-income cohorts are both more likely to bias towards reporting their overall subjective well-being higher than their underlying status, although the statistical significance and magnitude vary slightly.

We further probe the correlation between misclassification errors of SWB and individual characteristics conditional on the development stage of the country. Table 5 provides suggestive evidence of heterogenous relationships across countries in different stages of development. Gender has no effect on misclassification errors of SWB in low and middle-income countries, but males from high-income countries show higher misclassification errors in SWB reporting measured by Euclidean and rectilinear distance. In particular, in high-income countries, males tend to report being "quite happy" or "very happy" when they are actually "unhappy". Young people from low-income countries tend to report a "very happy" status when their underlying happiness status is lower. This bias is relatively weak in middle-income countries and it is not significant in high-income countries. Low-income individuals tend to report their underlying SWB in an upward-biased pattern. Moreover, the high-income group shares the same reporting pattern of SWB as the low-income group. The coefficients are significant for both cohorts in low-income countries. In middle-income countries, both low-income and high-income people who are actually "unhappy" tend to report they are "quite happy" or "very happy". Additionally, low and high-income people living in high-income countries present larger misclassification errors measured by Euclidean and rectilinear distances.

4.3 The Easterlin Paradox

In this section, we revisit the Easterlin paradox by investigating the correlation between reported and corrected happiness and GDP *per capita*. We also conduct an analysis of the correlation between happiness and income at the individual level conditional on country characteristics.

We first implement simple regressions of the average reported and corrected happiness on the log of GDP *per capita*. As shown in Table 6, there is no significant correlation between reported happiness and the log of GDP *per capita*. This result, based on the reported level

of happiness, provides support for the Easterlin paradox. However, the corrected measure of happiness is strongly associated with the log of GDP *per capita*, suggesting the rejection of this hypothesis. Notably, the coefficients are only slightly different. Meanwhile, an equivalent representation of this relationship is displayed in the two panels of the scatter plots in Figure 4, in which only a minor change in the slope is observed when comparing the two fitted lines for reported and corrected happiness.

We also test the modified-Easterlin hypothesis following Stevenson and Wolfers (2013):

$$SubjectiveWellbeing_c = \alpha + \beta_{poor} * I(GDP < k) \times [log(GDP_c) - log(k)] + \beta_{rich} * I(GDP \geq k) \times [log(GDP_c) - log(k)] + \epsilon_c \quad (14)$$

where GDP_C stands for GDP per capita of country C, and k is the threshold of satiation point (e.g., \$15,000 in Stevenson and Wolfers (2013)).

If the modified-Easterlin hypothesis holds, the equality of $\beta_{rich} = 0$ must hold, or at least the relationship of $\beta_{rich} < \beta_{poor}$. However, we find strong evidence against the modified-Easterlin hypothesis, as shown in Table 7. In columns 1 and 2 of panel A with \$10,000 as the threshold, we find that $\beta_{rich} > 0 \geq beta_{poor}$, regardless of whether the dependent variable is reported happiness or corrected happiness. The reported and corrected happiness measures are positively associated with the log of GDP *per capita* for high-income individuals at the 1% level of significance. We further test whether this relationship is sensitive to the selected threshold amount and the exact specification. The result of $\beta_{rich} > \beta_{poor}$ is robust to the variation of the threshold to \$15,000 and \$20,000. This results are consistent with the findings in Stevenson and Wolfers (2013).

It is likely that there are heterogenous correlations between GDP and SWB across different income cohorts. Hence, we also specify a flexible nonparametric linear spline. The results are presented in panel b of Table 7 with knots set at \$10,000 and \$20,000. The point estimate is similar to the results in panel a at the 1% level of statistical significance. Although there is a reduction in the magnitude of the correlation between the log of GDP *per capita* and SWB

after applying the SWB correction in all specifications, it is clear that the correlation between income and happiness is robust even beyond a threshold of $20,000. Taken together, neither the original nor the modified-Easterlin hypothesis is supported by the cross-country analysis of corrected SWB.

5 Conclusion

Research related to the causes and consequences of subjective well-being needs reliable data. However due to its inherent nature, reported SWB is subject to substantial misclassification errors. In this article we used a new method to uncover the latent true distribution of subjective well-being using data from the integrated EVS/WVS surveys. We find that reported happiness in the survey data has substantial misclassification errors. This is of particular importance to the literature since most studies rely on reported SWB to address economic questions of interest. We explore the characteristics of countries and demographic groups with substantial misclassification error and find that religious beliefs and the development stage of the countries play a critical role in the magnitude of misclassification errors in the reported SWB. We revisit the Easterlin paradox and find that based on a country level analysis there is no evidence supporting either the original hypothesis or the modified version of the Easterlin's paradox when using our corrected measure of happiness. It is noteworthy that using the reported (uncorrected) SWB provides support to the original Easterlin paradox.

Our methodology and results are useful and can be applied in future research related to subjective well-being. First, further efforts are expected to conduct causal analysis of the relationship between misclassification errors and their influencing factors. A richer longitudinal dataset and convincing exogenous variations would be needed to establish the direction of causality. In addition, follow-up surveys may enable researchers to explore which individual characteristics are more likely to drive misclassification errors in SWB reports. Lastly, experimental studies can be conducted to examine how psychological elements such as envy and self-deception affect misclassification errors of SWB measures in survey data.

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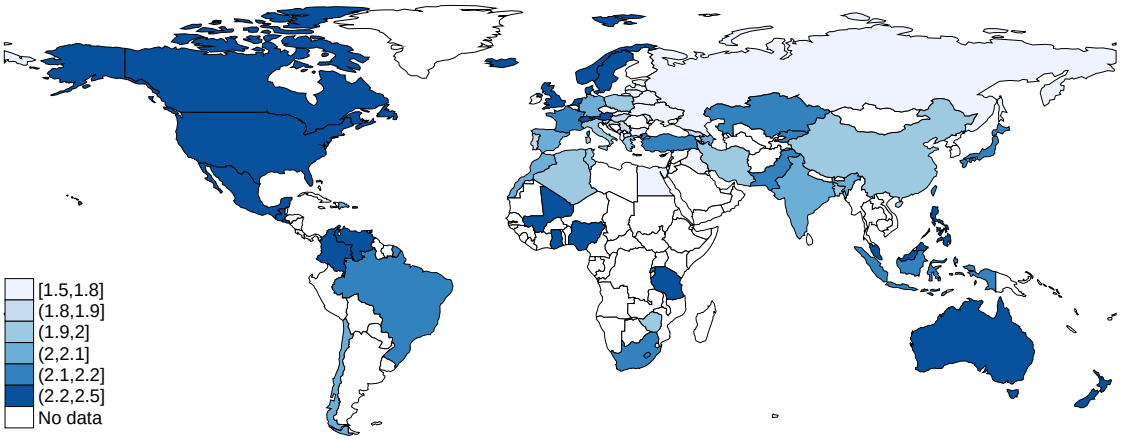
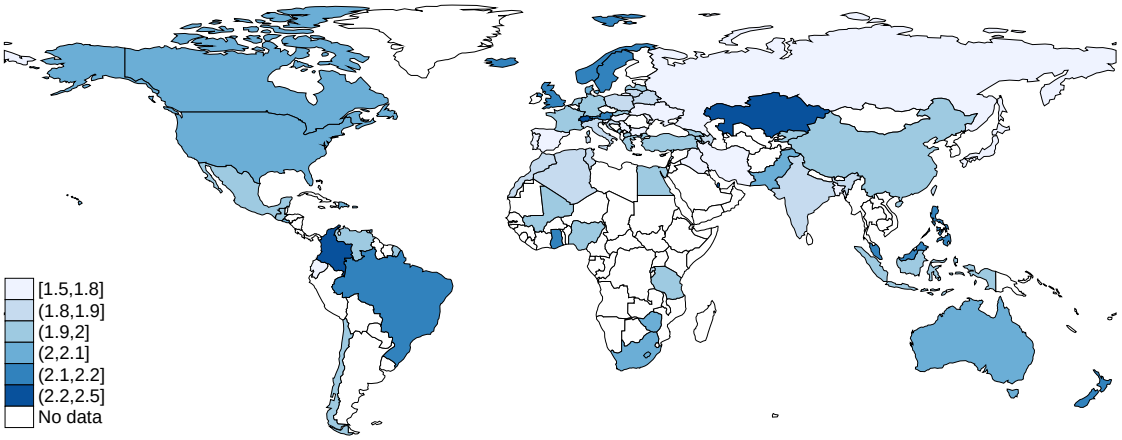
Figures and Tables

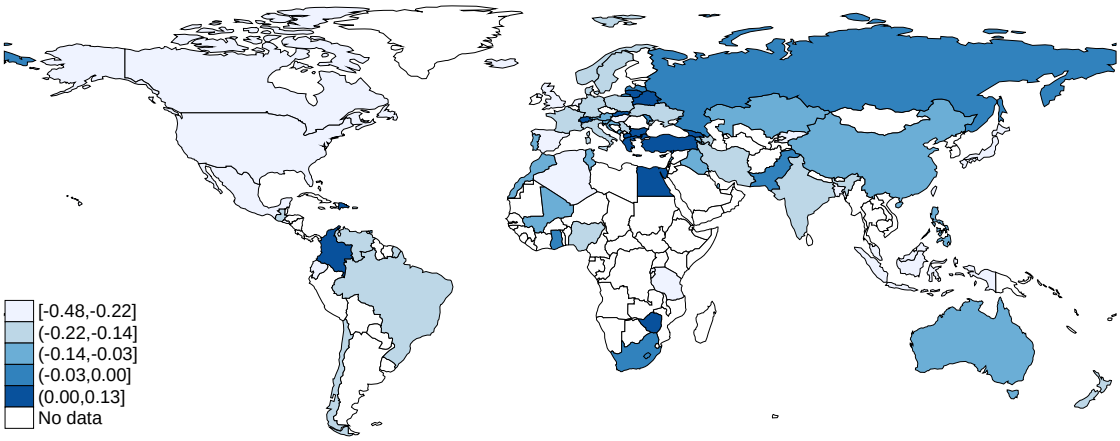


(a) Reported Happiness

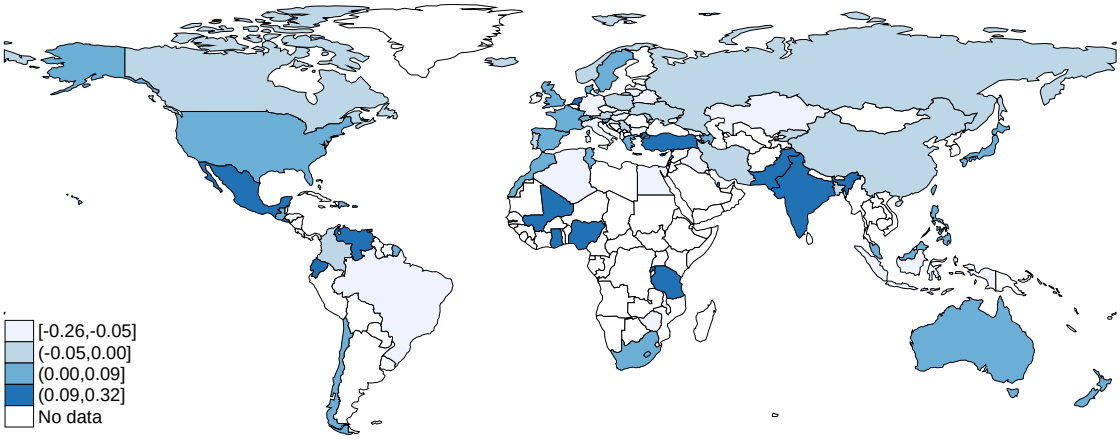


(b) Corrected Happiness

Figure 1: World Map: Reported vs. Corrected Happiness

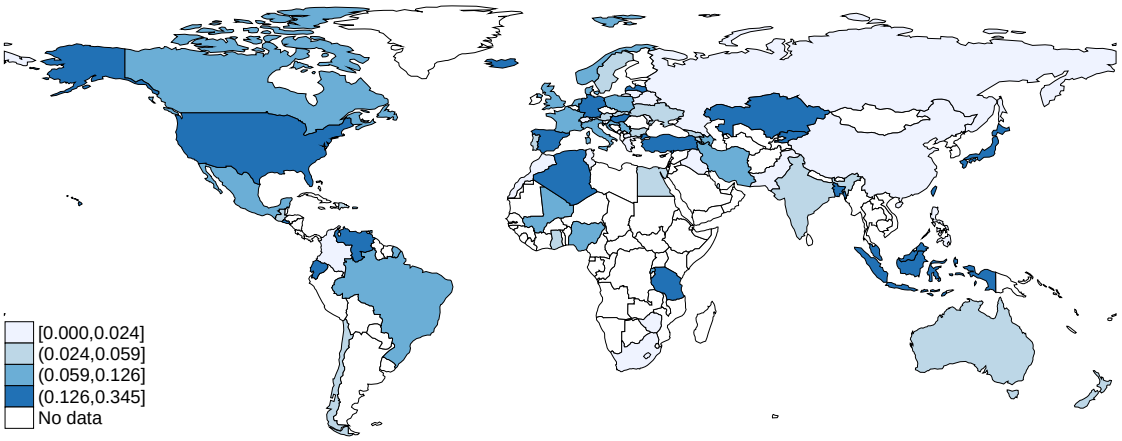


(a) **Level 1** Bias (Unhappy)

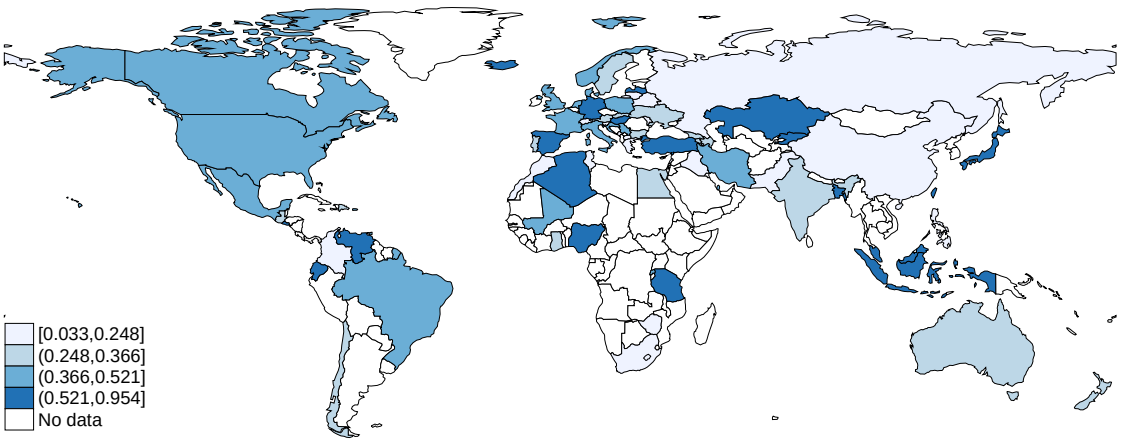


(b) **Level 3** Bias (Very Happy)

Figure 2: World Map: misclassification Error of Happiness

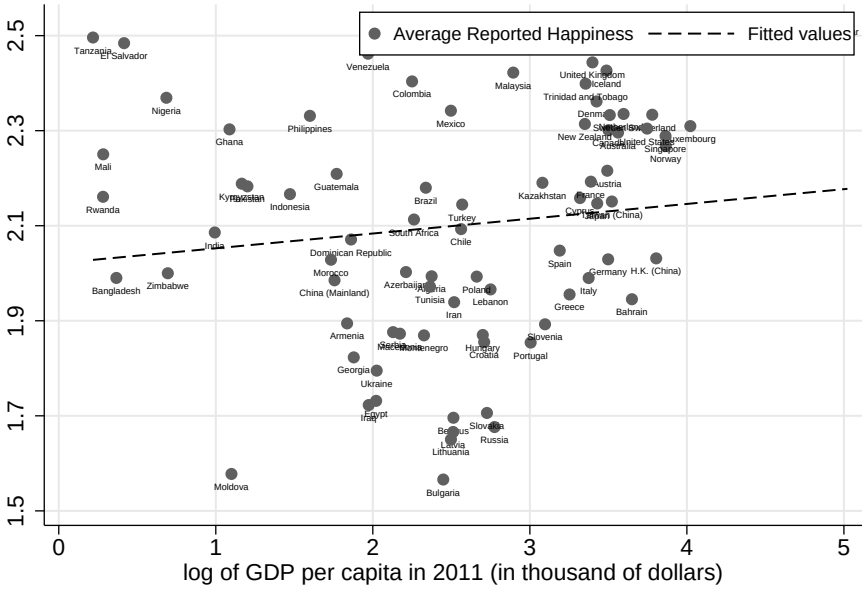


(a) ME-Euclidean

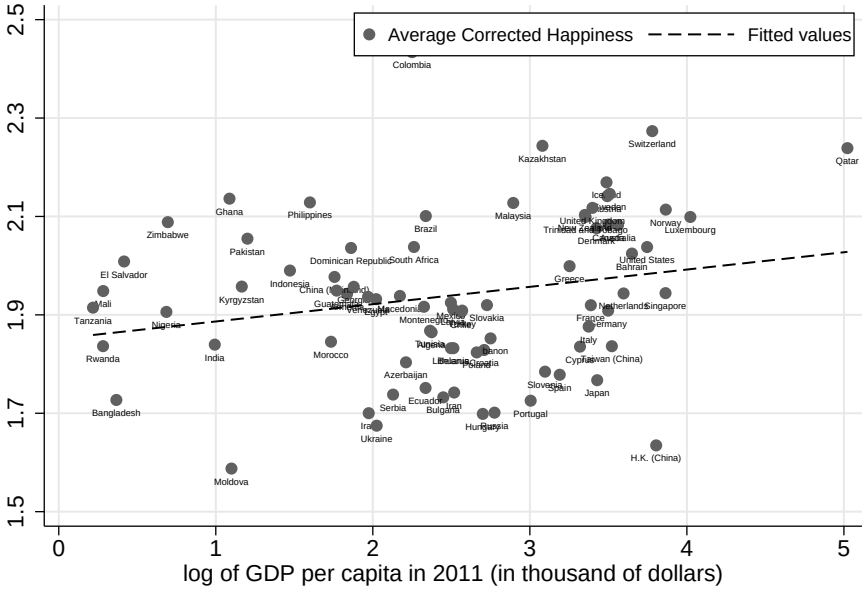


(b) ME-rectilinear

Figure 3: World Map: misclassification Error of Happiness



(a) Reported Happiness and GDP per capita



(b) Corrected Happiness and GDP per capita

Figure 4: Cross-Country Analysis of Happiness and GDP per capita

Table 1: **Misclassfication Error At Country Level**

Country	**Religion**	**Area**	**Development**	*Reported*	*Corrected*	**Misclassfication Error**			
						Euclidean	*Rectilinear*	*Level 1*	*Level 3*
Algeria	Islam	GME	Upper middle	1.994	1.865	0.158	0.632	-0.223	-0.094
Andorra	Christianity	Europe	High	2.206	1.633	0.419	0.985	-0.493	0.081
Armenia	Christianity	Europe	Lower middle	1.894	1.943	0.035	0.301	-0.051	-0.099
Australia	Christianity	Oceania	High	2.296	2.083	0.026	0.261	-0.131	0.083
Austria	Christianity	Europe	High	2.216	2.141	0.034	0.290	-0.110	-0.035
Azerbaijan	Islam	Europe	Upper middle	2.003	1.804	0.059	0.361	-0.180	0.019
Bahrain	Islam	GME	High	1.945	2.025	0.040	0.314	-0.039	-0.118
Bangladesh	Islam	Asia	Lower middle	1.990	1.727	0.146	0.544	-0.268	-0.005
Belarus	Mixed	Europe	Upper middle	1.696	1.832	0.014	0.194	0.040	-0.097
Brazil	Christianity	Americas	Upper middle	2.180	2.101	0.073	0.433	-0.148	-0.069
Bulgaria	Christianity	Europe	Upper middle	1.566	1.732	0.029	0.267	0.033	-0.134
Canada	Christianity	Americas	High	2.301	2.083	0.100	0.450	-0.221	-0.004
Chile	Christianity	Americas	High	2.093	1.906	0.058	0.352	-0.176	0.011
China(Mainland)	Confucian	Asia	Upper middle	1.985	1.977	0.012	0.181	-0.049	-0.041
Colombia	Christianity	Americas	Upper middle	2.404	2.434	0.000	0.033	0.017	-0.013
Croatia	Christianity	Europe	High	1.855	1.829	0.066	0.418	-0.118	-0.091
Cyprus	Christianity	Europe	High	2.158	1.835	0.054	0.362	-0.142	0.181
Denmark	Christianity	Europe	High	2.362	2.076	0.075	0.436	-0.218	0.068
Dominican Rep.	Christianity	Americas	Upper middle	2.071	2.036	0.031	0.285	0.054	0.089
Ecuador	Christianity	Americas	Upper middle	2.512	1.751	0.345	0.954	-0.477	0.284
Egypt	Islam	GME	Lower middle	1.732	1.932	0.024	0.250	0.125	-0.075
El Salvador	Christianity	Americas	Lower middle	2.484	2.008	0.133	0.592	-0.296	0.180
France	Christianity	Europe	High	2.193	1.920	0.074	0.430	-0.215	0.058
Georgia	Christianity	Europe	Upper middle	1.823	1.957	0.032	0.258	0.005	-0.129
Germany	Christianity	Europe	High	2.029	1.909	0.157	0.631	-0.218	-0.097
Ghana	Christianity	SSA	Lower middle	2.303	2.136	0.055	0.331	-0.001	0.166
Great Britain	Christianity	Europe	High	2.444	2.117	0.105	0.512	-0.256	0.070

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Table 1 – continued from previous page

Country	**Religion**	**Area**	**Development**	*Reported*	*Corrected*	**Misclassfication Error**			
						Euclidean	*Rectilinear*	*Level 1*	*Level 3*
Greece	Christianity	Europe	High	1.955	1.999	0.009	0.146	0.058	0.015
Guatemala	Christianity	Americas	Lower middle	2.209	1.949	0.047	0.353	-0.176	0.083
H.K.(China)	Confucian	Asia	High	2.031	1.635	0.393	0.916	-0.427	-0.031
Hungary	Christianity	Europe	High	1.870	1.699	0.175	0.655	-0.249	-0.078
Iceland	Christianity	Europe	High	2.426	2.169	0.165	0.593	-0.277	-0.020
India	Hinduism	Asia	Lower middle	2.086	1.839	0.033	0.288	-0.144	0.102
Indonesia	Islam	Asia	Lower middle	2.166	1.990	0.199	0.699	-0.263	-0.086
Iran	Islam	GME	Upper middle	1.939	1.742	0.082	0.410	-0.201	-0.004
Iraq	Islam	GME	Upper middle	1.723	1.700	0.023	0.246	-0.073	-0.050
Italy	Christianity	Europe	High	1.990	1.876	0.099	0.497	-0.181	-0.067
Japan	Confucian	Asia	High	2.147	1.767	0.134	0.583	-0.291	0.088
Kazakhstan	Islam	Asia	Upper middle	2.190	2.244	0.159	0.647	-0.135	-0.188
Kyrgyzstan	Islam	Asia	Lower middle	2.188	1.957	0.177	0.633	-0.274	-0.043
Latvia	Christianity	Europe	High	1.666	1.912	0.136	0.531	-0.010	-0.255
Lebanon	Islam	GME	Upper middle	1.966	1.852	0.013	0.181	-0.091	0.023
Lithuania	Christianity	Europe	High	1.650	1.832	0.022	0.240	0.062	-0.120
Luxembourg	Christianity	Europe	High	2.310	2.099	0.054	0.357	-0.179	0.032
Macedonia	Christianity	Europe	Upper middle	1.873	1.938	0.007	0.121	0.005	-0.061
Malaysia	Islam	Asia	Upper middle	2.422	2.127	0.173	0.588	-0.294	0.001
Mali	Islam	SSA	Low	2.250	1.948	0.065	0.416	-0.094	0.208
Mexico	Christianity	Americas	Upper middle	2.342	1.925	0.090	0.460	-0.230	0.187
Moldova	Christianity	Europe	Lower middle	1.578	1.588	0.002	0.074	-0.014	-0.024
Montenegro	Christianity	Europe	Upper middle	1.869	1.916	0.023	0.244	-0.037	-0.085
Morocco	Islam	GME	Lower middle	2.028	1.845	0.021	0.236	-0.118	0.065
Netherlands	Christianity	Europe	High	2.335	1.943	0.093	0.496	-0.248	0.144
New Zealand	Christianity	Oceania	High	2.314	2.103	0.050	0.347	-0.174	0.037
Nigeria	Mixed	SSA	Lower middle	2.369	1.906	0.125	0.572	-0.177	0.286
Norway	Christianity	Europe	High	2.268	2.114	0.064	0.374	-0.170	-0.017

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Table 1 – continued from previous page

Country	**Religion**	**Area**	**Development**	*Reported*	*Corrected*	**Misclassfication Error**			
						Euclidean	*Rectilinear*	*Level 1*	*Level 3*
Pakistan	Islam	Asia	Lower middle	2.183	2.055	0.024	0.229	-0.014	0.115
Philippines	Christianity	Asia	Lower middle	2.331	2.129	0.023	0.246	-0.123	0.080
Poland	Christianity	Europe	High	1.993	1.824	0.104	0.490	-0.207	-0.038
Portugal	Christianity	Europe	High	1.854	1.726	0.038	0.283	-0.135	-0.006
Puerto Rico	Christianity	Americas	High	2.444	2.083	0.072	0.430	-0.215	0.146
Qatar	Islam	GME	High	2.535	2.239	0.052	0.370	-0.112	0.185
Russia	Christianity	Europe	Upper middle	1.676	1.701	0.001	0.054	-0.001	-0.026
Rwanda	Christianity	SSA	Low	2.161	1.836	0.075	0.446	-0.223	0.102
Serbia	Christianity	Europe	Upper middle	1.876	1.738	0.086	0.451	-0.182	-0.044
Singapore	Confucian	Asia	High	2.289	1.944	0.082	0.469	-0.110	0.234
Slovakia	Christianity	Europe	High	1.706	1.920	0.052	0.352	0.038	-0.176
Slovenia	Christianity	Europe	High	1.893	1.785	0.009	0.156	-0.078	0.030
South Africa	Christianity	SSA	Upper middle	2.113	2.038	0.003	0.094	-0.028	0.047
Spain	Christianity	Europe	High	2.048	1.778	0.143	0.536	-0.268	0.001
Sweden	Christianity	Europe	High	2.333	2.146	0.033	0.287	-0.144	0.043
Switzerland	Christianity	Europe	High	2.334	2.273	0.011	0.159	0.010	0.070
Taiwan	Confucian	Asia	High	2.151	1.836	0.152	0.576	-0.288	0.027
Tanzania	Islam	SSA	Low	2.496	1.915	0.173	0.632	-0.266	0.316
Trinidad&Tobago	Mixed	Americas	High	2.399	2.099	0.070	0.430	-0.085	0.215
Tunisia	Islam	GME	Lower middle	1.972	1.868	0.013	0.176	-0.088	0.016
Turkey	Islam	GME	Upper middle	2.145	1.909	0.145	0.559	0.022	0.258
Ukraine	Christianity	Europe	Lower middle	1.795	1.675	0.052	0.347	-0.147	-0.026
United States	Christianity	Americas	High	2.304	2.038	0.126	0.512	-0.256	0.010
Venezuela	Christianity	Americas	Upper middle	2.462	1.937	0.149	0.613	-0.219	0.306
Zimbabwe	Christianity	SSA	Low	2.000	2.088	0.005	0.112	0.032	-0.056

Continued on next page

Table 1 – continued from previous page

Country	**Religion**	**Area**	**Development**	*Reported*	*Corrected*	**Misclassfication Error**			
						Euclidean	*Rectilinear*	*Level 1*	*Level 3*

Notes: SSA, Sub-Saharan Africa. GME, Greater Middle East

Categorization of Development Stage is obtained from World Bank.

Major Religion and Area are from World Factbook.

Data Source: Identified results from Section 3.

Table 2: Determinants of Misclassification Error of SWB

	(1) Euclidean	(2) Euclidean	(3) Rectilinear	(4) Rectilinear	(5) Level 1	(6) Level 1	(7) Level 3	(8) Level 3
log of GDP per capita	0.004		0.012		-0.013		-0.017	
	(0.008)		(0.021)		(0.013)		(0.013)	
Christianity		-		-		-		-
		(.)		(.)		(.)		(.)
Confucian		0.086**		0.179**		-0.103*		0.041
		(0.033)		(0.087)		(0.056)		(0.056)
Hinduism		-0.036		-0.078		-0.014		0.088
		(0.071)		(0.187)		(0.120)		(0.121)
Mixed		0.001		0.033		0.056		0.120*
		(0.042)		(0.110)		(0.071)		(0.071)
Islam		0.023		0.062		-0.006		0.014
		(0.019)		(0.050)		(0.032)		(0.032)
Constant	0.069***	0.069***	0.361***	0.366***	-0.104***	-0.130***	0.066*	0.015
	(0.022)	(0.010)	(0.056)	(0.026)	(0.036)	(0.017)	(0.036)	(0.017)
adj.R-squared	-0.010	0.050	-0.009	0.018	-0.001	0.004	0.008	-0.005
Observations	78	79	78	79	78	79	78	79

* pi0.1, ** pi0.05, *** pi0.01

Notes: $*p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Mixed indicates countries with more than one major religion.

Andorra and Puerto Rico excluded due to the lack of GDP data for these two countries.

Level 1 indicates the difference between reported and corrected value in level of "Unhappy". **Level 3** indicates the difference between reported and corrected value in level of "Very Happy".

Table 3: Misclassification Error of SWB, by Group

	(1) ME-Euclidean	(2) ME-rectilinear	(3) **Level 1**	(4) **Level 3**
Male	0.024	0.039*	-0.022	-0.016
	(0.016)	(0.023)	(0.015)	(0.014)
15-29 years	0.015	0.022	-0.037**	0.055***
	(0.020)	(0.028)	(0.018)	(0.017)
30-49 years	0.005	0.013	-0.015	0.010
	(0.020)	(0.028)	(0.018)	(0.017)
50 and more years	-	-	-	-
	(.)	(.)	(.)	(.)
Income Level: Low	0.038*	0.053*	-0.082***	0.072***
	(0.020)	(0.029)	(0.018)	(0.017)
Income Level: Middle	-	-	-	-
	(.)	(.)	(.)	(.)
Income Level: High	0.043**	0.068**	-0.092***	0.032*
	(0.020)	(0.028)	(0.018)	(0.017)
Constant	0.248***	0.644***	-0.045**	-0.017
	(0.020)	(0.028)	(0.018)	(0.017)
adj.R-squared	-0.060	-0.059	-0.035	-0.040
Observations	1301	1301	1301	1301

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Level 1 indicates the difference between reported and corrected value in level of "Unhappy".

Level 3 indicates the difference between reported and corrected value in level of "Very Happy".

All specifications controlled for country level fixed effects.

Table 4: Misclassification Error of SWB, Different Religions

	(1) ME-Euclidean	(2) ME-rectilinear	(3) **Level 1**	(4) **Level 3**
		Confucian Countries		
Male	0.109	0.155*	-0.089	-0.079
	(0.072)	(0.093)	(0.061)	(0.048)
15-29 years	0.016	0.052	0.139*	-0.121**
	(0.090)	(0.115)	(0.076)	(0.059)
30-49 years	-0.066	-0.082	0.159**	0.002
	(0.087)	(0.112)	(0.074)	(0.057)
Income Level: Low	0.035	0.051	-0.133*	0.173***
	(0.089)	(0.115)	(0.076)	(0.059)
Income Level: High	0.009	-0.016	-0.104	0.120**
	(0.088)	(0.113)	(0.075)	(0.058)
Observations	81	81	81	81
		Christian Countries		
Male	0.024	0.039	-0.030*	0.008
	(0.020)	(0.029)	(0.018)	(0.016)
15-29 years	-0.001	-0.002	-0.037*	0.051**
	(0.024)	(0.035)	(0.022)	(0.020)
30-49 years	0.029	0.054	-0.045**	0.012
	(0.024)	(0.035)	(0.022)	(0.020)
Income Level: Low	0.046*	0.063*	-0.098***	0.041**
	(0.025)	(0.036)	(0.022)	(0.020)
Income Level: High	0.059**	0.086**	-0.098***	0.023
	(0.024)	(0.035)	(0.022)	(0.020)
Observations	838	838	838	838
		Islamic Countries		
Male	-0.002	-0.003	0.028	-0.062**
	(0.036)	(0.048)	(0.030)	(0.031)
15-29 years	0.037	0.044	-0.052	0.082**
	(0.044)	(0.059)	(0.037)	(0.038)
30-49 years	-0.010	-0.024	0.023	-0.000
	(0.044)	(0.059)	(0.037)	(0.038)
Income Level: Low	-0.014	-0.027	-0.040	0.122***
	(0.044)	(0.060)	(0.037)	(0.038)
Income Level: High	0.007	0.039	-0.080**	0.041
	(0.043)	(0.059)	(0.037)	(0.037)
Observations	315	315	315	315

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

All specifications controlled for country level fixed effects.

Table 5: Misclassification Error of SWB, Different Development Stages

	(1) ME-Euclidean	(2) ME-rectilinear	(3) **Level 1**	(4) **Level 3**
		Low Income Countries		
Male	-0.051	-0.064	0.015	-0.031
	(0.033)	(0.045)	(0.030)	(0.030)
15-29 years	0.035	0.057	-0.054	0.109***
	(0.041)	(0.055)	(0.037)	(0.037)
30-49 years	0.014	0.033	0.006	0.040
	(0.040)	(0.055)	(0.036)	(0.037)
Income Level: Low	0.069*	0.076	-0.103***	0.167***
	(0.041)	(0.055)	(0.037)	(0.037)
Income Level: High	0.034	0.059	-0.142***	0.112***
	(0.040)	(0.054)	(0.036)	(0.037)
Observations	334	334	334	334
		Middle Income Countries		
Male	0.023	0.057	-0.010	0.011
	(0.029)	(0.041)	(0.027)	(0.025)
15-29 years	-0.026	-0.039	-0.029	0.051*
	(0.036)	(0.051)	(0.033)	(0.031)
30-49 years	-0.016	-0.008	0.023	0.012
	(0.037)	(0.051)	(0.034)	(0.031)
Income Level: Low	-0.024	-0.035	-0.069**	0.031
	(0.036)	(0.051)	(0.034)	(0.031)
Income Level: High	-0.001	0.005	-0.067**	-0.020
	(0.036)	(0.050)	(0.033)	(0.030)
Observations	386	386	386	386
		High Income Countries		
Male	0.067***	0.086**	-0.049**	-0.024
	(0.024)	(0.036)	(0.022)	(0.019)
15-29 years	0.031	0.043	-0.031	0.026
	(0.030)	(0.044)	(0.026)	(0.023)
30-49 years	0.012	0.013	-0.051*	-0.008
	(0.030)	(0.043)	(0.026)	(0.023)
Income Level: Low	0.060**	0.096**	-0.078***	0.044*
	(0.030)	(0.044)	(0.026)	(0.023)
Income Level: High	0.079***	0.117***	-0.080***	0.023
	(0.030)	(0.043)	(0.026)	(0.023)
Observations	581	581	581	581

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

All specifications controlled for country level fixed effects.

Countries ranked as lower-middle-income are integrated with low-income countries.

Table 6: Easterlin Paradox, Simple Regressions

	(1)	(2)
	Average Reported Happiness	Average Corrected Happiness
log of GDP per capita	0.031	0.035**
	(0.027)	(0.018)
Constant	2.021***	1.851***
	(0.073)	(0.047)
adj.R-squared	0.004	0.038
Observations	78	78

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Andorra and Puerto Rico are excluded due to the lack of GDP data for these two countries.

The log of *per capita* GDP is adjusted in 2011 in thousand of dollars.

Table 7: Modified Easterlin Paradox

	(1) Reported	(2) Corrected	(3) Reported	(4) Corrected	(5) Reported	(6) Corrected	(7) Reported	(8) Corrected
Panel a								
rich10=0 × lgdp10	-0.165***	-0.031						
	(0.047)	(0.034)						
rich10=1 × lgdp10	0.220***	0.099***						
	(0.046)	(0.033)						
rich15=0 × lgdp15			-0.126***	-0.027				
			(0.038)	(0.027)				
rich15=1 × lgdp15			0.319***	0.149***				
			(0.060)	(0.043)				
rich20=0 × lgdp20					-0.086**	-0.014		
					(0.035)	(0.025)		
rich20=1 × lgdp20					0.391***	0.186***		
					(0.083)	(0.058)		
Panel b								
$< lgdp10$							-0.149***	-0.011
							(0.051)	(0.036)
$> lgdp10, < lgdp20$							0.117	-0.024
							(0.126)	(0.090)
$> lgdp20$							0.297***	0.191***
							(0.099)	(0.070)
Constant	1.930***	1.878***	1.934***	1.879***	1.960***	1.892***	2.296***	1.931***
	(0.042)	(0.030)	(0.041)	(0.030)	(0.044)	(0.031)	(0.090)	(0.064)
adj.R-squared	0.229	0.086	0.258	0.121	0.207	0.112	0.226	0.101
Observations	78	78	78	78	78	78	78	78

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

rich10=1 indicates countries with GDP over $10,000 per capita, similar definition for other thresholds.

lgdp15 is the corresponding log difference over this threshold as in Equation 14. The similar notations applies for lgdp10 and lgdp20.

Appendix: For Online Publication

Table A1: Misclassification Errors, By Income Group *(five representative countries)*

Country	**Level 1** (Unhappy)			**Level 3** (Very Happy)		
	reported	*corrected*	*difference*	*reported*	*corrected*	*difference*
Panel A: Low Income						
China(Mainland)	0.126	0.295	-0.170	0.205	0.311	-0.106
	(0.013)	(0.100)		(0.019)	(0.071)	
Germany	0.098	0.387	-0.289	0.192	0.268	-0.076
	(0.009)	(0.101)		(0.011)	(0.084)	
Iraq	0.113	0.214	-0.101	0.292	0.274	0.018
	(0.014)	(0.101)		(0.030)	(0.090)	
Mali	0.073	0.099	-0.026	0.623	0.353	0.269
	(0.020)	(0.106)		(0.037)	(0.108)	
United States	0.036	0.201	-0.165	0.445	0.521	-0.076
	(0.005)	(0.118)		(0.013)	(0.080)	
Panel B: Middle Income						
China(Mainland)	0.301	0.330	-0.029	0.190	0.301	-0.110
	(0.010)	(0.108)		(0.008)	(0.071)	
Germany	0.231	0.392	-0.161	0.142	0.227	-0.085
	(0.009)	(0.089)		(0.008)	(0.047)	
Iraq	0.490	0.369	0.122	0.074	0.155	-0.082
	(0.012)	(0.091)		(0.006)	(0.054)	
Mali	0.348	0.201	0.146	0.266	0.231	0.035
	(0.031)	(0.105)		(0.029)	(0.104)	
United States	0.140	0.464	-0.324	0.307	0.324	-0.017
	(0.009)	(0.096)		(0.012)	(0.055)	
Panel C: High Income						
China(Mainland)	0.165	0.208	-0.043	0.197	0.182	0.015
	(0.006)	(0.103)		(0.007)	(0.047)	
Germany	0.127	0.356	-0.229	0.199	0.308	-0.109
	(0.006)	(0.085)		(0.006)	(0.034)	
Iraq	0.357	0.511	-0.154	0.093	0.136	-0.044
	(0.009)	(0.095)		(0.005)	(0.051)	
Mali	0.116	0.318	-0.202	0.419	0.160	0.259
	(0.013)	(0.104)		(0.021)	(0.089)	
United States	0.067	0.326	-0.259	0.390	0.343	0.047
	(0.004)	(0.092)		(0.007)	(0.053)	

Notes: Numbers reported in parentheses are bootstrap standard errors based on 300 repetitions.
Source: Identified results from section 3.

Table A2: Misclassification Errors, By Gender Group *(five representative countries)*

Country	**Level 1** (Unhappy)			**Level 3** (Very Happy)		
	reported	*corrected*	*difference*	*reported*	*corrected*	*difference*
Panel A: Female						
China(Mainland)	0.190	0.249	-0.059	0.205	0.212	-0.008
	(0.007)	(0.111)		(0.007)	(0.056)	
Germany	0.164	0.300	-0.137	0.189	0.288	-0.099
	(0.006)	(0.071)		(0.006)	(0.032)	
Iraq	0.341	0.318	0.023	0.107	0.102	0.006
	(0.009)	(0.089)		(0.006)	(0.045)	
Mali	0.149	0.258	-0.109	0.408	0.120	0.288
	(0.015)	(0.100)		(0.022)	(0.078)	
United States	0.075	0.402	-0.327	0.390	0.345	0.045
	(0.004)	(0.082)		(0.008)	(0.059)	
Panel B: Male						
China(Mainland)	0.228	0.269	-0.041	0.188	0.258	-0.070
	(0.007)	(0.087)		(0.007)	(0.048)	
Germany	0.140	0.451	-0.311	0.173	0.269	-0.096
	(0.006)	(0.091)		(0.006)	(0.043)	
Iraq	0.413	0.580	-0.166	0.094	0.199	-0.105
	(0.010)	(0.100)		(0.006)	(0.059)	
Mali	0.178	0.257	-0.079	0.420	0.291	0.129
	(0.017)	(0.099)		(0.022)	(0.096)	
United States	0.080	0.266	-0.186	0.373	0.397	-0.024
	(0.005)	(0.095)		(0.008)	(0.044)	

Notes: Numbers reported in parentheses are bootstrap standard errors based on 300 repetitions.
Source: Identified results from section 3.

Table A3: Misclassification Errors, By Age Group *(five representative countries)*

Country	**Level 1** (Unhappy)			**Level 3** (Very Happy)		
	reported	*corrected*	*difference*	*reported*	*corrected*	*difference*
Panel A: Age Band 15-29 Years						
China(Mainland)	0.210	0.354	-0.144	0.193	0.283	-0.090
	(0.011)	(0.092)		(0.011)	(0.082)	
Germany	0.105	0.428	-0.323	0.198	0.259	-0.061
	(0.008)	(0.081)		(0.010)	(0.042)	
Iraq	0.339	0.402	-0.062	0.128	0.126	0.003
	(0.011)	(0.083)		(0.008)	(0.042)	
Mali	0.119	0.424	-0.305	0.456	0.196	0.260
	(0.016)	(0.118)		(0.025)	(0.090)	
United States	0.076	0.086	-0.010	0.371	0.330	0.041
	(0.007)	(0.114)		(0.012)	(0.073)	
Panel B: Age Band 30-49 Years						
China(Mainland)	0.205	0.110	0.095	0.202	0.225	-0.023
	(0.007)	(0.118)		(0.007)	(0.052)	
Germany	0.137	0.269	-0.133	0.195	0.316	-0.121
	(0.007)	(0.101)		(0.008)	(0.042)	
Iraq	0.388	0.481	-0.093	0.088	0.097	-0.009
	(0.010)	(0.119)		(0.006)	(0.047)	
Mali	0.169	0.119	0.049	0.398	0.229	0.170
	(0.017)	(0.114)		(0.024)	(0.114)	
United States	0.077	0.519	-0.442	0.380	0.373	0.007
	(0.005)	(0.117)		(0.009)	(0.053)	
Panel C: Age Band 50 and More Years						
China(Mainland)	0.221	0.462	-0.241	0.186	0.212	-0.027
	(0.009)	(0.117)		(0.009)	(0.061)	
Germany	0.190	0.437	-0.247	0.162	0.255	-0.093
	(0.008)	(0.092)		(0.007)	(0.046)	
Iraq	0.428	0.469	-0.041	0.079	0.340	-0.261
	(0.016)	(0.127)		(0.009)	(0.145)	
Mali	0.233	0.251	-0.018	0.374	0.177	0.197
	(0.030)	(0.132)		(0.034)	(0.090)	
United States	0.079	0.288	-0.209	0.390	0.393	-0.003
	(0.005)	(0.090)		(0.009)	(0.067)	

Notes: Numbers reported in parentheses are bootstrap standard errors based on 300 repetitions.
Source: Identified results from section 3.