Aging, Proximity to Death, and Religiousness

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Considerable evidence has documented that the elderly are more religious and that religiousness is associated with better health and lower mortality. Yet, little is known about the reverse role of life expectancy or proximity to death, as opposed to age, for religiousness. This paper provides evidence for the distinct role of expected remaining life years for the importance of religion in individuals' lives. We combine individual survey response data for more than 311,000 individuals from 95 countries over the period 1994-2014 with information from period life tables. Contrary to wide-held beliefs, religiousness decreases with greater expected proximity to death. The findings have important implications regarding the consequences of population aging for religiousness and associated outcomes.

JEL-classification: J10, N30, Z12

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1. Introduction

A considerable body of empirical research has documented positive associations between religiousness and well-being at the individual level. In particular, religiousness has been associated with better physical and mental health (Koenig et al., 2012; Smith et al., 2012; Aldwin et al., 2014; Zimmer et al., 2016; Opsahl et al., 2019), higher levels of subjective well-being and happiness (Inglehart, 2010; Lun and Bond, 2013), and greater resilience and coping capacities amongst the elderly (Wilkinson and Coleman, 2010; Malone and Dadswell, 2018). On the aggregate level, religiousness has been found to correlate with better economic performance and higher levels of development (McCleary and Barro, 2003; Guiso et al., 2003; McCleary and Barro, 2006; Noland, 2005; Qayyum et al., 2019). At the same time, empirical studies have reported mounting evidence about an age gap in religiousness (see, e.g., Ainlay et al., 1992; Argue et al., 1999). According to recent findings, younger individuals identify less with a religion, are less likely to believe in God or to engage in a variety of religious practices than older individuals.[1]

In a world with population aging affecting many countries in various ways, this raises the question about the consequences of demographic change for religiousness and the related implications for public health, well-being and development in general. In particular, the consequences of aging depend on whether the age gap captures a life cycle profile in religiousness or a shift across cohorts. At the same time, rapid increases in life expectancy due to improved medical technology not only induce shifts in the age distribution but generate substantial variation in the relation between age and proximity to death, such that individuals might grow older in terms of age while their remaining life years might stay constant or even increase (Sanderson and Sherbov, 2005, 2013).

This paper investigates the role of remaining life expectancy for religiousness, thereby disentangling the distinct roles of proximity to death and age. In contrast to age, the role of

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[1]A recent report by the Pew Research Center concludes based on survey data from more than 100 countries that younger adults are less religious than older adults, regardless of the economic or social environment in a country, or of the dominant religion in a country. Source: Pew Research Center, "The Age Gap in Religion Around the World", June 13, 2018.

the proximity to death for religiousness has received little attention. This is surprising in light of the role of death and afterlife in behavioral models of religiousness and religious activity. Such models are mostly based on the notion that religiousness provides benefits that outweigh the costs of religious participation. These can be metaphysical benefits that are experienced during afterlife, corresponding to the "salvation motive for religious participation", or because religion helps individuals to deal with unpleasant living conditions or expectations. The salience of these motives is therefore associated with expected proximity of death. Typically, higher age is used as proxy in this context, and findings of higher church attendance and religious activity among elderly that has been reported in recent empirical studies is consistent with this interpretation. However, (chronological) age is not necessarily a good measure of proximity to death. Age itself might be associated with religiousness through other channels than proximity to death, such as mounting life experiences. Moreover, age is not fully exogenous to individuals' religiousness in light of evidence that religiousness has a positive effect on health. A similar argument applies to subjective beliefs about proximity to death, which have been used in the existing empirical work on this topic.

The analysis is based on a combination of individual survey response data on religiousness, age, gender and country of residence spanning more than 260,000 individual observations from 93 countries over the period 1994-2014 with information about expected remaining life years from period life tables referring to the respective age and gender cells in these countries. Information about expected remaining life years obtained from life tables is plausibly exogenous to individuals' religiousness. The fact that this information about life expectancy varies by age, gender, country and over time allows identifying the effect of proximity to death and disentangling it from age and cohort effects.

The empirical results show that the association of age with religiousness is weakly positive and exhibits a moderate U-shaped pattern when restricting attention on age only, paralleling earlier findings in the literature. When considering expected remaining life years without accounting for age, the results show a weakly positive effect of proximity to death on the importance of religion. When disentangling the effects of chronological

age in terms of years since birth and proximity to death, however, the results reveal strikingly different patterns. In particular, the findings point towards a significant negative association between proximity to death (in terms of fewer expected remaining years of life) and religiousness holding age fixed. At the same time, age reveals a positive gradient in the subjective importance of religion conditional on the expected remaining years of life. These results are robust when accounting for period-specific and cohort-specific shifts in religiousness, when controlling for various socio-demographic factors that might affect the subjective importance of religion, and when considering different religious denominations.

Contribution to the Literature. The evidence presented here sheds new light on the association between expected remaining lifetime, age and religiousness. Formal models of religious participation typically predict participation to increase with age. However, already the early work by Azzi and Ehrenberg (1975) suggests that religious participation can decline at later ages as consequence of uncertainty about the time of death. In an early study on the subject, Ainlay et al. (1992) found no age pattern in religious attitudes but a decline in religious participation due to health-related limitations. Most subsequent theories of religiousness focused on age but made no distinction between age and life expectancy (Iannaccone, 1998; Stolz, 2009; Iyer, 2016). The distinction between chronological age in terms of years since birth and a forward-looking definition of age reflected by remaining life expectancy adopted in this paper builds on seminal work in demography (Sanderson and Sherbov, 2005, 2013). We are aware of no existing study that has tried to identify the role of remaining life expectancy for religiousness and the importance of religion in individuals' lives holding age fixed, and that disentangles the distinct roles of age and remaining years of life.

The findings are informative for economic models of religion as providing access to specific religious services (e.g. Iannaccone, 1998; Iyer, 2016) and complement recent evidence for the role of community-based redistribution in response to external shocks (Gruber, 2004; Gruber and Hungerman, 2007, 2008; Berman and Laitin, 2008; Ager and Ciccone,

2018) by adopting a more individualistic perspective of religiousness. In this respect, our findings are related to increased religiousness in the context of shocks as predicted by "terror management theories", according to which religiousness increases with anxiety of dying, while anxiety of dying decreases as religiousness increases, see Jong et al. (2018) for a review of the literature. While the identification of this coping effect of religiousness is usually problematic as it relies on self-reported subjective anxiety, recent empirical work has established evidence that is consistent with this coping interpretation of religiousness using a credible identification strategy in the context of natural disasters (Bentzen, 2019). The present paper takes an alternative approach by exploiting variation in life expectancy from life tables that is plausibly exogenous to individual religious beliefs and thus allows for an identification of the causal role of proximity to death while overcoming problems of endogeneity through correlations between religiousness, preferences regarding how long individuals want to live (which might depend on expectations of the quality of life in old age), and longevity.[2]

Our results also complement survey-based evidence for aging patterns and generational trends in religiousness. For instance, Bengtson et al. (2015) find that individual aging affects religious development over the life course and point to the relevance of cohort effects. Silverstein and Bengtson (2018) estimate the correlates of change in religiousness among baby-boom generations in the US over age 50 on the basis of retrospective interview studies and find that religiousness is fairly stable, with some tendency to increased religiousness that is attributed to lower worldly concerns and better coping with partner loss or health problems. However, none of these studies considers the role of expected remaining life years for religiousness.

Instead of focusing on age, some research has concentrated attention on religiousness and its impact on health outcomes during the last year of life (Idler et al., 2001, 2009). Recent work has also provided estimates of religious affiliation among older individuals

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[2]See, e.g., Bowen and Skirbekk (2017) and Bowen et al. (2019) for recent studies on the link between expectations about quality of life and the preference to die rather young and subjective expectations about the length of life, respectively.

and at the time of death, as well as projections of future religious composition by age and at the time of death (Skirbekk et al., 2018a,b). Our evidence enriches this work by disentangling the role of age and proximity of death for religiousness.

There is a vast literature of evidence that religiousness and religious participation affect health behavior and health outcomes. In general, religiousness appears to be associated with greater longevity and better health (see, e.g, Hummer et al., 2004, Koenig et al., 2008, and Zimmer et al., 2016, for surveys of studies on the impact of religiousness on health and longevity). While most of this evidence is based on small and specific samples of subjects, some contributions provided evidence for health effects based on large national samples (Hummer et al., 1999). Deaton (2011) investigated the relationship between religiousness, age, and gender, as well as the effects of religiousness on health outcomes and health-related behaviors, using variation within and between countries. His findings point towards an increase in religiousness with age which is distinct from a cohort effect, while religious individuals exhibit better self-reported health outcomes. Here we use cross-country panel data and a novel empirical strategy to explore the opposite direction of causality, from remaining life expectancy to religiousness.

2. Data and Methods

2.1. Data

The empirical analysis is based on individual-level survey responses from the World Value Surveys (WVS).[3] These surveys are conducted among nationally representative samples in almost 100 countries. The data are based on a common questionnaire that contains consistent and comparable sets of questions on various topics. The survey questions of main importance for the purpose of this study concern individual religious attitudes. The analysis in this paper mainly relies on responses to three questions. The main outcome variable asks respondents about whether religion is important in their lives, with a response scale

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[3]The data are available at `http://www.worldvaluessurvey.org/wvs.jsp`.

from 1 (not important) to 4 (very important). A second question concerns the belief in god, with responses 0 (no) or 1 (yes). Intensity of beliefs are measured using responses to a question about importance of god in a respondent's life, with responses ranging from 1 (not important) to 10 (very important).[4] The same questions have been used in previous work on religiousness using the WVS (e.g., Norris and Inglehart, 2004; Bentzen, 2019). The main analysis is based on responses to the question about the importance of religion in life. In robustness analysis, we also use the other questions or a composite measure based on the principal component of the responses to the three questions. The baseline sample for the empirical analysis contains information for survey rounds 3-6 (1994-1998, 1999-2004, 2005-2009 and 2010-2014).

These data are linked with information about the life expectancy of a respondent of a given age and gender who lives in a particular country when the respective surveys are elicited. The data about the expected remaining years of life of an individual is based on information from period life tables assembled by the United Nations (UN, 2015).[5] These data are available for the periods 1990-1995, 1995-2000, 2000-2005, 2005-2010, and 2010-2015, and contain the respective information about expected remaining years of life for each country for age brackets of five years and separately for both genders. We match these data to the corresponding WVS waves for 5-year age brackets (Wave 3: 1995-2000, Wave 4: 2000-2005, Wave 5: 2005-2010, Wave 6:2010-2015), which then allows assigning the life table information to individuals on the basis of their age reported in the respective WVS.[6]

The resulting estimation sample is an unbalanced panel data set comprising 311,360 individual responses from 95 countries for which the relevant questions regarding religiousness and life expectancy contain non-missing information. Descriptive statistics for

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[4]A fourth question, which asks about agreement to the statement "life is meaningful because god exists", with responses 0 (disagree/neither) or 1 (agree) is not used due to the large proportion of missing responses.

[5]The respective variable for life expectancy at exact age a (years), $x(a)$, is defined as average number of remaining years of life expected by a hypothetical cohort of females or males alive at age a who would be subject during the remaining of their lives to the mortality rates of a given period.

[6]Andorra and Taiwan are not matched due to no available information in UN life tables. Serbia and Montenegro are dropped since they do not appear as separate countries in the UN Life Tables.

the variables of main interest are contained in Table 1.[7]

Table 1: Descriptive Statistics

	Mean	Std. Dev.	Min	Max	N
Importance of Religion in Life	3.10	1.05	1	4	311,360
Belief in God	0.88	0.33	0	1	203,147
Importance of God in Life	7.78	2.99	1	10	292,181
Religiosity: Composite Measure (PCA)	0.00	1.00	-3	1	200,782
Remaining years of life	35.75	13.74	2	68	311,360
Age	40.70	16.09	15	97	311,360
Gender	0.48	0.50	0	1	311,360

Note: Summary statistics for the variables of main interest. See text for details.

2.2. Unconditional Results

Figure 1 presents unconditional plots of the replies to the question about the importance of religion in life for different ages, using the pooled data at the individual level, in relation to remaining years and age, respectively. Figure 1(a) suggests that religiosity is higher the greater the expected proximity of death, whereas Figure 1(b) confirms earlier findings that the elderly report to be more religious than the young. In particular, religiousness is declining with age up to about 60 years of age. For older ages, religiousness exhibits an increase. The patterns are quantitatively moderate, however.

Figure 2 shows the corresponding patterns when restricting to country averages of the WVS samples. Figure 2(a) reveals that the finding that religiousness increases with a greater proximity to death is confirmed when considering country averages for the remaining life expectancy at age 40. At the same time, in countries with greater average age of the sample, religiousness is lower, as suggested by Figure 2(b). At first sight, this contradicts the view that religiousness increases with age that was suggested from Figure 1(b) and in the literature. This can be rationalized by systematic differences in age composition and religiousness across countries, pointing towards the need for a more nuanced

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[7]Table A1 in the Appendix contains descriptive statistics for other variables used in additional analyses.

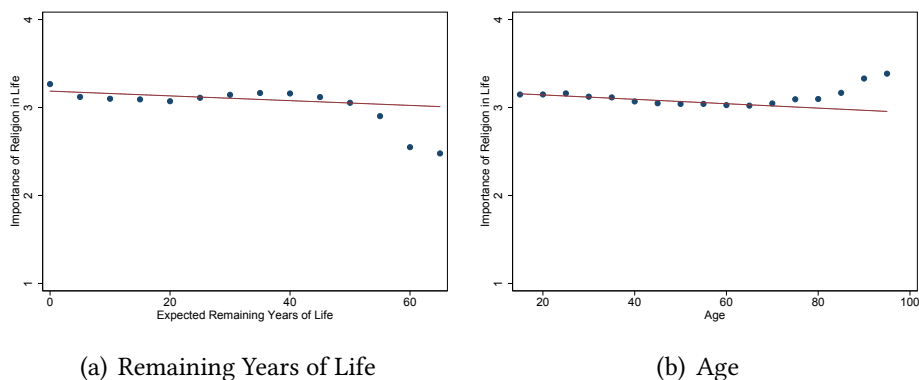(a) Remaining Years of Life   (b) Age

Figure 1: Age, Life Expectancy, and Religiousness

Unconditional scatter plots, data are plotted in 5-year bins for better visibility. Lines correspond to linear regression fits based on individual data. Religiousness is measured on a scale from 1 (not important) to 4 (very important). Panel (a): expected remaining years of life at current age. Panel (b): Age in years. See text for details on data sources.

empirical strategy.

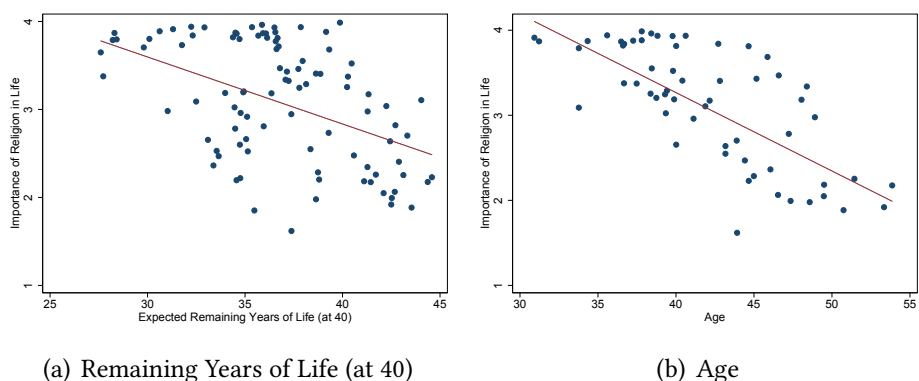(a) Remaining Years of Life (at 40)   (b) Age

Figure 2: Age, Life Expectancy, and Religiousness: Country Averages

Unconditional scatter plots of country averages. Religiousness is measured on a scale from 1 (not important) to 4 (very important). Panel (a): Expected remaining years of life at age 40. Panel (b): Age in years. See text for details on data sources.

While these patterns are consistent with most of the findings in the literature, the problem is that age and remaining years of life are highly correlated. Unconditional estimates of the age pattern of religiousness without fixing life expectancy, and not accounting for systematic differences in religiousness that are, e.g., due to the level of economic development, are therefore likely to deliver biased and unreliable results.

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2.3. Estimation Framework and Identification Strategy

In order to estimate the role of remaining life expectancy for religiousness and to disentangle this effect from the role of age, we apply an estimation framework that exploits variation in the remaining years of life that an individual of a given age and gender faces in the respective country at the respective point in time. The analysis is conducted for survey responses about religiousness, e.g., in terms of the importance of religion in life, R_{iagct}, by individuals i of age $a \in [15, 97]$ and gender $g \in \{male, female\}$ in country c at time (survey period) t as dependent variable. Religiousness is modelled as

$$R_{iagct} = g\left(x_{iagct}\right) + \sum_{a=15}^{97} \delta_a \mathbb{I}\left(a = Age_{iagct}\right) + \gamma X_{iagct} + \mathbb{I}_{a,g,c,t} + \varepsilon_{iagct} \, . \qquad (1)$$

The main interest lies in the shape of the function of expected remaining years of life, $g\left(x_{iagct}\right)$, which is specified as a parametric function (quadratic in the baseline) or a semi-parametric function that allows for a flexible semi-parametric estimation of coefficients of remaining years of life (in bins of one year), $\sum_{\tau=1}^{T} \beta_\tau \mathbb{I}\left(\tau = x_{iagct}\right)$, where $\mathbb{I}(\cdot)$ represents the indicator function. To account for the effects of age on religiousness, which has been the focus in the existing literature, the model also includes a flexible (semi-parametric) specification of the age profile, $\sum_{a=15}^{97} \delta_a \mathbb{I}\left(a = Age_{iagct}\right)$. In extended specifications, the model of religiousness also includes individual socio-demographic characteristics, such as education, income, number of children, or marital status, which might affect religiousness and which are comprised in a vector X_{iagct}. In addition, the empirical framework includes a vector $\mathbb{I}_{a,g,c,t}$ that contains additional binary indicator variables to account for systematic variation in religiousness across specific strata of the sample. In the baseline specification, this vector is given by

$$\mathbb{I}_{a,g,c,t} = \delta_c + \delta_t + \delta_g \, , \qquad (2)$$

and includes country fixed effects, period fixed effects to account for global trends and circumstances, as well as gender fixed effects to account for the systematic gender differences

in religiousness that have been documented in the literature.[8]

The coefficients of main interest refer to the influence of expected remaining years of life that is reflected by the shape of $g\left(x_{iagct}\right)$. Consistent estimation requires variation that allows identifying the effect of remaining life years above and beyond the influence of age, period, and birth cohorts. The specification of the empirical model implies that the identification of the estimates of interest relies on variation in remaining life years across age-gender-groups in a given country over time. Importantly, the flexible specification of the empirical model exploits variation over time in remaining life years within the same cohort in a given country and allows estimating a distinct coefficient for each year of remaining life expectancy (a vector of β-coefficients) and for each age (a vector of δ-coefficients). This implies that the estimates of the model of religiousness as a function of remaining years of life account for systematic differences in age, and vice versa, while using variation within a given birth cohort. The empirical model thereby delivers joint estimates of the respective patterns of the influence of remaining life years and of age, and disentangles the distinct roles of age and expected remaining life years for religiousness. In additional analysis, we estimate extended specifications that include explicit controls for birth cohort effects or interaction terms between the binary indicator variables,

$$\mathbb{I}_{a,g,c,t} = \delta_{ct} + \delta_{ga} \,, \tag{2a}$$

that allow for period-specific country effects or gender-specific age effects, respectively, and include various other control variables.[9]

All specifications of the empirical model are estimated by least squares, with the error term ε_{iagct} allowing for clustering at the country-age-gender-period level.

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[8]More formally, (2) can be written as $\mathbb{I}_{a,g,c,t} = \sum_c \delta_c \mathbb{I}\left(c = Country_{iagct}\right) + \sum_t \delta_t \mathbb{I}\left(t = Period_{iagct}\right) + \delta_g \mathbb{I}\left(g = Gender_{iagct}\right)$, respectively. Note that the respective patterns for remaining life years and age are identified relative to the respective reference category in each dimension.

[9]Formally, (2a) can be written as $\mathbb{I}_{a,g,c,t} = \sum_c \sum_t \delta_{ct} \mathbb{I}\left(c = Country_{iagct} \wedge t = Period_{iagct}\right) + \sum_a \sum_g \delta_{ag} \mathbb{I}\left(a = Age_{iagct} \wedge g = Gender_{iagct}\right)$.

3. Results

3.1. Main Results

Figure 3(a) depicts the results from estimating the baseline specification and the extended specification of the empirical framework while applying a flexible (semi-parametric) specification of the effect of remaining years of life, $g(x_{iagct})$. Figure 3(b) shows the corresponding age pattern. These results suggest that religiousness begins to decline at about 20 years before the expected death, keeping age fixed. At the same time, fixing expected remaining life years, religiousness increases at older ages, confirming the findings in the literature about greater importance of religion reported by the elderly. These findings put the unconditional results of Figures 1 and 2 into perspective. In particular, the conclusion of a sharp increase in religiousness at age 60 in Figure 1(b) or even a decline in religiousness when considering country averages in Figure 2(b) are likely the result of bias due to the omission of controlling for systematic differences in remaining life expectancy and variation in religiousness across countries, e.g., due to differences in economic and social development or secularization. Both are accounted for in the estimation framework that underlies the results in Figure 3.[10] Moreover, the graphs document that the effects of expected remaining life years and age are non-linear. Religiousness varies little with life expectancy above 30 years or more, but falls increasingly sharply with a greater proximity of death. Likewise, religiousness varies little with age below 40, but increases with a convex shape at older ages.

Table 2 presents the main results of the empirical analysis regarding the role of proximity to death, in terms of expected remaining years of life, for religiousness. The results refer to a quadratic specification of $g(x_{iagct})$ and are reported for different specifications of the control variables. The findings for the baseline specification in Column (1) confirm the descriptive results in terms of a significant positive effect of expected remaining years

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[10]This conclusion is confirmed by the results of estimations with restricted samples that do not account for either age or remaining years in the estimation of the coefficients for the profiles of remaining years or age, respectively, or that do not include country fixed effects. See Figure A1 in the Appendix.

| | (a) Expected Remaining Years of Life | (b) Age |

Figure 3: Age, Life Expectancy, and Religiousness: Multivariate Regression Results

Plots of coefficient estimates from various specifications. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on ± 1.96 standard deviations around point estimates. The baseline specification of the empirical model corresponds to Table 2(1), the extended specification corresponds to Table 2(6).

of life on religiousness, which corresponds to a decline in the importance of religion the greater the expected proximity to death. Importantly, this holds for keeping age fixed and accounting for systematic differences in religiousness across countries (by including country fixed effects), over time, and across genders. The results of the quadratic specification also confirm the finding of a non-linear (concave) association. Since remaining life years and age are correlated, this might lead to concerns about multicollinearity. In fact, the correlation is highest for the cells with high ages and low remaining life years.[11] In order to explore the robustness of the result with respect to excluding parts of the sample with the highest correlation, Column (2) presents the results when restricting the sample to individuals younger than 60 years of age, for whom the correlation between age and remaining years is lower and potential selection is less prevalent. The results are qualitatively and quantitatively almost identical. The same is true for the estimation of extended specifications (2a) with controls for interactions between the binary indicator variables, as indicated by the results for specifications that account for country-specific period effects (Column (3)), for gender-specific age effects (Column (4)), or both (Column

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[11]See Figure A2 in the Appendix. The raw correlation between age and remaining life years in the baseline sample is -0.92; in the sample aged less than 60 years, the correlation is -0.87.

(5)). Alternatively, individual religiousness might be associated with individual factors that correlate systematically with remaining years of life or age. For instance, marital status, education, income, and subjective health status all correlate with age and presumably remaining life years. Moreover, personal attitudes regarding others, such as trust, might vary over the life cycle and correlate with religiousness. Finally, recent work in political science has provided evidence that preferences for institutions, in particular the preference for democracy, are influenced by life time experiences and the individual life horizon (Fuchs-Schündeln and Schündeln, 2015; Lechler and Sunde, 2019). The inclusion of controls for these other factors in the empirical specification leaves the main results unaffected (Column (6)).

Table 2: Main Results: Importance of Religion and Expected Remaining Years of Life

Sample:	(1) Full	(2) Age$<$60	(3) Full	(4) Full	(5) Full	(6) Full
Remaining Years	0.0299***	0.0321***	0.0414***	0.0303***	0.0447***	0.0455***
	(0.0029)	(0.0030)	(0.0030)	(0.0033)	(0.0033)	(0.0038)
Remaining Years^2	-0.000362***	-0.000322***	-0.000432***	-0.000348***	-0.000443***	-0.000432***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Country FE	✓	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓	✓
Gender FE	✓	✓	✓	✓	✓	✓
Country x Survey round FE			✓		✓	✓
Age x Gender FE				✓	✓	✓
Children						✓
Marital Status						✓
Education Dummies						✓
Income Dummies						✓
Subj. Health						✓
Trust						✓
Democracy						✓
R^2	0.41	0.43	0.42	0.41	0.42	0.42
N	311,360	268,107	311,360	311,360	311,360	211,800
Cluster	3,211	2,160	3,211	3,211	3,211	2,698

Note: OLS estimates of different specifications of the empirical model (2). The dependent variable is the survey response to the question about the importance of religion in life, coded from 1 (not at all important) to 4 (very important); the measure is standardized. Standard errors clustered at the country-age-gender-period level in parentheses. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p< 0.01$.

3.2. Robustness

The result of a decline in religiousness with greater proximity to death (a smaller expected number of remaining years of life) is robust to a variety of robustness checks. In particular, a potential concern for the validity and robustness of the results is multicollinearity due

to the systematic correlation between remaining years of life and age. In order to explore the robustness of the results with respect to this concern, we computed variance inflation factors for the estimates for remaining years of life and age obtained on the full sample. The findings do not reveal any evidence for excessive multicollinearity.[12]

Second, the result is not driven by the particular measure of religiousness in terms of subjective importance of religion in life. The pattern also robustly emerges when using alternative measures of religiousness. This is illustrated by the results for alternative measures related to the subjective strength of religious beliefs, importance of god, or a composite measure of responses regarding the importance of religion, the belief in god, and the importance of god in life by ways of a principal component.[13]

The result is also robust to the use of alternative estimation methods. In particular, the results robustly emerge when applying interval regression methods that account for the interval censoring of responses as consequence of the coarse response scale.[14]

The result regarding a decline in religiousness as the expected remaining years of life decrease also robustly emerges for countries with different socio-economic development. In particular, the respective coefficient estimates from an extended specification that allows for different coefficients for each bin of remaining life years for the groups of OECD and Non-OECD countries reveal very similar patterns.[15] This is reassuring in light of the different levels of religiousness in rich and less developed countries.[16]

The main results are also robust to the inclusion of separate controls for birth cohorts. The joint identification of age, period and cohort effects is possible due to the estimation of flexible, semi-parametric specifications for 5-year bins of age and cohort. Most importantly, the effect of remaining years of life on religiousness is identified from the variation

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[12]Figure A3 in the Appendix depicts the variance inflation factors for the semi-parametric specification of the empirical model. They are below 10.

[13]Estimation results for different outcomes are reported in Table A2 in the Appendix, and Figure A4 in the Appendix depicts the results of the semi-parametric specification for the combined measure.

[14]Figure A5 in the Appendix depicts the results for the baseline specification obtained from interval regressions.

[15]Figure A6 in the Appendix shows the corresponding coefficient estimates for the baseline specification and for the extended specification.

[16]See Figure A7 in the Appendix for the respective distributions of religiousness in the raw data and after conditioning for observables as in the baseline specification of Table 2(1).

in remaining life expectancy across country-age-gender cells.[17] Besides a decline in religiousness for greater proximity to death and an increase in religiousness with age, the results document a decline in religiousness for later birth cohorts that is consistent with an increasing secularization among younger cohorts.[18]

Another method to identify cohort and period effects separately from the age pattern in religiousness is the inclusion of control variables that incorporate differences across cohorts in a non-linear way (Heckman and Robb, 1985).[19] We apply this methodology building on the hypothesis that personality and beliefs are formed during the critical period of adolescence, when individuals are particularly susceptible to environmental conditions (Arnett, 2000). In view of the fact that democracies typically grant freedom of religion whereas religious practices are more regulated in less democratic environments, we use the exposure to democracy during life as a cohort proxy variable for religiousness. This measure builds on existing work that has pointed out the role of the institutional environment for preferences for democracy (Fuchs-Schündeln and Schündeln, 2015). The estimation results for these extended specifications confirm the decline in religiousness the lower the expected number of remaining years of life as well as the increase in religiousness with age.[20]

Finally, the result of a decline in religiousness with greater proximity to death consistently emerges also in other data sets. To explore the robustness of the main results, we replicated the analysis using the Gallup World Poll, which contains comparable information about the importance of religion and demographic characteristics as the World Value Survey. The results that emerge from this exercise are qualitatively and quantitatively almost identical to those obtained before.[21]

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[17]All profiles, in particular regarding remaining years of life, age, and cohorts are identified relative to a reference group. The coefficient of this group reflects the average religiousness, and the absolute effects of age, remaining years, period and cohort on this average are not identified. Importantly, however, the relative effects of variation in the various dimensions, which are the object of main interest, are identified.

[18]See Figure A8 in the Appendix for details.

[19]This approach has been applied successfully in several contexts, including the identification of age patterns in risk attitudes (Dohmen et al., 2017).

[20]See Figure A9 in the Appendix for details.

[21]Figure A10 shows the results that correspond to the those in Figure 3 in terms of empirical specification,

3.3. Religiousness, Religious Service Attendance, and Health

The analysis so far has focused on the role of proximity to death, as opposed to age, for religiousness. A potential explanation for the result of declining religiousness with greater proximity to death is a decline in the participation of religious activities, in particular in the attendance of religious services at the end of life. Indeed, the findings for alternative outcomes also reveal a similar pattern for the attendance of religious services as dependent variable.[22] If health-related limitations imply reduced attendance, as suggested by evidence for older age by Ainlay et al. (1992), and if lower attendance is associated with lower subjective religiousness, either due to lower awareness or as consequence of less frequent and intense social interactions with other individuals during religious services, this might explain the empirical results as consequence of health deterioration at the end of life.

The robustness of the main results to the inclusion of subjective health status as a control variable should already account for a health confound to some extent. In order to explore the distinct predictions of a health effect working through attendance and a genuine effect of proximity to death, we also estimated more extensive specifications that allow for an interaction effect of health and remaining years of life.

The results for attendance as dependent variable show that better health indeed increases attendance of religious activities, while closer proximity to death (a smaller number of expected remaining years of life) reduces attendance.[23] A negative interaction between health and remaining years of life indeed indicates that better health partly compensates for the decline in religiousness closer to death, but the effect is too small to eliminate (or even reverse) the main result that religiousness decreases with greater expected proximity to death. When considering the importance of religion as dependent variable, health is positively related to religiousness, whereas the interaction effect turns out to be insignificant. The positive health effect is indeed consistent with the previous literature.

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based on data from the Gallup World Poll, 2012 wave.

[22]See the results in Column (5) of Table A2 in the Appendix.

[23]See Table A3 in the Appendix for details.

However, the main finding of a negative effect on religiousness of greater proximity to death remains unaffected by this extension.

Another, more direct way to explore the possibility that the results for religiousness are driven by attendance of religious services is to control for attendance when conducting the main estimates. The respective estimation results reveal indeed that respondents state a greater importance of religion in their lives when they attend religious services more often.[24] The qualitative results regarding the decline of religiousness along with a decline in expected remaining years of life remain unaffected, however. Although the coefficient estimates are reduced to about half the size compared to the estimates reported in the main results, the patterns of religiousness with remaining years of life and age remain robust and significant.

3.4. Heterogeneity by Gender, Religious Affiliation, and Development

Gender has been found to be a key determinant of religiousness in the existing literature, with women being more religious than men.[25] This pattern also emerges in the estimation results of this paper, which reveal a significantly higher level of importance of religion in life for women than for men. A question that emerges in the context of the previous results is therefore whether there is not only a gender difference in average religiousness, but also in the life cycle patterns of religiousness. To account for differences in the age pattern, we estimated extended specifications of the empirical model (2a) that allow for gender-specific age effects. The results of these estimates reveal similar age patterns for women and men, although the age profile is slightly more pronounced for women.[26] To explore whether the role of remaining life years for religiousness varies systematically by gender, we also estimated extended specifications that allow for a gender-specific pattern

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[24]See Figure A11 and Table A4 for the respective results.
[25]See, e.g., Pew Research Center Report "The Gender Gap in Religion Around the World", March 22, 2016.
[26]See Figure A12 in the Appendix for details.

of remaining lifetime. Again, the results reveal a similar pattern as for the baseline.[27] If anything, the decline in religiousness is even more pronounced for women, but the gender differences are not significant.

Religions differ in many dimensions, including behavioral norms, beliefs about afterlife, and concepts of salvation. This likely maps into the motives for religious participation and the role of proximity to death or age for religiousness. In order to investigate this issue and explore possible heterogeneity in the role of expected remaining life years for religiousness, we replicated the analysis separately for individuals reporting different religious affiliations. The main result regarding a decline in religiousness in association with a smaller number of expected remaining years of life holds for respondents that report to be of Christian, Muslim, or Buddhist faith.[28] Together, these religious denominations cover more than 60% of the sample. The pattern is not significant (and even opposite in slope) for respondents that report to be of Hindu or Jewish faith. Together, these respondents only make up less than 4% of the sample, however. The pattern is qualitatively similar as in the full sample, although somewhat tilted to the positive and not significant, for individuals reporting to be member of no religion, who make up for around 17% of the sample.[29]

Even within Christianity, the beliefs about afterlife as well as social norms differ substantially across denominations. For instance, recent work by Becker and Woessmann (2018) has pointed out that religious beliefs and social norms are a possible explanation for a higher propensity of suicide propensity among Protestants compared to Catholics. Replicating the analysis for Catholics and Protestants indeed reveals differences in the gradient for remaining life years among the two denominations. In particular, the gradient is more pronounced for Protestants than for Catholics, which suggests a more pronounced erosion of religious beliefs.[30]

To further explore heterogeneity in the nexus between remaining life years and reli-

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[27]See Figure A13 in the Appendix for details.
[28]See Figure A14 in the Appendix for details.
[29]The information about religious affiliation is missing for the remaining share of participants.
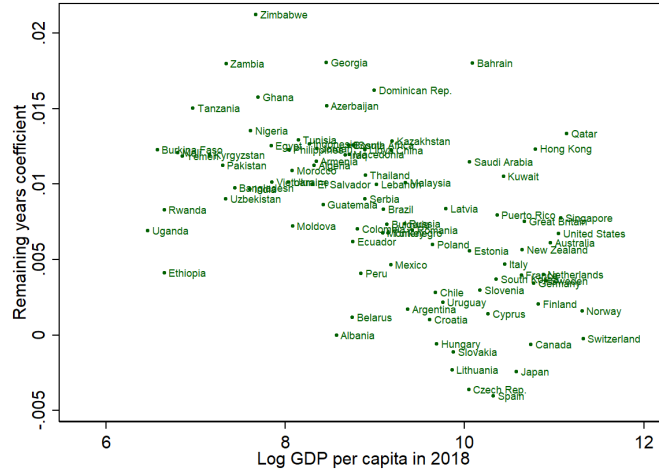[30]See Figure A15.

Figure 4: Effect of Life Expectancy on Religiousness: Heterogeneity Across Countries
Plots of coefficient estimates from a linear specification of the empirical model with country-specific slope parameters. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. With the exception of a linear effect of remaining years instead of a quadratic specification, the specification of the empirical model is the same as in Table 2(1).

giousness with respect to the overall level of economic development, we replicated the analysis with a linear specification of the effect of expected remaining life years while allowing for country-specific slope parameters.[31]

The coefficient estimates are positive for the vast majority of countries in the sample, with smaller coefficient estimates for countries with higher levels of per capita income, as illustrated in Figure 4. In the estimation sample, religiousness and economic development exhibit a strong negative correlation across countries, but there is no significant relationship between average expected remaining years among survey respondents and economic development across countries. This implies that the pattern of heterogeneity is not due to sample composition. Instead, together with the result that religiousness is

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[31]In particular, the estimation framework is a modified specification of the empirical framework (1) with

$$R_{iagct} = \sum_{c=1}^{95} \beta_c \cdot x_{iagct} \cdot \mathbb{I}(c = Country_{iagct}) + \sum_{a=15}^{97} \delta_a \mathbb{I}(a = Age_{iagct}) + \gamma X_{iagct} + \mathbb{I}_{a,g,c,t} + \varepsilon_{iagct} \,.$$

where β_c corresponds to a country-specific slope coefficient for the effect of expected remaining life years.

predicted to be lowest among a young population in environments with a short life expectancy, this finding implies that population aging in terms of increased life expectancy is expected to be associated with a stronger increase in religiousness in less developed countries, including many African countries. This provides important insights regarding the consequences of demographic aging for developing countries given that religiousness has been associated with faster economic development at the aggregate level and with better health and greater resilience at the individual level. In particular, the consequences of aging are expected to be stronger among less developed countries. At the same time, the results indicate that the effects of demographic change on religiousness and related outcomes might be limited among some of the more developed countries.

4. Concluding Remarks

This paper has provided new evidence on the association between expected remaining lifetime, age and religiousness. Based on individual survey response data for more than 311,000 individuals from 95 countries over the period 1994-2014, we document that a decline in the expected remaining life years based on information from period life tables is associated with a decline in religiousness, holding age constant. At the same time, conditional on expected remaining life years, religiousness increases with age.

Our findings have important implications for the consequences of population aging. Sustained health improvements and medical progress boost expected remaining years of life across age groups. Fears of waning religiousness based on evidence of an age gap in religiousness that does not account for remaining life years may thus be unwarranted. In light of the positive association of religiousness with individual well-being and health, this points to important complementarities between medical progress and subjective individual aging experiences that are supported by religiousness. This corroborates calls for integrating religiousness in a holistic public health approach towards aging (Zimmer et al., 2016; Malone and Dadswell, 2018). In the comparative development context, the findings call for some caution regarding the implications of religiousness for economic

performance on the aggregate, since religiousness is predicted to be lowest in the most underdeveloped countries where young populations are confronted with short life expectancies. At the same time, an expansion of life expectancy is expected to lead to a stronger increase in religiousness in less developed countries, partly as a consequence of the greater scope for improvements in life expectancy, partly as consequence of a stronger effect of remaining life years on religiousness.

In sum, the evidence sheds new light on the age pattern in religiousness and contradicts the widespread belief that religion gains importance for individuals the greater the proximity to death. Instead, the results show that the opposite is true when considering objective proximity as implied by life table variation. This does not rule out that individuals that hold a subjective belief of dying sooner report a greater importance of religion. In this respect, the results of this paper are not incompatible with the relevance of subjective beliefs and psychological factors for religiousness that have been emphasized in theoretical explanations. To the extent that subjectively perceived life expectancy is often lower than actual life expectancies as suggested by recent work by Philipov and Sherbov (2020), the effect of remaining years of life on religiousness estimated here might constitute a lower bound of the total effect of the proximity to death. Disentangling the effects for religiousness of subjective perceptions about the length of the remaining life from the objective length as predicted by life table information constitutes a natural next step in this research agenda. This will require reliable and comparable data on subjective perceptions about the length of life as well as an empirical design that allows decomposing objective and subjective factors. Devising such an empirical approach that isolates the channels by disentangling the effects on different aspects of religiousness such as believing and belonging constitutes an interesting avenue for future research.

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A. Appendix: Supplementary Material

Table A1: Descriptive Statistics: Other Variables

	Mean	Std. Dev.	Min	Max	N
Children	0.72	0.45	0	1	311,360
Education	4.71	2.23	1	8	279,402
Income Steps	4.63	2.31	1	10	285,524
Christian	0.35	0.48	0	1	311,360
Muslim	0.23	0.42	0	1	311,360
Buddhist	0.03	0.17	0	1	311,360
Hindu	0.03	0.17	0	1	311,360
Jewish	0.00	0.05	0	1	311,360
No Denomination	0.17	0.38	0	1	311,360
Preference for Democracy	1.64	0.74	1	4	261,152
Most people can be trusted	0.26	0.44	0	1	297,709

Note: See text for details.

(a) Expected Remaining Years of Life (b) Age

Figure A1: Robustness: Multivariate Regression Results for Restricted Specifications

Plots of coefficient estimates from various specifications. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on $\pm$ 1.96 standard deviations around point estimates. Restricted Spec: No Life Horizon, Country F.E. corresponds to (1) without $g(x_{iagct})$; Restricted Spec: No Age, Country F.E. corresponds to (1) without the semi-parametric function for age, Restricted Spec: Life Horizon/Age, Country F.E. corresponds to (1) without country fixed effects.
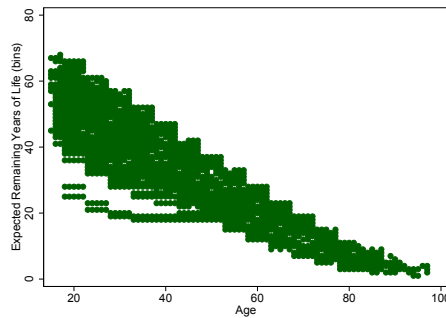
Figure A2: Correlation between Age and Expected Remaining Years of Life

Unconditional scatter plot. See text for details.

(a) VIFs for Coefficients: Remaining Years   (b) VIFs for Coefficients: Age
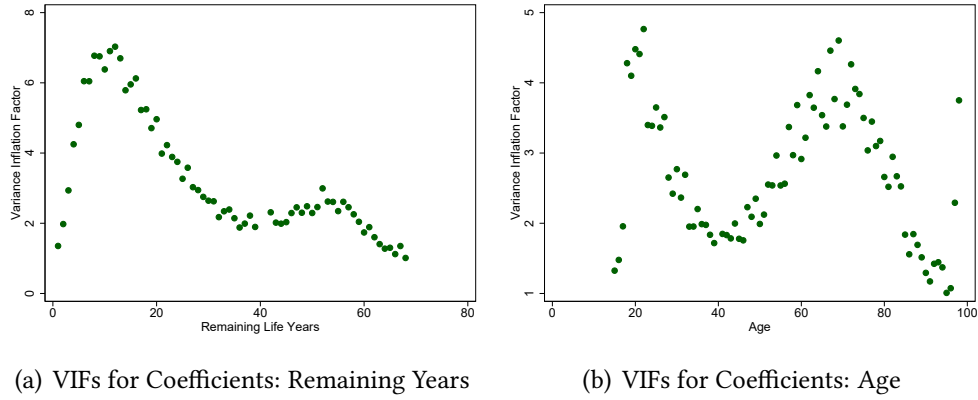
Figure A3: Variance Inflation Factors

Variance inflation factors for coefficients in the semi-parametric specification. See text for details.

Table A2: Alternative Outcomes

	(1) Importance religion	(2) Believe	(3) Importance god	(4) PC	(5) Attendance
Remaining Years	0.0455***	0.0565***	0.0551***	0.0594***	0.0461***
	(0.0038)	(0.0052)	(0.0039)	(0.0049)	(0.0055)
Remaining Years^2	-0.000432***	-0.000452***	-0.000480***	-0.000510***	-0.000370***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Country FE	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓
Gender FE	✓	✓	✓	✓	✓
Country x Survey round FE	✓	✓	✓	✓	✓
Age x Gender FE	✓	✓	✓	✓	✓
Children	✓	✓	✓	✓	✓
Marital Status	✓	✓	✓	✓	✓
Education Dummies	✓	✓	✓	✓	✓
Income Dummies	✓	✓	✓	✓	✓
Subj. Health	✓	✓	✓	✓	✓
Trust	✓	✓	✓	✓	✓
Democracy	✓	✓	✓	✓	✓
R^2	0.42	0.30	0.42	0.44	0.27
N	211,800	145,932	209,281	143,254	209,023
Cluster	2,698	1,831	2,659	1,829	2,661

Note: OLS estimates of the most extensive specification of the empirical model (2) as in Table 2(6). The dependent variables are the survey responses to the questions about the importance of religion in life, religious beliefs, importance of god in life, a principal component of the responses to the three previous questions, as well as responses to the question about attendance of religious services. All dependent variables are standardized. Standard errors clustered at the country-age-gender-period level in parentheses. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
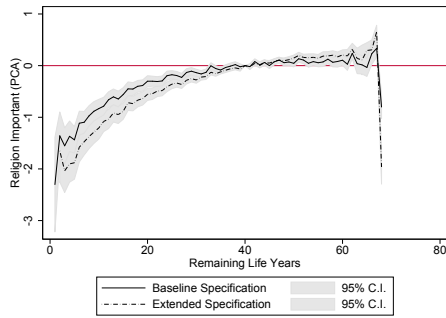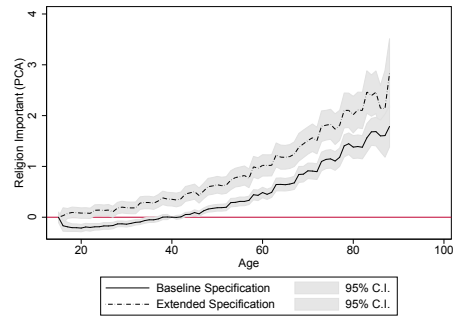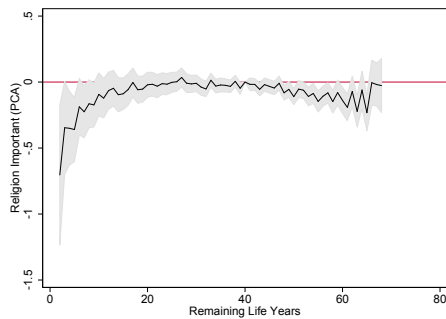
(a) Expected Remaining Years of Life   (b) Age

Figure A4: Robustness: Composite Measure of Religiousness (PCA)

Plots of coefficient estimates from various specifications. Religiousness is measured as the principal component of survey responses to questions about the importance of religion in life, the belief in god, and the importance of god in life; see text for details. The measure is standardized. Shaded areas represent confidence intervals based on $\p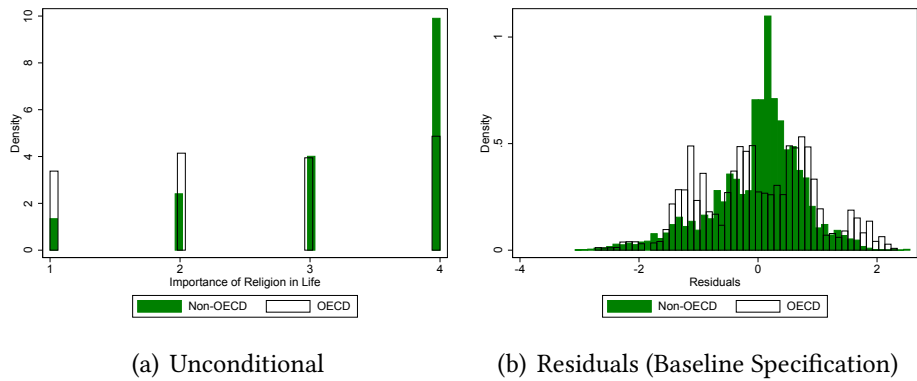m$ 1.96 standard deviations around point estimates. The baseline specification corresponds to Table 2(1), the extended specification corresponds to Table 2(6).
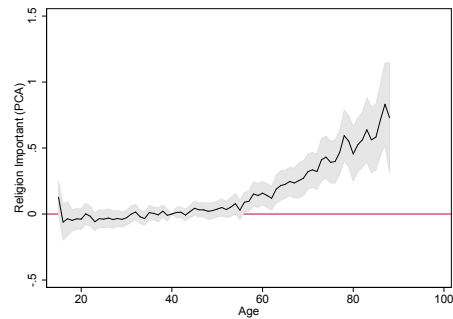
(a) Expected Remaining Years of Life   (b) Age

Figure A5: Robustness: Interval Regressions

Plots of coefficient estimates from interval regressions. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on $\p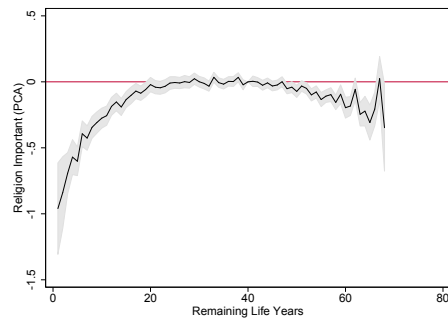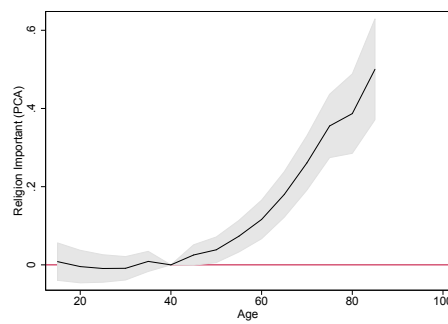m$ 1.96 standard deviations around point estimates. The baseline specification corresponds to Table 2(1), the extended specification corresponds to Table 2(6).

30

(a) Baseline Specification   (b) Extended Specification
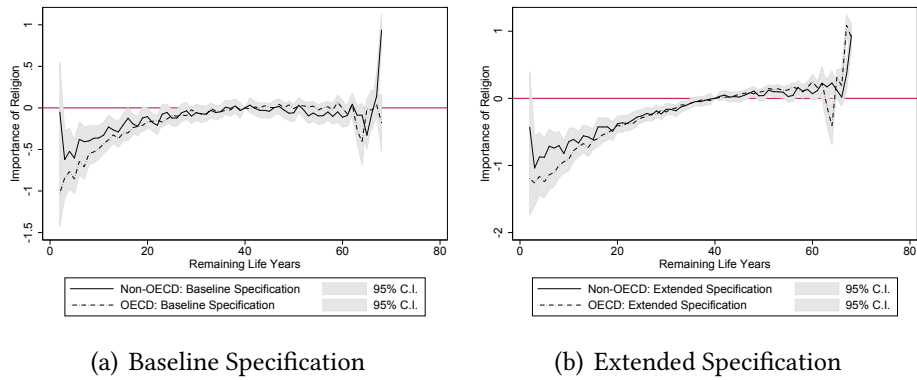
Figure A6: Robustness: The Effect of Remaining Years of Life by Socio-Economic Development

Plots of coefficient estimates from an extended specification that allows for different coefficients for each bin of remaining life years for the groups of OECD and Non-OECD countries, respectively. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on $\pm$ 1.96 standard deviations around point estimates. See text for details on data sources.

(a) Unconditional   (b) Residuals (Baseline Specification)

Figure A7: Religiousness in OECD and Non-OECD Countries

Scatter of religiousness for OECD and Non-OECD countries. Panel (a): raw data (unconditional). Panel (b): Residuals from estimations of the baseline specification as in Table 2(1).
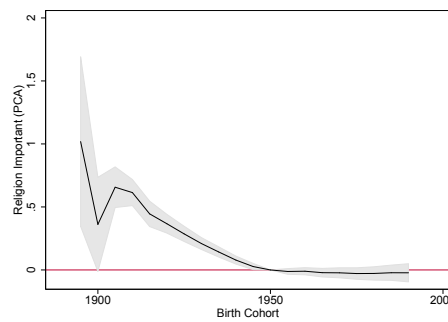
(a) Expected Remaining Years of Life

(b) Age

(c) Birth Cohort

Figure A8: Extended Specifications: Remaining Life Years, Age, and Birth Cohorts
Plots of coefficient estimates from an extended specification that accounts for survey period, age (5-year bins), birth cohort (5-year bins) and expected remaining years of life. Otherwise the specification corresponds to the baseline specification in Table 2(1). Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on $\pm$ 1.96 standard deviations around point estimates. See text for details on data sources.

(a) Expected Remaining Years of Life
(b) Age
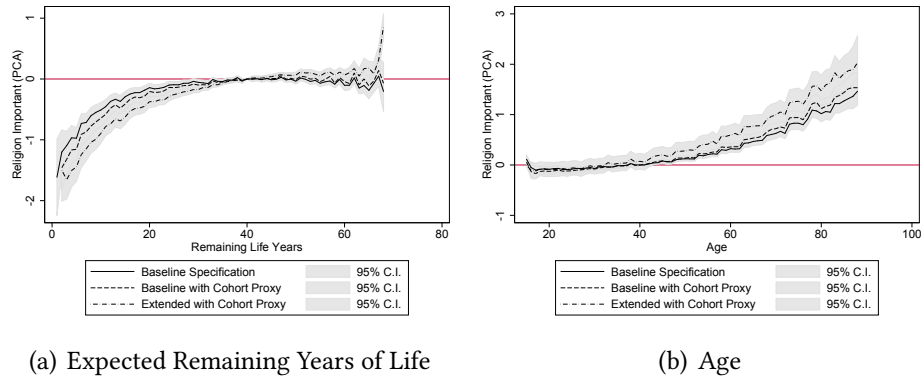
Figure A9: Extended Specifications: Exposure to Democracy as Proxy for Cohort Effects
Plots of coefficient estimates from an extended specification that accounts for lifetime exposure to democracy and democratic attitudes as proxy for cohort effects. Otherwise the specification corresponds to the baseline specification as in Table 2(1) or the extended specification as in Table 2(6). Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on ± 1.96 standard deviations around point estimates. See text for details on data sources.

(a) Expected Remaining Years of Life
(b) Age
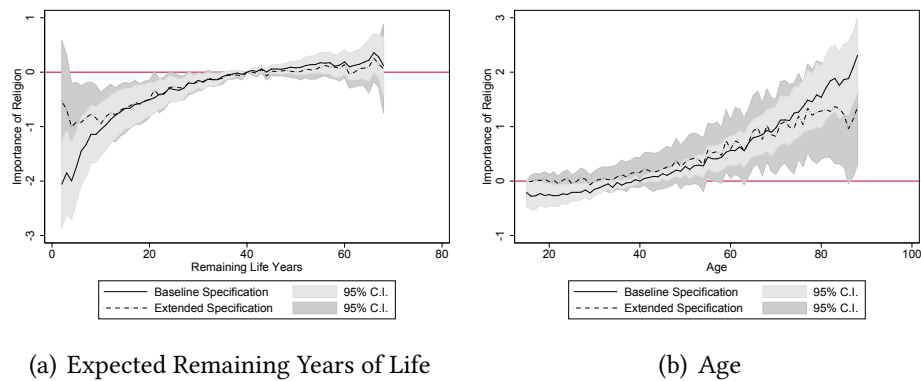
Figure A10: Effect of Age and Life Expectancy on Religiousness: Replication with Data from Gallup
Plots of coefficient estimates from various specifications. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on ± 1.96 standard deviations around point estimates. The baseline specification of the empirical model corresponds to Table 2(1), the extended specification corresponds to Table 2(6). The data source is the Gallup World Poll, wave 2012.

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Table A3: Accounting for Health Interactions

	(1) Attendance	(2) Attendance	(3) Religion important	(4) Religion important
Remaining Years	0.0629***	0.0696***	0.0287***	0.0489***
	(0.0055)	(0.0067)	(0.0042)	(0.0053)
Remaining Years^2	-0.000661***	-0.000658***	-0.000352***	-0.000464***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Health	0.102***	0.140***	-0.0183	0.0359**
	(0.0129)	(0.0146)	(0.0122)	(0.0137)
Health*Remaining Years	-0.00441***	-0.00629***	0.000865	-0.000963
	(0.0008)	(0.0009)	(0.0008)	(0.0009)
Health*Remaining Years^2	0.0000580***	0.0000773***	-0.00000615	0.00000967
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Country FE	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓
Age FE	✓	✓	✓	✓
Gender FE	✓	✓	✓	✓
Country x Survey round FE		✓		✓
Age x Gender FE		✓		✓
Children		✓		✓
Marital Status		✓		✓
Education Dummies		✓		✓
Income Dummies		✓		✓
Trust		✓		✓
Democracy	0.26	0.27	0.42	0.42
R^2	294,694.00	209,023.00	303,373.00	211,800.00
N	3,081	2,661	3,163	2,698

Note: OLS estimates of different specifications of the empirical model (2) as in Table 2 Columns (1) and (6). The dependent variables are survey responses to the questions about attendance of religious services, and the importance of religion in life. All dependent variables are standardized. Standard errors clustered at the country-age-gender-period level in parentheses. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

!h

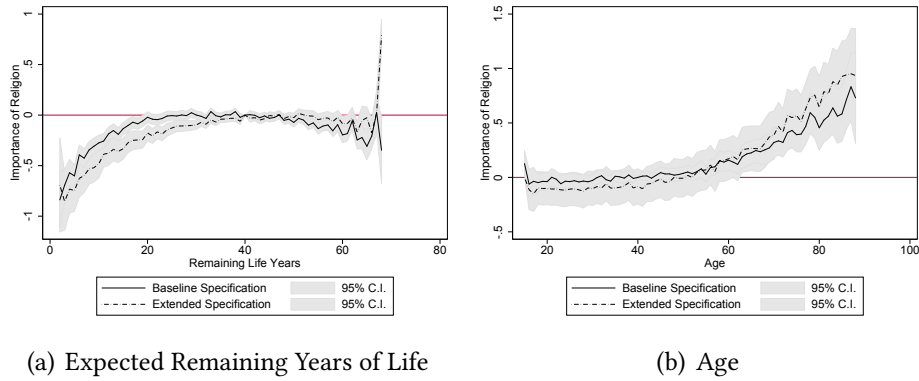(a) Expected Remaining Years of Life

(b) Age

Figure A11: Regression Results When Controlling for Attendance of Religious Services

Plots of coefficient estimates from various specifications. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on $\pm$ 1.96 standard deviations around point estimates. The baseline specification of the empirical model corresponds to Table 2(1), the extended specification corresponds to Table 2(6), while including attendance of religious services as additional control variable.

Table A4: Main Results: Controlling for Religious Attendance

	(1) Full	(2) Age<60	(3) Full	(4) Full	(5) Full	(6) Full
Rel. Attendance	0.334***	0.318***	0.334***	0.334***	0.334***	0.341***
	(0.0060)	(0.0065)	(0.0059)	(0.0060)	(0.0059)	(0.0066)
Remaining Years	0.0140***	0.0169***	0.0208***	0.0153***	0.0240***	0.0273***
	(0.0027)	(0.0027)	(0.0026)	(0.0029)	(0.0027)	(0.0033)
Remaining Years^2	-0.000212***	-0.000203***	-0.000257***	-0.000214***	-0.000275***	-0.000294***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Country FE	✓	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓	✓
Gender FE	✓	✓	✓	✓	✓	✓
Country x Survey round FE			✓		✓	✓
Age x Gender FE				✓	✓	✓
Children						✓
Marital Status						✓
Education Dummies						✓
Income Dummies						✓
Subj. Health						✓
Trust						✓
Democracy						✓
R^2	0.48	0.49	0.49	0.48	0.49	0.49
N	295,105	253,489	295,105	295,105	295,105	204,407
Cluster	3,111	2,091	3,111	3,111	3,111	2,645

Note: OLS estimates of different specifications of the empirical model (2) as in Table 2. The dependent variable is the survey response to the question about the importance of religion in life. The dependent variable is standardized. Standard errors clustered at the country-age-gender-period level in parentheses. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

(a) Remaining Years of Life

(b) Age

Figure A12: Heterogeneity by Gender in Age Effects

Plots of coefficient estimates from estimates of various specifications as in Table 2, extended to allow for gender-specific age effects. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. See text for details on data sources.
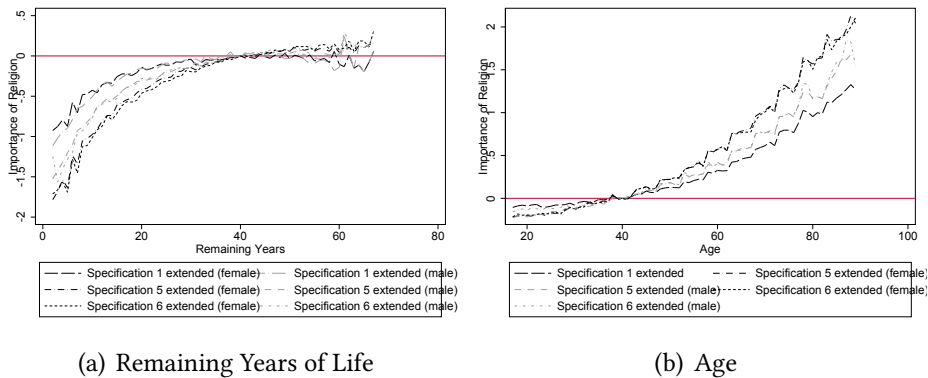

(a) Remaining Years of Life

(b) Age

Figure A13: Heterogeneity by Gender in Remaining Years Effects

Plots of coefficient estimates from estimates of various specifications as in Table 2, extended to allow for gender-specific effects of remaining years of life. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. See text for details on data sources.
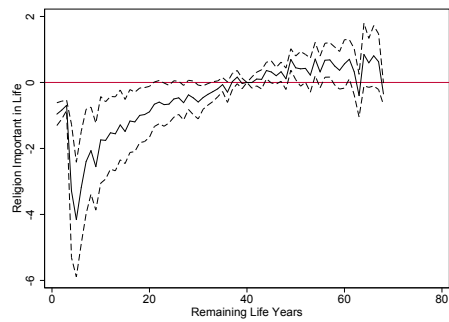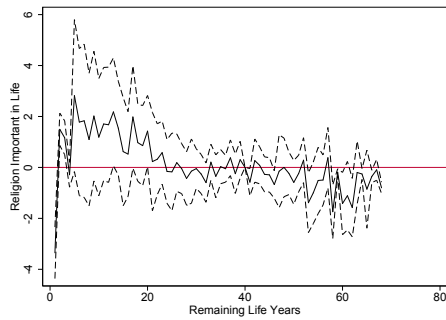
36
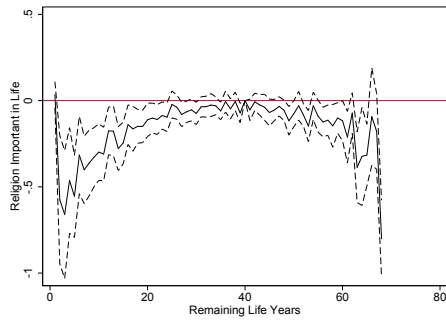
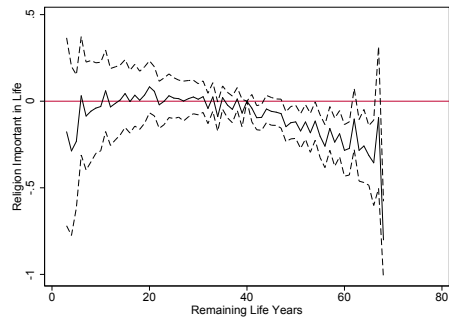(a) Christian
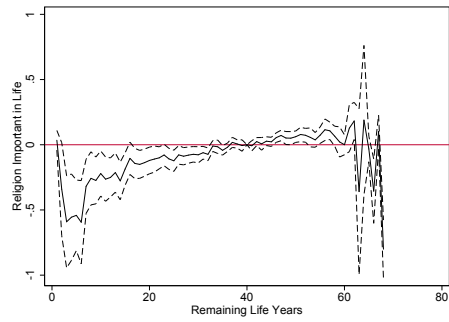
(b) Muslim
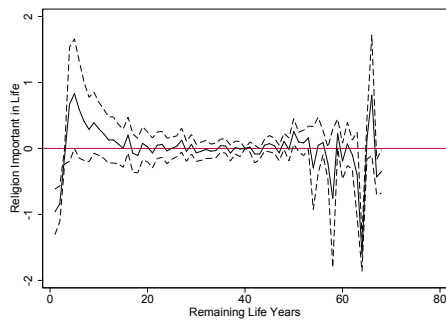
(c) Hindu

(d) Buddhist

(e) Jewish

(f) No Denomination

Figure A14: Effect of Remaining Life Years: Different Denominations

Plots of coefficient estimates from estimates of the baseline specification in Table 2(1) for different denominational subsamples. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Dotted lines represent confidence intervals based on $\pm$ 1.96 standard deviations around point estimates. See text for details on data sources.

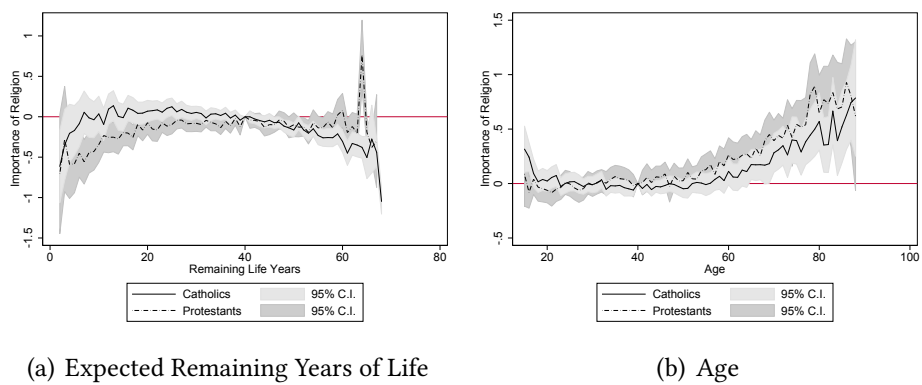(a) Expected Remaining Years of Life (b) Age

Figure A15: Effect of Age and Life Expectancy on Religiousness: Catholics Vs. Protestants

Plots of coefficient estimates from various specifications. Religiousness is measured on a scale from 1 (not important) to 4 (very important), the measure is standardized. Shaded areas represent confidence intervals based on ± 1.96 standard deviations around point estimates. The specification of the empirical model corresponds to the baseline specification as in Table 2(1). Estimates are based on a sample that only includes individuals Christians of Catholic or Protestant denomination.