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Abstract:

The empirical relation between happiness and religiosity is considered from the perspective of basic utility theory. An unbalanced cross-country panel data set is used to study whether religiosity can be considered as a substitute in the happiness function, which itself is held to be a proxy for the utility function. We find that the same level of happiness can be maintained with high and low levels of religiosity due to substitution along a standard indifference curve. Our empirical results are consistent with three stylized facts of the empirical literature, namely a positive correlation between happiness and religiosity, a positive correlation between happiness and income, and a negative correlation between religiosity and income.

Keywords: Happiness, religiosity, utility function, long-run development

JEL: I31, Z12, O11

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# Religiosity as a determinant of happiness

## 1. Religiosity, happiness, and utility theory

Religious behavior does not generate a direct financial reward to believers, but it cannot be questioned that religious activities generate subjective happiness. Hence religiosity appears to be a plausible determinant of happiness. Since happiness is often considered to be a plausible proxy for utility it is almost self-evident to address any presumed link between religiosity and happiness from the perspective of basic utility theory. However, the theoretical link between happiness and religiosity has not been clearly established in the literature. The present study aims to fill this gap. We develop a simple theoretical framework that can be used as a point of reference when assessing the empirical evidence on the various links between religiosity and happiness.

Empirical research on happiness has been influenced by the Easterlin paradox, which has long been held to be at odds with the idea that happiness is a good proxy for utility. The Easterlin paradox states that rich people generally report higher levels of happiness than poor people, but rising average incomes do not increase happiness beyond a satiation point (Easterlin 1973, 1974, 1995). Accordingly, an increase in income beyond the satiation point only seems to shift the reference point within a society, without affecting utility as proxied by a measure of happiness. This conclusion contradicts textbook utility theory, where changes in income always shift the indifference curve to a higher level of utility.

Taken at face value, the Easterlin paradox has far-reaching policy implications beyond any link between religiosity and happiness. If rising incomes only shift the reference point instead of improving utility, a primary goal of government policy should be higher taxes on income or consumption rather than a focus on economic growth (Layard 2003). This conjecture has led to two related theoretical reactions in the happiness literature.

Frey and Stutzer (2006) appeal to mistakes in rational decision making in cases where reported levels of happiness do not correspond with utility maximization. For instance, accepting a better paid job with higher commuting cost should not result in less happiness, but there appears to be some evidence that it does. Criticizing the assumption that individuals systematically fail to maximize their utility, Becker and Rayo (2008) argue that measures of happiness and the reported Easterlin paradox might not be founded on utility theory at all. They consider subjective happiness as an argument of the utility function rather than a direct proxy for utility itself. According to their approach, utility would remain in the realm of the

empirically unknown and a decline of happiness with rising income could be interpreted as a simple substitution effect.

It is not without irony that the rationalization of the Easterlin paradox by Becker and Rayo (2008) has been published as a comment to an empirical study that rejects the Easterlin paradox (Stevenson and Wolfers 2008). Deaton (2008) and Sacks et al. (2010) also provide strong evidence for a robust positive link between aggregate indicators of happiness and (log) per capita income across countries and over time. Moreover, the estimated effects of income on happiness closely resemble the well-known within-country correlation between individual levels of happiness and individual income.

The new empirical evidence allows for a fresh start of empirical research on happiness and religiosity that is based on a standard model of utility maximization. We revise the model proposed by Becker and Rayo (2008) by treating happiness as a direct proxy for utility, which has also been the starting point of the older empirical happiness literature (Frey and Stutzer 2002). Accordingly, a higher level of income should be reflected by a higher-level indifference curve for happiness. Religiosity enters as one of the commodities of the happiness function. We show that our theoretical framework can account for three stylized facts of the empirical literature, namely a positive correlation between happiness and income, a positive correlation between happiness and religiosity, and a negative correlation between religiosity and income.

Section 2 briefly reviews selected empirical studies on religiosity and happiness. Section 3 introduces the theoretical framework. Section 4 discusses data and samples that we use for our empirical estimates in Section 5. Section 6 concludes.

## 2. Basic results of the empirical literature on happiness and religiosity

Empirical research on the link between religious activities and alternative measures of well-being starts with Ellison (1991), who divides religious involvement into denominational ties, divine relations, existential certainty, and social integration, which is considered to be influenced by church membership and attendance. Religious involvement is reported to be positively correlated with subjective well-being. Along these lines, Greene and Yoon (2004) assert that subjective well-being rises with religious attachment as measured by the willingness to attend religious services regularly. Ferriss (2002) confirms a positive correlation between happiness and the frequency of church attendance but points to denominational and doctrinal differences across churches.

One strand of the literature discusses the effects of religious activities on well-being over the life cycle. Peacock and Poloma (1999) define religiosity by the four categories personal devotion, participation in public ritual, divine interaction, and the preference for public or private religiosity. They suggest that religiosity increases with age and as such tends to increase reported well-being. Various other studies report positive effects of different measures of religious involvement on general well-being over the life cycle (Beit-Hallahmi, Argyle, 1997; Chamberlain, Zika, 1988; Ellison et al., 2001; Willits, Crider, 1988; Witter et al., 1985). However, there are also studies that do not find a statistically significant effect of religious activities on the well-being of selected age groups (Koenig et al., 2001, Walls, Zarit, 1991). Ardelt (2003) uses a survey method to analyze the relationship between well-being and different indicators for intrinsic and extrinsic religious orientation for elderly people. She shows that religious affiliation and the frequency of religious attendance reduce the fear and increase the acceptance of death, but a purpose in life is found to be more important for the well-being of elderly people than holding religious beliefs per se. Robbins and Francis (1996) report a positive relationship between the attitude towards Christianity and happiness in a study among undergraduate students.

Lelkes (2006) uses the economic transition in Hungary after the collapse of socialism as an exogenous shock and corroborates that higher church attendance is positively correlated with reported well-being. Hayo (2007) also investigates the determinants of happiness across Eastern Europe after the collapse of the socialist systems and finds that frequent churchgoers report a significantly higher life satisfaction than those who do not attend church, with no difference in life satisfaction across different denominations. Elliott and Hayward (2009) use responses from the World Values Survey to differentiate between religious involvement, as measured by church attendance, and personal religious identity, which is proxied by self-reported levels of religiosity. They find that both measures have an independent and positive effect on life satisfaction. However, tighter government regulation is found to decrease the effect of religious involvement on life satisfaction. At very high levels of government regulation, religious involvement may even generate a negative effect on life satisfaction.

Focusing on life satisfaction as well, Okulicz-Kozaryn (2010) finds a bimodal relation with social and individual religiosity. It appears that religious people in general tend to be either very satisfied or dissatisfied and that they are happier in religious than in non-religious countries. Social religiosity, which is measured by the time spent in church, the adherence to a religious organization, and church attendance rates, appears to promote life satisfaction. In contrast, individual religiosity, which is measured by the reported belief in God and the

importance of religion, appears to have a detrimental effect on life satisfaction. Clark and Lelkes (2009) analyze the spillover effects of other people's religiosity on well-being. They also find that people in religious societies report higher levels of well-being than people in non-religious societies.

Snoep (2008) provides further support for the importance of the social context in understanding the link between religiosity and happiness. She reports different effects of various measures of religiosity[3] on happiness in the US as compared to the Netherlands and Denmark. For the US, the correlations with happiness are positive and mostly statistically significant but they are not statistically significant in the Netherlands and Denmark.

Lim and Putnam (2010) analyze the channels through which religiosity affects subjective well-being. By running ordinal logistic regressions of life satisfaction on different measures of religiosity they find that church attendance and network membership within a congregation positively affect well-being. By contrast, more intrinsic forms of religious practice, such as praying and believing in an afterlife, are reported to have no effect on life satisfaction.

Durkin and Greeley (1991) present religion as an outcome of a decision under rational choice. In their model faith works as an insurance against perdition in a possible afterlife. Clark and Lelkes (2005) argue that religious belief may also be considered a form of insurance against adverse advents in present life, not only in afterlife. They estimate the impact of various measures of religiosity on individual consequences of major socioeconomic shocks over the life cycle, such as divorce, unemployment, and widowhood. Life satisfaction is found to rise with religiosity. In addition, religious persons who are insured by their religious belief system appear to be satisfied with lower levels of other benefits than non-religious persons, for instance in the case of unemployment benefits.

Overall, the empirical literature points to a positive correlation between religious activities and measures of well-being such as life satisfaction and happiness. Given that income is a good proxy for happiness, as discussed in the introduction, it may appear straightforward to conclude that there should be a positive correlation between the prevalence of religious activities and the level of income as well.[4]

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3. The measures are taken from the World Values Survey and include time spent at church, belonging to a religious organization, belonging to a denomination, church attendance, importance of God, frequency of praying, frequency of private prayer.

4. A positive correlation between *specific* religious activities and the level of income was proposed by Weber (1904/05), who identified the protestant work ethic as a causal factor in long-run economic growth in the early phase of the Industrial Revolution. Blum and Dudley (2001) argue that Protestantism did not play a causal role as a specific *religious* activity, but established a positive network effect that reduced the probability of default in a one-time game of exchange and thereby increased the possibilities for productivity enhancing specialization

The link between religious activities and income was modeled in the seminal paper on the economics of religion by Azzi and Ehrenberg (1975). Based on standard microeconomic theory, one of the main insights is that rising incomes originating from market work may generate a substitution effect due to changes in the opportunity cost of time for household production. Consequently, time-intensive activities in household production will be reduced in favor of activities that are more compatible with market work. Religious activities, especially those related to social networking, appear to be relatively time intensive and thus may be substituted for other activities with rising levels of income. However, it remains an empirical question whether the substitution effect dominates the income effect in the demand for religion.

One school of thought on the economics of religion, pioneered in a series of papers by Iannaccone (1990, 1991, 1992, 1995, 1996) and summarized by Iannaccone (1998), develops the concept of a market for religion, where the market outcome is determined by rational decisions of producers and consumers. The main insight from this line of research is that an efficient market for religion will supply the level and the quality of the product (religion) that is demanded. But if there is an inefficient market with monopolistic supply, the quality of the product may be rated as substandard by the consumers, who will reduce their demand accordingly. Thus, low levels of religiosity in developed countries may not be the consequence of substitution away from religion due to rising levels of market income. They may simply reflect government interference in the market for religion in the form of state churches, which supply a product that most consumers (believers) do not want. For this reason, Stark and Iannaccone (1994) claim that secularization, i.e., the long-run decline of religious activities with rising levels of income, is a myth.

In contrast, if the substitution effect dominates, the level of religious activities may decline with rising levels of income even in the presence of an efficient market for religion.[5] Paldam and Gundlach (2009) document a robust negative correlation between the level of income and a summary measure of religiosity (explained in more detail in Section 4). One interpretation of the negative correlation is that the *weight* that is given to religious beliefs in everyday decision making may decline with rising levels of income, which may be independent of the level of religious beliefs in a country.

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and trade. Becker and Woessmann (2009) also do not find a direct growth effect of Protestantism per se but claim that the income effect identified by Weber is mainly due to the higher literacy caused by the translation of the bible from Latin to German under Protestantism. Using a broader data set, Cantoni (2009) does not find a direct or indirect effect of Protestantism on economic growth in Europe in the early stages of the Industrial Revolution.

5. For an empirical assessment of the efficient-market hypotheses in the case of religion, see Opfinger (2011).

Without a substitution effect, it is difficult to rationalize a negative income-religiosity correlation in the presence of a positive happiness-religiosity correlation and a positive happiness-income correlation. The next section uses basic utility theory to provide a consistent account of all three stylized correlations. Religiosity is modeled as one of the commodities of the happiness function and the observed correlations are disentangled as movements along and shifts of an indifference curve. To the best of our knowledge, this basic theoretical framework has not explicitly been estimated.

## 3. A theoretical framework for the empirical analysis of religiosity and happiness

We model the link between religiosity and happiness along the lines of the utility model proposed by Becker and Rayo (2008), but we treat happiness as a direct proxy for utility.[6] Happiness (utility) is modeled as a function of two non-marketable "commodities", with religiosity being one of them. The happiness function is of the form

$$(1) \qquad H = H\left(R, Z\right),$$

where happiness $H$ is a proxy for utility, $R$ is a measure of religiosity, and $Z$ represents another commodity of the happiness function. The partial derivatives of equation (1) are generally assumed to be positive:

$$(2) \qquad \partial H / \partial R > 0 \qquad \text{and} \qquad \partial H / \partial Z > 0,$$

but the sign of the partial derivative of $Z$ obviously depends on the definition of the commodities of the happiness function. For instance, if $Z$ stands for a misery index of inflation and unemployment (see Section 4), its partial derivative is expected to be negative.

We assume that religiosity and also the other commodity of the happiness function cannot be bought and sold on markets. Both commodities have to be produced according to the two household production functions

$$(3) \qquad R = R\left(x, h_r, C\right) \qquad \text{and} \qquad Z = G\left(y, h_z, C\right),$$

6. In contrast to our approach, Becker and Rayo (2008) argue that happiness is not a direct proxy for utility but one of many commodities of the utility function. From this starting point, they show that a missing positive correlation between income and happiness, as reported in earlier empirical studies, may not necessarily point to systematic errors in individual utility maximization.

where *x* and *y* are inputs of various marketable goods, $h_r$ and $h_z$ are individual household time inputs, and *C* is a vector of socio-economic context variables. The context variables may include the health and educational status of individual households, the level of religiosity in a country or the level of the other commodity produced by other households, or the household's command over technology necessary to produce religiosity and the other commodity.

The budget constraint includes market and non-market income:

(4) $$p_x x + p_y y = wl + N = I ,$$

where $p_x$ and $p_y$ are market prices for the inputs *x* and *y*; *w* is the wage rate; *l* is hours worked with $l = 1 - h_r - h_z$; *N* is nonwage income; and *I* is total income. Following Becker and Rayo (2008), equation (4) can be solved for an income measure *S* that is independent of the allocation of time between household production and market work:

(5) $$\pi_r R + \pi_z Z = w + N = S ,$$

where $\pi_r$ and $\pi_z$ are the shadow prices of producing *R* and *Z*. In this setting, the shadow prices depend on the prices of the input goods $p_x$ and $p_y$, on the wage rate *w*, and on the productivity of household production, which in turn depends on the socio-economic context variables *C*. Stated this way, the production of religiosity (and of the other commodity of the happiness function) depends on market outcomes and on household-specific components.

Households maximize happiness (utility) subject to the household production functions and the budget constraint. The Hicks demand function for religiosity resulting from the happiness function (1) is

(6) $$R = R(H, \pi_r, \pi_z) = R(H, p_x, p_y, w, C).$$

This simplified theoretical framework generates a number of hypotheses that can be estimated. For instance, equation (6) can be used to discuss the effect of religiosity on happiness, which depends on the assumed household production function for religiosity. Given that the production of religiosity is time intensive relative to the household production of other commodities, an increase in the wage rate *w* should increase the optimal amount of market work and hence decrease the level of religiosity for a given level of happiness

$(\partial R/\partial w < 0)$.[7] For a variable level of happiness, it is worth noting that equation (6) also allows for the possibility that an increase in the wage rate simultaneously increases happiness and reduces religiosity, which accounts for the reported positive correlation between income and happiness and the reported negative correlation between income and religiosity.[8]

In addition, equations (1), (3), and (5) suggest a reduced-form regression of happiness on total income *S*, where *S* would account for the effects of the commodities of the happiness function *R* and *Z*, which in turn would account for the effects of the input goods *x* and *y*, the time inputs $h_r$ and $h_z$, and the socio-economic context variables *C*:

$$H = \lambda S + \upsilon, \tag{7}$$

with $\upsilon$ as a random error term.

Detailed estimates of this reduced-form regression are provided by Stevenson and Wolfers (2008), who use GDP per capita as a proxy for market and non-market income *S*. A higher income implies a higher level of utility in the standard model of utility maximization. A missing correlation between income and happiness, as in previous empirical studies, would not be consistent with the idea that happiness is a direct proxy for utility, which inspired the approach of Becker and Rayo (2008). But the robust results by Stevenson and Wolfers (2008) on the positive link between income and happiness do not reject the hypothesis that measures of happiness may be used as a proxy for utility.

However, equation (5) suggests that a regression of happiness on GDP per capita may contain systematic residual variation that reflects the effects of non-market income *N* on happiness, as given by

$$H = \beta\, w + \gamma N + \nu, \tag{8}$$

where $\beta$ and $\gamma$ are the parameters to be estimated, the wage is assumed to be proportional to GDP per capita ($w = w(gdpc)$), and $\nu$ is a random error term. In order to estimate equation (8) a measure of non-market income *N* is needed. We proxy *N* with a measure of female labor

7. Azzi and Ehrenberg (1975) emphasize how changes in market income or unemployment will affect the structure of religious activities that differ by their time intensity. In our approach, we simply assume that religious activities are generally more time-intensive in household production than the other commodities of the happiness function in order to generate a hypothesis that can be estimated, see Section 5.

8. GDP per capita is proportional to the (real) wage because the shares of factor income in GDP appear to be rather constant across countries and over time (Bernanke and Gurkaynak 2001, Gollin 2002). The proportionality follows because the labor share is defined as the real wage divided by labor productivity, and labor productivity is proportional to GDP per capita for a constant share of the working-age population.

force participation ($N = N(flp)$). Assuming that a high degree of female labor force participation will indicate a low level of non-market income, we expect to find a negative partial derivative

(9) $\partial H / \partial N(flp) = \gamma < 0$.

Estimating equation (8) with a proxy for *N* should also reveal whether the effect of (market) income on happiness reported by Stevenson and Wolfers (2008) suffers from omitted variables bias. Put differently, one would expect to find that $\lambda = \beta$ if market income is largely independent of the inclusion of non-market income in equation (8). This is the first hypothesis to be estimated in Section 5.

The theoretical framework implies the presence of an indifference curve for the determinants of the happiness function, which allows for estimates of the relation between religiosity and other potential determinants of happiness. For instance, a movement along a given indifference curve for *Z* and *R* may be estimated for a constant level of happiness *H*. Hence based on the happiness function (1), our estimation equation is

(10) $Z = \alpha R + \delta H + \varepsilon$,

where *Z* may represent a single commodity or an index of commodities of the happiness function, $\alpha$ and $\delta$ are the parameters to be estimated, and $\varepsilon$ is a random error term. The linear specification is assumed to generate a reasonable approximation of the observed data points, i.e., we presume an indifference curve with consistently negative slope but ignore changes in the negative slope as we move along the indifference curve.

So if *Z* represents a misery index, which is defined in the empirical happiness literature as the (weighted) average of the rates of (log) inflation and unemployment, we would expect to find that $\delta < 0$. If *Z* represents an index of political participation, which is also held to be a commodity of the happiness function, we would expect to find that $\delta > 0$. Given that *Z* and religiosity are substitutes in the happiness function, we would expect to find that $\alpha > 0$ in case of the misery index and $\alpha < 0$ in case of the index of political participation.

In these examples, the predicted signs of the partial derivatives obviously depend on the definition of the respective indices. Less misery and more political participation are expected to produce more happiness, and more misery and less political participation are expected to lead to more religiosity in order to keep happiness constant. Hence, we assume by default that the relation between religiosity and happiness can be represented by a standard

indifference curve. Substituting religiosity for other commodities of the happiness function along a standard indifference curve should produce the same level of happiness with alternative levels of religiosity. This is the second hypotheses to be estimated in Section 5.

Once the other commodity of the happiness function is held constant instead of the level of happiness, a higher level of religiosity should produce a higher level of happiness. Put differently, increasing the level of religiosity and holding fixed the other input of the happiness function, we expect to find that $\mu > 0$ in

(11) $H = \eta Z + \mu R + \rho$,

where $\rho$ is a random error term. This is the third hypothesis to be estimated in Section 5.

## 4. Data and samples

All variables used for the empirical estimates of the next section are listed together with their sources in Table A1 in Appendix A. The next subsection explains some details of the data. Section 4.2 considers restrictions of the sample to be used for the estimates.

### *4.1. Notes on variables*

Our measure of *happiness* is taken from the study by Stevenson and Wolfers (2008). Their measure is calculated from data provided by the World Values Survey (WVS). The WVS is based on surveys that have been conducted in many developing and industrialized countries in several waves. The survey questionnaire includes information about the respondents' demographics, such as age and gender, as well as the economic circumstances of the household and people's attitudes towards society in general. The data used in Stevenson and Wolfers (2008) span the four waves 1982, 1990, 1995, and 2000.

The WVS question concerning happiness is asked in the following way: "Taking all things together, would you say you are: very happy; quite happy; not very happy; not at all happy?" Stevenson and Wolfers (2008) create a measure of average national happiness from the sample data by running an ordered probit regression on country fixed effects.[9] We use

9. The WVS also includes a measure of life satisfaction. In parts of the literature, well-being, happiness, and life satisfaction have been used synonymously. But there may be differences between the concepts, notwithstanding a statistically significant correlation between the measures of happiness and life satisfaction. A possible discrepancy could be the time horizon that is considered when respondents answer questions about happiness and life satisfaction. Happiness is probably a more short-term measure of personal well-being, whereas life satisfaction takes into account a long-term perspective. In this paper, we focus on happiness as the dependent variable and report results for life satisfaction only when considering the robustness of our main result.

their approach to generate an augmented sample that includes the 2005 WVS wave.[10] This unbalanced panel of happiness data with the aggregated individual information from the five WVS waves includes 93 countries, with 11 countries participating in all five waves and 32 countries participating in at least three of the five waves.

The ordered probit index of happiness is our dependent variable, i.e., our proxy for average national utility. This index of happiness is distributed mainly between -1 and 1. The lowest sample value of the happiness index is reported by Albania in 1995 (-1.142), the highest by Nigeria in the year 2000 (0.9982).

The WVS also includes a measure of *life satisfaction*. Life satisfaction, well-being, and happiness have been used synonymously in parts of the literature. But there may be differences between the concepts, notwithstanding a statistically significant correlation between the measures of happiness and life satisfaction. A possible discrepancy could be the time horizon that is considered when respondents answer questions about happiness and life satisfaction. Happiness is probably a more short-term measure of personal well-being, whereas life satisfaction might take into account a long-term perspective. In Tables B1-B4 in Appendix B, we replicate all reported estimates of Section 5 with life satisfaction as the dependent variable. However, we find only minor differences.

Our measure of *religiosity* is taken from Paldam and Gundlach (2009). Religiosity is defined as a latent variable that measures the importance of religion in all aspects of peoples' lives. If the full aspect space of religiosity would include $k = 1, ....., n$ variables, the measured religiosity score would be the largest common factor in all *n* variables. The actual religiosity score is estimated by a factor analysis of $n = 14$ items from the same waves of the WVS that have been used to construct the happiness index. The items from the WVS all disregard the specifics of a religion, but ask about the importance of religious behavior in a dozen fields of life. Examples include questions on the importance of believing in God, on the role of religion in one's own life and in teaching children, and on the relevance of attending religious services. The religiosity score (in percent) is based on the fraction of the respondents giving the answer "high importance" to the 14 selected questions in each poll of the WVS. The resulting measure of religiosity is shown to be robust to a number of qualifications. We divide the religiosity score reported by Paldam and Gundlach (2009) by 100 to avoid four-digit regression coefficients, such that the rescaled religiosity score ranges from 0.1 points in Estonia in 1990 to 0.91 points in Nigeria in 1995 in our sample (see Section 4.2).

10. We have been able to reproduce the Stevenson-Wolfers happiness data for the first four WVS waves up to minor differences in the range of second decimal points.

The data on market *income* come from the Maddison homepage (Maddison 2010), where income is measured as Gross Domestic Product per person in constant international prices (ln *gdpc*). For countries that are included in the WVS but not in the Maddison data, we rely on income data from the CIA World Factbook. In our sample, per capita income in constant prices ranges from 686 dollars for Ethiopia in 2005 to 43,900 dollars for Luxembourg in 2000.

Non-market income is proxied by *female labor force participation*, i.e., by the share of females in the total labor force, which is taken from the Word Development Indicators database provided by the World Bank (2010). In our sample, female labor force participation ranges from 12 percent in Pakistan in 1995 to 52 percent in Rwanda in 2005.

A number of variables are considered to be other commodities of the happiness function, together with religiosity. For instance, Frey and Stutzer (2002) note that political participation, unemployment, and inflation have been identified as possible determinants of happiness in the empirical literature. Easterlin (1973, 2001) argues that happiness is not only influenced by political and economic factors, but also by personal and family matters, and by health. Political participation is measured by indices of *political rights* and *civil liberties*, which are taken from Freedom House (2011) and rescaled in a way that the highest value of 7 relates to a situation with the highest degree of political rights and civil liberties, respectively. The arithmetic average of these measures is called the *participation* index, which ranges from 1 for dictatorships to 7 for full democracies in our definition. Economic factors are measured as the rate of (log) *inflation* and the *unemployment* rate, which are both taken from World Bank (2010). The arithmetic average of these two measures is called the *misery* index, which ranges from -2.3 for Switzerland in 1995 to 1.7 for Brazil in 1990 across our sample countries. Finally, the presumed effect of health on happiness is measured by *life expectancy* at birth, which is also taken from World Bank (2010) and ranges in our sample from 43 years for Zambia in 2005 to 82 years in Hong Kong in 2005.

### *4.2 Sample selection*

Measuring happiness, life satisfaction, and religiosity at the macro level may be classified as an attempt to measure the un-measurable. There is probably a higher danger of measurement error in this kind of data than in other macroeconomic variables like GDP per capita, female labor force participation, inflation, or unemployment. If the measurement error is large and unsystematic, robust correlations are unlikely to show up. But the review of the literature has shown that there are robust correlations between happiness and religiosity and between

happiness and income. It follows that a major concern should be to check for systematic measurement errors in the data, for instance in the form of coding errors.

We construct our sample of countries in two steps. Since we are mainly interested in the link between religiosity and happiness, we first delete all observations from the raw data with no entry for the religiosity score. This leaves us with an unbalanced panel of 237 observations on *religiosity*, which are matched with data on GDP per capita (income). In this sample, we have 235 observations for *happiness* and *life satisfaction* each, though with a missing overlap for two observations each. So the regression results reported for happiness in Section 5 and for life satisfaction in Appendix B are based on the same number of observations but on slightly different samples.

We use a method proposed by Hadi (1992, 1994) to detect multiple outliers in multivariate data, which is available in Stata as the package -hadimvo-. We run the Hadi test for outliers in the variables that constitute the three stylized correlations reported in the literature, namely *happiness* (and *life satisfaction*), *religiosity*, and *income*. For our combined sample of 233 observations, the Hadi test identifies four outliers: the observations for China in 1990 and 1995, for Vietnam in 2000, and for Tanzania in 2000.

The outliers are also identifiable by visual inspection. The two scatter diagrams in Figure 1 show the four sample observations identified as outliers. In the income-religiosity correlation, China and Vietnam have suspiciously low levels of religiosity, relative to their (log) per capita income (left diagram). Measures of happiness and life satisfaction appear to be closely correlated (right diagram), so the observation on Tanzania looks like a coding error.

We delete the four identified outliers from our basic sample, which is thereby reduced to a maximum of 231 observations (see Table 1, column (1) in Section 5). The regression coefficients reported in the next section are somewhat affected by deleting the outliers, but the main results remain unchanged. Detailed regression results for the initial sample of 235 observations are available upon request.

## 5. Empirical results[11]

The basic model of happiness and religiosity discussed in Section 3 presumes that religiosity is one of the commodities of the happiness function, which can be substituted for other commodities along a standard indifference curve. This reasoning based on the standard utility

11. A data file (in Stata format) and a log file with Stata code and detailed regression results are available upon request.

model implies a positive link between happiness and total income, which captures the utility derived from consuming religiosity and the other commodities of the happiness function. We address these implications in reverse order to connect our results with the most recent empirical studies on happiness.

The first step in our empirical analysis is an estimate of the link between happiness and *total* income, as derived by equation (8). We confirm the positive relation between happiness and *market* income reported by Stevenson and Wolfers (2008), though our coefficient estimates are somewhat smaller (Table 1). An increase in income by one logarithmic point is found to raise the happiness index by about 0.2 points (column (1)). This income effect is robust to the inclusion of our proxy for non-wage income, namely female labor force participation (column (2)).

The effect of market income is large. In our adjusted sample, the difference in the measure of happiness between the $25^{th}$ and the $75^{th}$ percentile is about 0.65 index points. The difference in GDP per capita between the $25^{th}$ and the $75^{th}$ percentile is about 1.44 logarithmic points. The variation in market income statistically explains about 45 percent of the variation in happiness between the $25^{th}$ and the $75^{th}$ percentile ($0.2 \cdot 1.44/0.65=0.45$).

The coefficient estimate for our proxy of non-wage income has the expected negative sign and is statistically significant in case of OLS or BE estimation, but not for FE and RE estimation. The implied effect of non-wage income is smaller than the effect of market income (OLS and BE). The difference in the share of female labor force participation between the $25^{th}$ and the $75^{th}$ percentile is about 9 percentage points. Hence the variation in this proxy of non-wage income can statistically explain between 21 percent and 26 percent of the variation in happiness between the $25^{th}$ and the $75^{th}$ percentile ($1.5 \cdot 0.09/0.65=0.21$; $1.9 \cdot 0.09/0.65=0.26$).

The estimates for the effect of non-wage income on happiness are less robust than the effects of market income. The Gould test[12] reveals that the implicit assumption of equal time series and cross country effects that underlies the RE estimator cannot be rejected for the effects of GDP per capita, which are all in the same range for the different estimators. But the limited times series variation in our unbalanced panel data is apparently not sufficient to allow

12. Gould (2001) proposes a coefficient test to check the efficiency of the random-effects estimator. The first step is to decompose each explanatory variable into a mean value (across countries) and a difference from the mean. Then a regression of the dependent variable on this set of explanatory variables produces the coefficients on the averaged and the demeaned variables that would be estimated separately by a BE and by a FE regression. The random effects estimator can be considered as efficient if the coefficients on the averaged and the demeaned variables are not statistically significantly different from each other. The advantage of this test is that it can be directly applied to the coefficients of interest, whereas the Hausman test for the efficiency of the RE estimator relies on moment conditions that are often not satisfied.

for statistically significant estimates of female labor force participation, so the hypothesis of unequal time-series and cross-section effects that underlies the Gould test cannot be rejected for this variable.

Table B1 in Appendix B presents results for life satisfaction as the dependent variable. The same pattern emerges as in Table 1 for happiness. There is a large robust effect of market income and a smaller effect of non-wage income on life satisfaction. With life satisfaction as dependent variable, the hypothesis of unequal time-series and cross-country effects is rejected by the Gould test. Hence the RE estimator can be considered as efficient, which confirms the results for the OLS and the BE estimator.

The next step in the empirical analysis is an estimate of an indifference curve implied by equation (10). Table 2 presents the OLS results for religiosity and alternative other commodities of the happiness function, which are individually treated as endogenous variables. These commodities of the happiness function are held to reflect economic, political, and social conditions. The misery index (*mis*) is an average of log inflation (*lninfl*) and unemployment (*unemp*).[13] The index of political participation (*part*) is an average of civil liberties (*cl*) and political rights (*pr*). The social conditions are proxied by a measure of life expectancy (*life*).

Conditional on the level of happiness, all coefficients on religiosity are statistically significant and have the expected sign. The RESET test does not indicate that the linear regression equations are misspecified. Religiosity is positively correlated with "bads" like unemployment and log inflation and negatively correlated with "goods" like civil liberties, political rights, and life expectancy. Apparently, religiosity can be considered as a substitute for other commodities of the happiness function.

The implication of our finding is that the same level of happiness can be attained with high and with low levels of religiosity by substitution along a given indifference curve. The negative correlation between income and religiosity reported by Paldam and Gundlach (2009) is in line with this finding. Higher levels of income are associated with lower levels of religiosity because religiosity is substituted for other goods of the happiness function once people become richer.

Table A2 in the appendix repeats the same regression equations with life satisfaction as dependent variable. The results are fairly similar. All regression coefficients have the

13. Frey and Stutzer (2002) point out that empirical studies have shown that inflation should receive a smaller weight than unemployment in an aggregate index of unfavorable economic conditions. However, both variables are usually equally weighted in the misery index.

expected sign and are statistically significant. The only difference is the RESET test pointing to a possible misspecification of the functional form in columns (4) and (7) of Table A2.

Table 3 considers the robustness of the estimated indifference curves for religiosity, thereby focusing on the misery index, the index of political participation, and the measure of life expectancy. Since there is insufficient time series variation in the measure of religiosity, we do not report fixed effects estimates but test for the consistency of the random effects estimator, which is a weighted average of the between- and the fixed-effects estimator.

For all three alternative commodities of the happiness function, the coefficients on religiosity are statistically significant for the BE and the RE estimator and resemble the OLS estimates in Table 2. The coefficients on the control variables are also all statistically significant and close to the OLS estimates. The Gould test reveals that the hypothesis of equal time-series and cross-country effects for both right-hand-side variables cannot be rejected if the misery index is the dependent variable (column (2)). For the other two specifications, this only holds for the control variable *happiness*. Overall, these results tend to confirm that religiosity may be considered a substitute for other commodities of the happiness function.

Table A3 in the appendix demonstrates that the robustness also holds for the indifference curves with life satisfaction as the dependent variable. The coefficient on religiosity in column (1) of Table A3 is not statistically significant, but otherwise the results resemble the estimates in Table 2, including the performance of the Gould test.

The third step in our empirical analysis is an attempt to understand, within our theoretical framework, the positive correlation between happiness and religiosity that has been reported in the literature (see Section 2). Happiness is positively correlated with income (Stevenson and Wolfers 2008; Table 1) but religiosity is negatively correlated with income (Paldam and Gundlach 2009). Hence a positive correlation between happiness and religiosity deserves second thoughts.

Equation (11) predicts a positive effect of religiosity on happiness conditional on other commodities of the happiness function. Our estimates of the happiness function in Table 4 confirm the results derived for the indifference curves. Except for the fixed effects estimator, all the coefficients of the four considered commodities of the happiness function have the expected sign and except for one all are statistically significant. According to the Gould test, the random effects estimator can be considered as efficient since the hypothesis of joint coefficient equality cannot be rejected (though it has to be individually rejected for religiosity as before).

The effects reported in column (4) of Table 4 can be evaluated like the income effects reported in Table 1. It turns out that each of the considered commodities of the happiness function accounts for about the same share of the sample difference in the measure of happiness. For the sample used in Table 4, the difference in the measure of happiness between the $25^{th}$ and the $75^{th}$ percentile is 0.60 percentage points. The respective differences for the measures of religiosity, misery, participation, and life expectancy are 0.28 percentage points, 0.90 index points, 2.5 index points, and 8 years (scaled as 0.08 years). The estimated coefficients imply that religiosity accounts for 25 percent of the variation in happiness; misery accounts for 17 percent; participation accounts for 21 percent; and life expectancy accounts for 20 percent.

Table A4 in the appendix shows similar results for a life satisfaction function, but in this case the RE estimator cannot be considered as efficient according to the Gould test. Otherwise there is the same pattern as in Table 4. Except for the FE estimates, all coefficients have the expected sign, are statistically significant with one exception, and do not differ by much across the OLS, BE, and RE estimates.

It could be objected that our results suffer from at least three shortcomings. One qualification is that we solely rely on happiness and religiosity data from the World Values Survey (WVS). These data may include some rather extreme observations, as already discussed in the previous section. More generally, survey responses to questions about happiness and religiosity may be biased in countries with autocratic regimes. However, the results in Stevenson and Wolfers (2008) on the effect of income on happiness did not depend on WVS data, so a possible bias in the happiness data does not seem to be systematic. Along the same lines, Paldam and Gundlach (2009) do not find evidence for a systematic bias in the WVS religiosity data.

Another qualification is that we have considered a limited set of possible commodities of the happiness function. For instance, family matters and health conditions can be expected to have a strong effect on the level of happiness. It could well be that our proxy variable for social context (life expectancy) does not appropriately capture all of these effects. However, our main interest is the effect of religiosity on happiness. Our results already indicate that religiosity may be considered a substitute in the happiness function, so the inclusion of further control variables may improve the estimates of the happiness function but is unlikely to reverse the role of religiosity.

A third qualification is that our results are mainly driven by the cross-country variation of our data, due to a limited amount of time series variation in our unbalanced panel data.

Since sufficient time series evidence on changes in religiosity will not become available in the form of panel data anytime soon, the robustness of our model of happiness and religiosity may be tested on individual or household data within countries in future research.

Figure 2 summarizes our interpretation of the empirical evidence, which is in line with basic utility theory. Happiness *H* is a function of religiosity *R* and other commodities *Z* of the happiness function. The level of happiness is represented by a standard indifference curve, so $H_2$ represents a higher level of happiness than $H_1$. A higher income causes a shift from $H_1$ to $H_2$, as reported in Table 1. A constant level of happiness can be maintained by substituting religiosity for other commodities of the happiness function, as indicated by the relative religiosity points $r_1$ and $r_2$ and reported in Tables 2 and 3. Conditional on a constant level of *Z*, a higher level of religiosity causes a higher level of happiness, as indicated by points $r_2$ and $r_3$ and reported in Table 4. A rise in income may cause a decline in religiosity from $r_1$ to $r_3$, as reported in Paldam and Gundlach (2009). The latter result would imply an increase in the relative shadow price of religiosity. Whether this hypothesis also holds is left for further research.

## 6. Conclusion

Empirical research on religiosity and happiness has not been based on a clear foundation in utility theory. We address this gap in the literature with a simple theoretical framework that is inspired by Becker and Rayo (2008). In our version of their approach, happiness is modeled as a direct proxy for utility and religiosity enters as one of the commodities of the happiness function.

Our theoretical framework generates three major hypotheses, which we bring to the data. First, higher levels of total income should lead to higher levels of happiness, i.e., they should shift an indifference curve for a given level of happiness. Second, the same level of happiness should be attainable with alternative levels of religiosity along a standard indifference curve, given that religiosity is substitutable for other commodities of the happiness function. Third, higher levels of religiosity should lead to higher levels of happiness given that all other commodities of the happiness function are held constant.

Our measures of religiosity and happiness rely on data from the World Values Survey; our data on income and on the other commodities of the happiness function are taken from various sources as documented in the appendix. Our empirical results support the three derived hypotheses. First, market income and non-market income have a positive effect on

happiness. Second, religiosity is negatively correlated with other commodities of the happiness function for a constant level of happiness. Third, religiosity is positively correlated with happiness for constant levels of the other commodities of the happiness function.

Overall, these results are in line with basic utility theory. They are also in line with three stylized facts of the empirical literature on religiosity and happiness. As expected, happiness is positively correlated with religiosity and with income, but income and religiosity are negatively correlated. Our estimates suggest that the negative correlation between income and religiosity is due to a substitution effect.

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# Appendix

## A. Definitions and sources of variables

Table A1. Variables used in Section 5

| | |
|---|---|
| **Dependent variable** | |
| *happiness* | Measure of average national happiness, generated by ordered probit regression with country fixed effects from individual answers to the World Values Survey question: "Taking all things together, would you say you are: very happy; quite happy; not very happy; not at all happy?"<br>Sources: Own calculations based on Stevenson and Wolfers (2008) and WVS data for 1982, 1990, 1995, 2000, and 2005. |
| **Explanatory variables (alphabetical order)** | |
| *civil liberties* | Index of civil liberties, here rescaled so that a higher value corresponds to a higher level of civil liberties.<br>Source: Freedom House (2011).<br>http://www.freedomhouse.org/template.cfm?page=439 |
| *income* | Natural logarithm of GDP per capita, measured in 1990 international Geary-Khamis dollars.<br>Sources: Maddison (2010), CIA (2011).<br>http://www.ggdc.net/MADDISON/oriindex.htm<br>https://www.cia.gov/library/publications/the-world-factbook/ |
| *life expectancy* | Years of life expectancy at birth.<br>Source: World Bank (2010). http://data.worldbank.org/indicator |
| ln *inflation* | Natural logarithm of the rate of inflation.<br>Source: World Bank (2010).<br>http://data.worldbank.org/indicator |
| *misery* | Arithmetic average of *unemployment* rate and *inflation*. |
| *participation* | Arithmetic average of *civil liberties* and *political rights*.<br>Source: Freedom House (2010).<br>http://www.freedomhouse.org/template.cfm?page=439 |
| *political rights* | Index of political rights, here rescaled so that a higher value corresponds to a higher level of political rights.<br>Source: Freedom House (2011).<br>http://www.freedomhouse.org/template.cfm?page=439 |
| *religiosity* | Index of the intensity of religion, compiled from 14 items of the WVS.<br>Source: Paldam and Gundlach (2009). |
| *unemployment* | Unemployment rate.<br>Sources: World Bank (2010).<br>http://data.worldbank.org/indicator |
| **Alternative dependent variable** | |
| *life satisfaction* | Measure of average national life satisfaction, generated by ordered probit regression with country fixed effects from individual answers to the World Values Survey question: "All things considered, how satisfied are you with your life as a whole these days?"<br>Source: Own calculations based on Stevenson and Wolfers (2008) and WVS data for 1982, 1990, 1995, 2000, and 2005. |

B. Empirical results for life satisfaction

Table B1. Estimates for income and life satisfaction

| | Dependent variable: *life satisfaction* | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| ln *gdpc* | 0.32* | 0.36* | 0.32* | 0.30* | 0.32* |
| | (0.03) | (0.03) | (0.04) | (0.09) | (0.03) |
| *flp* | | -1.86* | -1.25* | -0.55 | -1.15* |
| | | (0.40) | (0.48) | (0.93) | (0.41) |
| Estimator | OLS | OLS | BE | FE | RE |
| Number of obs. | 231 | 225 | 225 | 225 | 225 |
| Number of countries | 93 | 90 | 90 | 90 | 90 |
| R squared | 0.37 | 0.45 | 0.45 | 0.42 | 0.44 |
| F-test fixed effects | - | - | - | 9.27 | - |
| Gould test (*p*-val.) | - | - | - | - | |
| ln *gdpc* | | | | | 0.79 |
| *flp* | | | | | 0.51 |
| Joint coefficient equal. | | | | | 0.80 |

Note: The columns refer to results achieved with alternative estimation methods: ordinary least squares (OLS), between estimates (BE), country-fixed effects estimates (FE), and random effects estimates (RE). Standard errors in parentheses; robust standard errors for OLS. *denotes statistical significance at the 5 percent level. R squared refers to adjusted $R^2$ for Ols and overall $R^2$ otherwise. The Gould test evaluates the RE hypothesis that the BE and the FE parameters are not statistically significantly different from each other.

Table B2. Indifference curves for religiosity and alternative other commodities of the life-satisfaction function

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Dependent variable: *Alternative commodity* | *mis* | *part* | *lninfl* | *unemp* | *cl* | *pr* | *life* |
| Explanatory variable *religiosity* | 0.65* | -2.75* | 1.34* | 0.06* | -2.73* | -2.78* | -0.19* |
| | (0.23) | (0.57) | (0.43) | (0.02) | (0.52) | (0.64) | (0.02) |
| Control variable *life satisfaction* | -0.62* | 1.86* | -1.18* | -0.03* | 1.80* | 1.93* | 0.07* |
| | (0.10) | (0.17) | (0.19) | (0.01) | (0.16) | (0.20) | (0.01) |
| Number of obs. | 194 | 227 | 209 | 215 | 227 | 227 | 228 |
| Number of countries | 84 | 91 | 91 | 86 | 91 | 91 | 91 |
| R squared | 0.21 | 0.39 | 0.21 | 0.09 | 0.41 | 0.34 | 0.47 |
| RESET test (*p*-value) | 0.80 | 0.49 | 0.71 | 0.03 | 0.46 | 0.72 | 0.04 |

Note: All equations estimated with OLS. Robust standard errors in parentheses. *denotes statistical significance at the 5 percent level. R squared refers to adjusted $R^2$. The RESET test evaluates the null hypothesis of a non-linear specification.

Table B3. Robustness tests of the life-satisfaction indifference curves for religiosity

| | (1) | (2) | (3) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|
| Dependent variable: *Alternative commodity* | *mis* | *mis* | *part* | *part* | *life* | *life* |
| Explanatory variable *religiosity* | 0.35 | 0.60* | -3.18* | -2.08* | -0.22* | -0.16* |
| | (0.32) | (0.29) | (0.74) | (0.65) | (0.03) | (0.02) |
| Control variable *life satisfaction* | -0.64* | -0.65* | 1.94* | 1.39* | 0.08* | 0.03* |
| | (0.12) | (0.11) | (0.28) | (0.25) | (0.01) | (0.01) |
| Estimator | BE | RE | BE | RE | BE | RE |
| Number of obs. | 194 | 194 | 227 | 227 | 228 | 228 |
| Number of countries | 84 | 84 | 91 | 91 | 91 | 91 |
| R squared | 0.22 | 0.22 | 0.39 | 0.39 | 0.47 | 0.44 |
| Gould test (*p*-value) | - | | - | | - | |
| *religiosity* | | 0.30 | | 0.00 | | 0.04 |
| *life satisfaction* | | 0.36 | | 0.00 | | 0.00 |
| Joint coefficient equality | | 0.35 | | 0.00 | | 0.00 |

Note: BE and RE estimation. *denotes statistical significance at the 5 percent level. R squared refers to overall $R^2$. The Gould test evaluates the RE hypothesis that the BE and the FE parameters are not statistically significantly different from each other.

Table B4. Estimates of the life-satisfaction function

| | Dependent variable: *life satisfaction* | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *religiosity* | 0.74* | 0.63* | -0.18 | 0.31 |
| | (0.17) | (0.25) | (0.29) | (0.20) |
| *misery* | -0.12* | -0.20* | -0.10* | -0.07* |
| | (0.06) | (0.07) | (0.03) | (0.03) |
| *participation* | 0.09* | 0.08* | 0.04 | 0.06* |
| | (0.02) | (0.03) | (0.02) | (0.02) |
| *life expectancy* | 3.58* | 3.18* | -1.20 | 2.14* |
| | (0.58) | (0.71) | (1.08) | (0.63) |
| Estimator | OLS | BE | FE | RE |
| Number of obs. | 191 | 191 | 191 | 191 |
| Number of countries | 82 | 82 | 82 | 82 |
| R2 squared | 0.47 | 0.45 | 0.08 | 0.46 |
| RESET test (*p*-value) | 0.23 | - | - | - |
| F-test fixed effects | - | - | 9.76 | - |
| Gould test (*p*-value) | - | - | - | |
| *religiosity* | | | | 0.01 |
| *misery* | | | | 0.38 |
| *participation* | | | | 0.11 |
| *life expectancy* | | | | 0.00 |
| Joint coefficient equality | | | | 0.00 |

Note: Alternative estimators. Standard errors in parentheses; robust standard errors for OLS. *denotes statistical significance at the 5 percent level. R squared refers to overall $R^2$. for BE, FE, and RE. The Gould test evaluates the RE hypothesis that the BE and the FE parameters are not statistically significantly different from each other.

Table 1. Estimates for income and happiness

| | Dependent variable: *happiness* | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| ln *gdpc* | 0.21* | 0.25* | 0.17* | 0.30* | 0.22* |
| | (0.03) | (0.04) | (0.04) | (0.09) | (0.04) |
| *flp* | | -1.94* | -1.46* | 1.05 | -0.60 |
| | | (0.37) | (0.50) | (0.93) | (0.44) |
| Estimator | OLS | OLS | BE | FE | RE |
| Number of obs. | 231 | 225 | 225 | 225 | 225 |
| Number of countries | 93 | 90 | 90 | 90 | 90 |
| R squared | 0.18 | 0.27 | 0.28 | 0.11 | 0.23 |
| F-test fixed effects | - | - | - | 10.95 | - |
| Gould test (*p*-val.) | - | - | - | - | |
| ln *gdpc* | | | | | 0.26 |
| *flp* | | | | | 0.01 |
| Joint coefficient equal. | | | | | 0.00 |

Note: The columns refer to results achieved with alternative estimation methods: ordinary least squares (OLS), between estimates (BE), country-fixed effects estimates (FE), and random effects estimates (RE). Standard errors in parentheses; robust standard errors for OLS. *denotes statistical significance at the 5 percent level. R squared refers to adjusted $R^2$ for Ols and overall $R^2$ otherwise. The Gould test evaluates the RE hypothesis that the BE and the FE parameters are not statistically significantly different from each other.

Table 2. Indifference curves for religiosity and alternative other commodities of the happiness function

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Dependent variable: *Alternative commodity* | *mis* | *part* | *lninfl* | *unemp* | *cl* | *pr* | *life* |
| Explanatory variable *religiosity* | 0.85* | -3.48* | 1.81* | 0.07* | -3.48* | -3.47* | -0.21* |
| | (0.21) | (0.55) | (0.40) | (0.02) | (0.51) | (0.63) | (0.02) |
| Control variable *happiness* | -0.71* | 1.69* | -1.28* | -0.03* | 1.63* | 1.74* | 0.05* |
| | (0.10) | (0.21) | (0.19) | (0.01) | (0.20) | (0.23) | (0.01) |
| Number of obs. | 194 | 227 | 209 | 215 | 227 | 227 | 228 |
| Number of countries | 84 | 91 | 91 | 86 | 91 | 91 | 91 |
| R squared | 0.23 | 0.32 | 0.21 | 0.08 | 0.34 | 0.27 | 0.36 |
| RESET test (*p*-value) | 0.33 | 0.48 | 0.74 | 0.08 | 0.28 | 0.58 | 0.33 |

Note: All equations estimated with OLS. Robust standard errors in parentheses. *denotes statistical significance at the 5 percent level. R squared refers to adjusted $R^2$. The RESET test evaluates the null hypothesis of a non-linear specification.

Table 3. Robustness tests of the happiness indifference curves for religiosity

| | (1) | (2) | (3) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|
| Dependent variable: *Alternative commodity* | *mis* | *mis* | *part* | *part* | *life* | *life* |
| Explanatory variable *religiosity* | 0.76* | 0.88* | -4.34* | -2.28* | -0.27* | -0.15* |
| | (0.32) | (0.29) | (0.79) | (0.66) | (0.04) | (0.02) |
| Control variable *happiness* | -0.73* | -0.81* | 1.72* | 1.37* | 0.06* | 0.03* |
| | (0.14) | (0.12) | (0.35) | (0.27) | (0.02) | (0.01) |
| Estimator | BE | RE | BE | RE | BE | RE |
| Number of obs. | 194 | 194 | 227 | 227 | 228 | 228 |
| Number of countries | 84 | 84 | 91 | 91 | 91 | 91 |
| R squared | 0.23 | 0.23 | 0.32 | 0.32 | 0.37 | 0.37 |
| Gould test (*p*-value) | - | | - | | - | |
| *religiosity* | | 0.55 | | 0.00 | | 0.00 |
| *happiness* | | 0.03 | | 0.24 | | 0.08 |
| Joint coefficient equality | | 0.08 | | 0.00 | | 0.00 |

Note: BE and RE estimation. *denotes statistical significance at the 5 percent level. R squared refers to overall $R^2$. The Gould test evaluates the RE hypothesis that the BE and the FE parameters are not statistically significantly different from each other.

Table 4. Estimates of the happiness function

| | Dependent variable: *happiness* | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *religiosity* | 0.82* | 0.90* | 0.11 | 0.54* |
| | (0.16) | (0.25) | (0.27) | (0.18) |
| *misery* | -0.17* | -0.23* | -0.09* | -0.11* |
| | (0.04) | (0.07) | (0.03) | (0.03) |
| *participation* | 0.08* | 0.05 | 0.05* | 0.05* |
| | (0.02) | (0.03) | (0.02) | (0.02) |
| *life expectancy* | 1.89* | 1.55* | 1.29 | 1.49* |
| | (0.51) | (0.71) | (1.05) | (0.59) |
| Estimator | OLS | BE | FE | RE |
| Number of obs. | 191 | 191 | 191 | 191 |
| Number of countries | 82 | 82 | 82 | 82 |
| R squared | 0.35 | 0.33 | 0.28 | 0.34 |
| RESET test (*p*-value) | 0.48 | - | - | - |
| F-test fixed effects | - | - | 11.27 | - |
| Gould test (*p*-value) | - | - | - | |
| *religiosity* | | | | 0.02 |
| *misery* | | | | 0.19 |
| *participation* | | | | 0.70 |
| *life expectancy* | | | | 0.71 |
| Joint coefficient equality | | | | 0.07 |

Note: Alternative estimators. Standard errors in parentheses; robust standard errors for OLS. *denotes statistical significance at the 5 percent level. R squared refers to overall $R^2$. for BE, FE, and RE. The Gould test evaluates the RE hypothesis that the BE and the FE parameters are not statistically significantly different from each other.

Figure 1. Multivariate outliers in basic sample

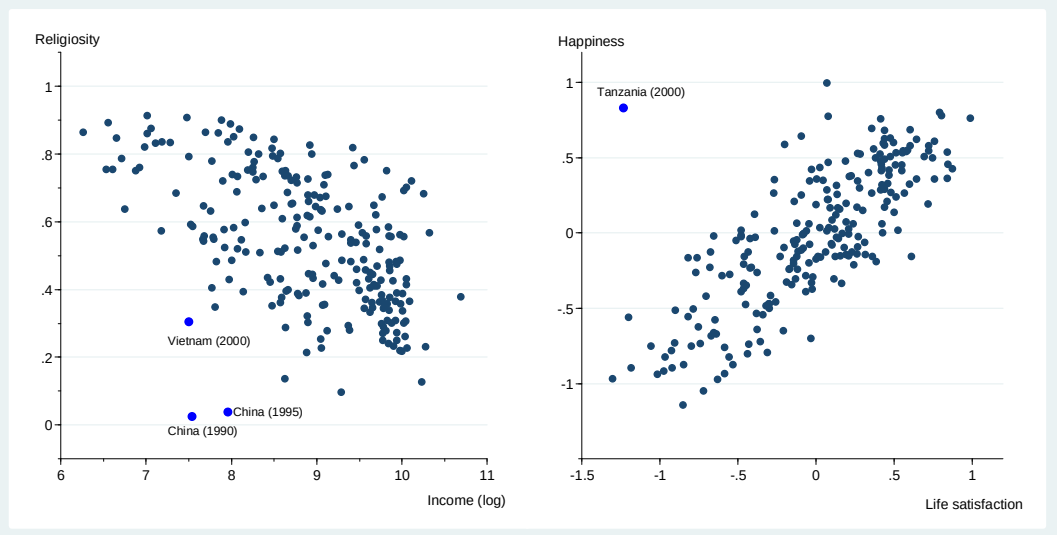


Figure 2. Summarizing the empirical results