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Good Faith and Bad Health: Self-Assessed Religiosity and Self-Assessed Health of Women and Men in Europe

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Abstract

Religion exerts a powerful influence on many people's lives. We investigate how self-assessed religiosity affects self-assessed health in Europe. Our sample consists of individuals with a native father and an immigrant mother from another European country. This sample allows for a causal interpretation since we can use the religiosity of the mother's birth country as an instrument for individual religiosity in the first stage of a 2SLS regression analysis, which is related, in the second stage, to the individual's health assessment. We find that the more religious are substantially more likely to report bad health. Several robustness tests offer a strong confirmation of the negative relationship between self-assessed religiosity and self-assessed health. Notably, this negative relationship is concentrated among women. The analysis indicates that religious constraints on women's autonomy can impair their health.

Keywords Health, Religion, Instrumental variables (IV) estimation, Gender, Women's health

Supplementary material at:

https://www.dropbox.com/s/joayxokcj3xtpp0/Supplementary%20material%20revised%202.docx?dl=0

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1 Introduction

Religion is a powerful phenomenon, yet its intensity varies greatly across countries and individuals. For example, when Gallup (2009) asked representative samples in 143 countries whether religion is an important part of daily life, almost everyone answered "yes" in countries such as Egypt, Bangladesh and Sri Lanka. But even in more developed countries like Switzerland, South Korea, Canada, Singapore and Austria, 40–55% answered in the affirmative. The median share in the 27 developed countries included was 38%. The United States stands at 64%. Then there are rather irreligious countries as well, with shares around 20%: Estonia, Sweden, Denmark, Norway and the Czech Republic top this list.

From a social-science point of view, not least since Max Weber's analysis of the Protestant work ethic, it is clear that religion affects people in certain ways and that it, therefore, is a determinant of important individual and aggregate outcomes.[2] One such outcome, and the focus of this study, is *health*. Why focus on health? It is certainly a strong policy goal embraced not only by national governments, but also by international organizations like the World Health Organization and the World Bank. It is not hard to see why. Health is first and foremost a concern for individuals and families – without it, life is less satisfactory and can come to entail pain and suffering (Binder and Coad 2013). In addition, lack of health can have inimical financial consequences that in turn reduce wellbeing. However, health is also of macroeconomic importance, by affecting government incomes (through the tax base) and expenditures (through welfare payments and healthcare) and, at least to some extent, by influencing economic growth (Weil 2014).

When considering religion as a factor behind health, there are several possible mechanisms (Oman and Thoresen 2017: 440). For example, religion can influence behavior (through the transmission of practices, values and moral codes), affect one's social setting (community access, social networks and family life) and shape psychological states (concerning matters such as meaningfulness, stress and feelings of belonging or being in conflict with others).

[2] To mention but a few: economic growth (Barro and McCleary 2003; Durlauf, Kourtellos and Tan 2012), trust (Johansson-Stenman, Mahmud and Martinsson 2009; Berggren and Bjørnskov 2011), the size of the shadow economy (Schneider, Linsbauer and Heinemann 2015), criminality (Brauer, Tittle and Antonaccio 2013), tolerance (Berggren, Ljunge and Nilsson 2019), the work ethic (van Hoorn and Maseland 2013) and entrepreneurship (Wiseman and Young 2014).

The empirical literature on the relationship between religion and health is vast (Koenig, King and Carson 2012; Schierman, Bierman and Ellison 2013). Most studies seem to find the relationship to be positive. As summarized by Oman (2018: 2): "An enormous body of empirical evidence … now links religious and spiritual (R/S) factors to health – and very commonly to *better health*" (italics in original; cf. VanderWeele 2017a: 367; Oman and Syme 2018: 261).

However, the existing literature is diverse in many dimensions: Different indicators of religiosity are used (some measure activities; others membership; others self-assessed religiosity; others yet a combination); different indicators of health are used (some measure objective, and others on self-assessed, health; some focus on a particular outcome, such as mortality; some focus on physical and others on mental health; etc.); some recent studies, especially longitudinal ones, make progress in enabling causal inference, while cross-country studies as a rule do not; and there is a certain dominance of data from the United States, although there is a small literature using European data as well.[3]

This study examines how religiosity affects self-assessed health throughout Europe with an empirical strategy that enables us to come closer to causal inference than most previous studies.[4] We combine two-stage least squares (2SLS) with a carefully selected sample (but show that results hold for less specific samples as well). The sample is from the European Social Survey and consists of 5,400 individuals born and residing in European countries in which their fathers were also born but whose mothers are immigrants from another European country. This enables us to use the religiosity of the mother's country of birth as an instrument for individual self-assessed religiosity, which singles out the effect of

[3] For examples of the diversity of the literature, see, e.g. Ellison and Levin (1998), Idler, Ellison, George, Krause, Ory, Pargament, Powell, Williams and Underwood (2003), Ellison and Hummer (2010), Hill and Cobb (2011) and Zimmer, Rojo, Ofstedal, Chiu, Saito and Jag (2019). Baker, Stroope and Walker (2018) identify a complex pattern between religious/secular identity and health outcomes in the United States. They find that "atheists report significantly fewer problems with physical health, mental health and pain than both nonaffiliated theists and some religious individuals" and that "[a]theism is the religious or secular identity with the healthiest outcomes on the basic psychiatric symptoms analyzed" (p. 53). Thus, while many affiliated theists benefit health-wise from their religiosity, atheists likewise seem to benefit from *their* (secular) identity, and sometimes even more so.

[4] A key concern is reverse causality – e.g., a negative relationship between religiosity and health could reflect sick people seeking religious comfort and consolation (Ferraro and Kelley-Moore 2000).

intergenerationally persistent religiosity on individual self-assessed health.[5] By restricting the sample in this way, the individuals have a common heritage from the European continent, which means that our findings are not driven by very heterogeneous countries with large differences in religiosity. We thus contribute with an analysis that alleviates concerns about endogeneity and that complements U.S.-oriented studies.

Our main finding is that individual self-assessed religiosity is a predictor of individual self-assessed bad health. An extensive set of tests furthermore demonstrate this to be a robust finding – it, e.g., withstands the inclusion of a dozen of variables that relate to religiosity in the mother's country of birth and could affect health, it does not entail health being a reflection of happiness or life satisfaction in general nor of the degree of integration, it holds for a number of different sample modifications and it is reproduced in a reduced-form, intention-to-treat model. In an analysis by gender, we furthermore find that the negative effect of religiosity on health is solely present for women, and the reduced form allows us to account for maternal birth country fixed effects. The analysis suggests women are influenced differently (and worse) by religion, as transmitted through the maternal side of the family, than men.

The present study can be related to two previous studies on religiosity and health in Europe. The first, Nicholson, Rose and Bobak (2010), is cross-sectional and relates self-assessed religiosity, religious attendance and prayer to self-assessed bad health. The crucial difference compared to our study is that we apply an instrumental-variable approach with an immigrant feature in order to rule out reverse causality.[6] The second, Ahrenfeldt, Möller, Andersen-Ranberg, Vitved, Lindahl-Jacobsen and Hvidt (2017), is a longitudinal study of Europeans over the age of 50, linking religious activities and education to health.[7] As we apply a different methodology, which may have certain advantages in ruling out reverse

[5] We use the terms "self-assessed" religiosity and "self-assessed" health, since these are indicators from surveys based on people's own assessments of how religious and how healthy they are. "Subjective" or "self-rated" are synonyms to "self-assessed", used in other studies.

[6] Nicholson, Rose and Bobak (2010: 233) point out that "… as this was a cross-sectional study, the potential for reverse causality is a major problem. … [R]everse causality is an important alternative explanation of our findings. These analyses could equally well be argued to show that poor health reduced attendance at religious services."

[7] This study forms part of an emerging body of longitudinal studies on religion and health that overcome some of the methodological challenges of cross-sectional studies but which predominantly use U.S. data (VanderWeele 2017b). See, e.g., VanderWeele (2017c) and Saad, Daher and de Medeiros (2019).

causality (Jelinek 2017), and use a different and non-age-restricted sample, we regard our findings as a distinct contribution to the literature.

2 Data

2.1 Main Data Source

The main source of data is the European Social Survey (ESS). We use individual data from the second to the eighth rounds (biannually, 2004–2016).[8] The residence countries – where the studied individuals were born and reside – are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine and United Kingdom.[9]

Summary statistics are presented in Table S1 in the supplementary material. The ancestral countries – i.e., the birth countries of immigrant parents – are listed in Table S2 in the supplementary material, along with means for the self-assessed bad health and the self-assessed religiosity for the maternal ancestral countries and means for the self-assessed bad health of the individuals in our study whose mothers stem from the various countries. Table S3 in the supplementary material shows the participation rounds for the residence countries.

2.2 The Sample

The main sample consists of about 5,400 individuals born and residing in a European country with a father born in the same country and an immigrant mother born in another European country.[10] The advantage of a sample with an immigration component is that it enables us to use religious features of the mother's country of birth as instruments in our 2SLS analysis. The reason for including individuals with an immigrant *mother* is that the statistical analysis

[8] The data from these rounds are stacked. The first round does not include information on parental-birth country.

[9] We also have data for Turkey and Israel, but to keep the sample more homogeneous, we do not include them in the main analysis. We have conducted all tests with them included, and there is no qualitative change in our findings (available upon request).

[10] The individuals in our sample are similar to the general population in the countries in which they were born on observables, including self-reported health (Ljunge 2016).

reveals the transmission channel to go through her and her country of origin.[11] An advantage of a sample with only one immigrant parent is that we thereby reduce the potential of omitted-variable bias, by automatically controlling for many potentially confounding factors, e.g., by individuals having access to the native culture and language in the family. This arguably also allows for a reasonable degree of generalizability to the general population: Like other individuals in their countries, our studied individuals were born and grew up there and have fathers from there. We include 28 European countries of residence and 41 European countries where the immigrant mothers were born.[12]

2.3 Dependent Variable

Our dependent variable is *individual self-assessed bad health*. It is based on this question in the ESS: "How is your health in general? Would you say it is ...", with the following reply options: "Very good," "Good," "Fair," "Bad," "Or, very bad." The dependent variable takes the value 1 if a respondent chose any of the two worst categories ("bad" or "very bad") and 0 otherwise. We use a dummy variable, like previous studies (Kim, Subramanian and Kawachi 2008; Huijts and Kraaykamp 2012), since the data are not normally distributed.[13]

We consider this measure a suitable indicator of health, for three reasons. First, it is comprehensive and covers all aspects of health, while objective measures tend to focus on some particular aspect (Benyamini 2011). Second, from an individual-well-being point of view, it is the individual's experience of her health situation that is most relevant. Third, while a subjective measure by definition expresses how healthy the individual feels, an objective measure risks being erroneous, if the individual does not remember the objective facts correctly. In any case, there are indications that subjective and objective health overlap to a substantial degree. For example, self-assessed health has been shown to stand in a negative relation to mortality (Benjamins, Hummer, Eberstein and Nam 2004; DeSalvo, Bloser,

[11] The importance of the mother in transmitting cultural traits like religiosity has been shown to hold for social trust as well (Ljunge 2014a). Note that we cannot, due to a lack of data, differentiate between mothers who migrated to their present country of residence early and those who did so later in life.

[12] By using this sample with immigrant mothers we also relate to a literature on migrant health in Europe (Huijts and Kraaykamp 2012; Rechel, Mladovsky, Ingleby, Mackenbach and McKee 2013), which we complement by explicitly focusing on the role of religiosity.

[13] In a robustness test, we code the replies from 1 ("very bad") to 5 ("very good") and conduct a linear regression analysis (see the section "Extended analysis and robustness tests").

Reynolds, He and Muntner 2006; Jylhä 2009; McFadden, Luben, Bingham, Wareham, Kinmonth and Khaw 2009; Bopp, Braun, Gutzwiller and Faeh 2012), inflammatory status (Christian, Glaser, Porter, Malarkey, Beversdorf and Kiecolt-Glaser 2011) and usage of health care (Pot, Portrait, Visser, Puts, Broese van Groenou and Deeg 2009), while it is positively related to functional ability in old age (Idler and Kasl 1995) and survival in HIV patients (Dzekedzeke, Siziya and Fylkenes 2008). Still, there are some who argue that subjective health does not coincide with its objective counterpart to any large degree (Jürges 2007; Johnston, Propper and Shields 2009), and an additional concern might be that cultural perceptions of health differ. However, as for the latter risk, it is mitigated by the fact that the individuals in our sample are all born in Europe, with fathers born in the same country and with mothers from another European country.[14]

In an extended analysis in the section "Effects by gender and evidence of mechanisms" we use three variables from the ESS measuring attitudes on a six-point scale as dependent variables: whether one has the attitude that it is important to be humble and modest, whether one has the attitude that it is important to follow traditions and customs and whether one has the attitude that it is important to live in safe and secure surroundings.

2.3 Main Explanatory Variables

The main explanatory variable is *individual self-assessed religiosity*. The question in the ESS is: "Regardless of whether you belong to a particular religion, how religious would you say you are?" The answer is given on a ten-point scale from "not at all religious," coded as 0, to "very religious," coded as 10. The advantage of this type of measure, which is different from activity- or membership-based measures of religiosity, is that it measures the strength of religious belief irrespective of whether respondents are active in or members of a religious organization (Berggren and Bjørnskov 2011). Still, the correlation coefficient between self-assessed religiosity and religious attendance in our sample of individuals is 0.59, implying a considerable but far from full overlap in our case. In a robustness test, we replace the self-assessed religiosity measure by *individual religious attendance*, which is measured by the question "Apart from special occasions such as weddings and funerals, about how often do

[14] In a robustness test, we also account for individuals' overall life satisfaction in several ways, in order to capture cultural differences in attitudes to life, which could contribute to comparability of the subjective-health data.

you attend religious services nowadays?" in the ESS, with replies ranging from "Every day" to "Never".

The instrumental variable is *religiosity in the mother's country of birth*, from the European Values Study (EVS) and the World Values Survey (WVS): the average value assigned in the mother's country of birth to the claim that religion is important in life, on a scale from 1 to 4, where 1 is "not at all important" and 4 is "very important". Averages are computed across the combined EVS/WVS data collected between 1981 and 2009.[15] To test instrument validity, we include additional indicators of religiosity as instruments – see the section "Extended analysis and robustness tests".

2.4 Control Variables

These are of three types: individual-level variables for the individuals studied and for the parents, and characteristics of the mother's country of birth. Some data details are described in the supplementary material.

Individual-level variables. We use, depending on the model specification, age, gender, marital status, education, income, employment status, happiness and life satisfaction from the ESS. Marital status is included since most religions stress the importance of long-time relationships, and since marriage, and the social support and behavioral changes it entails seems related to positive health outcomes (Koball, Moiduddin, Henderson, Goesling and Besculides 2010). It is indicated by two dummies for married and never married, with widowed/divorced being the excluded category. Education has been shown to be a strong predictor of health (Conti, Heckman and Urzua 2010); in addition, attitudes towards it very between religious traditions but arguably affect the formation of human capital among the religious. It is captured by one dummy for a tertiary (university) degree, and one dummy for upper secondary as the highest attained degree. Lower education is the excluded category. Regarding income, it has been shown to be related both to religiosity (Betterndorf and Dijkgraaf 2010) and self-assessed health (Mackenbach, Martikainen, Looman, Dalstra, Kunst and Lahelma 2005). In our regressions, one dummy captures income in the bottom three deciles (low income), and one dummy is for the middle four deciles (middle income). High income is the excluded category. As for labor-market status, we include it since it may be that

[15] The EVS/WVS variables are averaged for two reasons: Long-time averages are arguably better measures of persistent levels, and using many waves greatly increases the number of countries available.

unemployment affects health negatively (over and above an effect through income). One dummy captures individuals who are out of the labor force (students, not employed and not looking for work, and retired) and another dummy is used for unemployed who look for work. Those employed is the omitted category. Happiness and life satisfaction are measured as described in the supplementary material: the reason to include them is to see whether self-assessed health captures well-being instead of health.

Individual-level variables for the parents. We have information on the education and labor-market status of the parents. A dummy indicates if the parent has an upper secondary or tertiary degree, and a dummy denotes if a parent was working when the respondent was 14 years old. Just like the individual's own education and employment status can have an effect, it could also be that the parents' education and employment situation influences the self-assessed health of their children.

Characteristics of the mother's country of birth. The log of the gross domestic product (GDP) per capita is used to measure the effect of economic development; Barro and McCleary (2003) find a negative correlation between development and religiosity, and Deaton (2008) show a positive relationship between national income and subjective health.

Health outcomes can also be transmitted across generations. To account for this, life expectancy at birth and infant mortality (per 1,000 births) are used. Income inequality has been argued to affect health (Wilkinson and Pickett 2009) and is accounted for through the Gini coefficient. These measures are from the World Development Indicators (WDI).[16] Institutional features are included to account for the quality of the legal and political systems, which may influence the degree to which inclusice policies, with potential health effects, are enacted and enforced. As measures we use the rule of law (from the WDI) and the degree of democracy (measured by the polity2 variable from Polity IV). Communist regime in 1970 is measured by a variable from Barro and McCleary (2003), and it is relevant since such regimes oppressed religion but also purported to provide healthcare for citizens irrespective of socioeconomic status.

We include the average health assessment for the countries where the mothers were born (from EVS/WVS). Social trust in the birth countries of immigrant parents predicts health (Ljunge 2014b). We control for trust, measured by the fraction of the population that expresses that "most people can be trusted." The measure of individualism is from Hofstede,

[16] We use the dataset compiled by Samanni, Teorell, Kumlin and Rothstein (2010). Using Gini data from The Standardized World Income Inequality Database yields similar results.

Hofstede and Minkov (2010). Data on average IQ in the ancestral country are from Lynn et al. (Lynn, Harvey and Nyborg 2009).[17] Following Falk, Becker, Dohmen, Enke, Huffman and Sunde (2018), we include risk-taking, patience and altruism in the mothers' country of birth as well. Motivations for including IQ and the three latter variables are provided in section 4.2.

Additional instruments. We use additional measures of religiosity of the mothers' birth country as instruments. The fraction non-religious in 1970 and 2000 are from Barro and McCleary (2003). Measures on what fraction consider themselves to be a religious person and the frequency of attending religious services are computed across the first five waves of the EVS/WVS.

3 Method

We use an instrumental-variable (IV) approach in the form of 2SLS to derive our results, using linear probability models throughout.[18] The approach is inspired by the epidemiological method (Fernández and Fogli 2006; Algan and Cahuc 2010; Fernández 2011; Ljunge 2014a,b), whereby an individual outcome of a migrant is modeled as a function of a characteristic of an ancestral country. An important feature of this method is that it enables the ruling out of reverse causality, since an individual outcome in a different country cannot affect the average characteristic of a country from which a parent migrated. The further advantage of using an ancestral country characteristic as an *instrumental* variable is that we model through what mechanism the influence occurs – in our case that ancestral country religiosity works through individual religiosity (as demonstrated by Bisin and Verdier (2011), through transmission of religiosity in the family[19]) in influencing health.

We begin the empirical analysis by estimating the following first-stage regression:

$$IR_{icat}=\alpha_0+ \alpha_1 R_a+\alpha_2 GDP_a+ \alpha_3 X_i+\gamma_{ct}+\zeta_{icat} \quad (1)$$

[17] The IQ has been validated by Lynn and Meisenberg (2010) as a measure of cognitive ability.

[18] For more information about this method, see pp. 2–3 of the supplementary material.

[19] There are more studies showing that religion is transmitted in families (Bisin and Verdier 2000; Bengtson, Putney and Harris 2013; Jacob and Kalter 2013; van de Pol and van Tubergen 2014).

where IR_{icat} is the individual self-assessed religiosity of individual *i*, born and residing in country *c* with a mother born in country *a* and a father born in country *c*, with $a \neq c$, in period *t*, and where R_a is the religiosity of country a. GDP_a is the log GDP per capita of country *a*, and X_i is a number of individual demographic and economic controls that may affect individual self-assessed religiosity. We include country of residence-by-year fixed effects, denoted by γ_{ct}. ζ_{icat} is the error term. All standard errors are clustered by the mother's birth country to allow for arbitrary correlations of the error terms among individuals whose mothers stem from the same country.

In the second stage, we estimate this regression:

$$\text{Individual self-assessed bad health}_{icat} = \beta_0 + \beta_1 \widehat{IR}_{icat} + \beta_2 GDP_a + \beta_3 X_i + \gamma_{ct} + \varepsilon_{icat} \quad (2)$$

where Individudal self-assessed bad health_{icat} takes the value 1 if individual *i* from country *c* with a mother from country *a* and father from country *c* at time *t* has reported one of the two worst health conditions on the five-category scale and 0 otherwise; where $\widehat{IR}_{icat}$ is the fitted value of individual self-assessed religiosity from (1); where GDP_a and X_i are defined as for (1); and where the time-by-year fixed effects, γ_{ct}, mean that the institutional structure and all other unobserved differences which apply to all residents in country *c* in period *t* are accounted for. They also mean that the variation used to identify the estimate is to compare the outcomes of individuals within each country of residence and year with their religiosity as predicted by maternal birth-country religiosity. Since the country fixed effects are included for each year, they account for non-linear trends that may differ across countries. Lastly, ε_{icat} is the error term (handled like the error term in (1)). The 2SLS-related assumptions are that R predicts IR and that ε_{icat} is uncorrelated with $\widehat{IR}_{icat}$, GDP_a and X_i.

4 Results

4.1 Main Results

Tables 1 and 2 present our main findings. The first column in each contains the most exogenous individual controls (age and gender). The second column includes more individual controls (marital status, education, labor force status and income). The third column also

contains the individual controls for the parents (education and whether the parent was working when the respondent was 14).

Table 1 reports the first-stage results (cf. equation (1)). They indicate that the average religiosity in the mother's country of birth is a strong and highly statistically significant ($p<0.01$) predictor of individual self-assessed religiosity. The point estimates are around 0.53, which means that if the average religiosity in the mother's country of birth increases by 1 unit (on the 5-unit scale), this predicts an increase in the individual self-assessed religiosity of 0.53 units (on the 10-unit scale).

Table 1 First-stage results

Dependent variable: Individual self-assessed religiosity			
Estimator:	OLS	OLS	OLS
	(1)	(2)	(3)
Religiosity,	0.524	0.534	0.527
mother's country of birth	(0.080)***	(0.082)***	(0.079)***
Log GDP per capita,	0.193	0.196	0.189
mother's country of birth	(0.128)	(0.128)	(0.129)
Age	-0.013	-0.026	-0.030
	(0.012)	(0.010)***	(0.011)***
Age squared/100	0.038	0.044	0.046
	(0.012)***	(0.012)***	(0.013)***
Female	0.883	0.862	0.867
	(0.065)***	(0.072)***	(0.072)***
Married		0.242	0.222
		(0.132)*	(0.129)*
Never married		-0.244	-0.244
		(0.165)	(0.164)
Upper secondary		-0.088	0.027
		(0.074)	(0.085)
College or university		-0.133	-0.077
		(0.109)	(0.109)
Outside the labor force		0.153	0.160
		(0.090)*	(0.091)*
Unemployed		-0.154	-0.160
		(0.161)	(0.160)
Low income		-0.121	-0.147
		(0.081)	(0.082)*
Middle income		-0.007	-0.011
		(0.086)	(0.082)
Upper secondary education,			-0.036
mother			(0.165)
Tertiary education, mother			0.101
			(0.138)
Upper secondary education,			-0.117
father			(0.171)
Tertiary education, father			-0.381
			(0.138)***
Working mother (at age 14)			-0.206
			(0.108)*
Working father (at age 14)			0.061
			(0.124)
Country−by−year fixed effects	Yes	Yes	Yes
Observations	5364	5364	5364

Standard errors in parenthesis and clustered on the mother's birth country. Individual data are from the European Social Survey rounds 2–8 (collected between 2004 and 2016). * p<0.1, ** p<0.05, *** p<0.01.

The second-stage results are presented in Table 2 (cf. equation (2)). Most notably, individual self-assessed religiosity predicts individual self-assessed bad health ($p<0.01$). The more religious the individual is, the higher is the probability of reporting bad health. The magnitude is furthermore sizeable. An increase in religiosity by 1 unit (on the 10-point scale) is associated with an increase in the share of people assessing their health to be bad of 6–7 percentage points (from a situation where the average of that share is around 8 percent). The effect size (beta coefficient) corresponds to 0.72.[20] The F-statistic has a comforting value of around 40, which indicates a strong instrument.

[20] The standardized effect is computed as the estimate for religiosity times the standard deviation of religiosity as a fraction of the standard deviation of health.

Table 2 Second-stage results

Dependent variable: Individual self-assessed bad health			
Estimator:	2SLS	2SLS	2SLS
	(1)	(2)	(3)
Individual self-assessed religiosity	0.071	0.065	0.066
	(0.023)***	(0.020)***	(0.021)***
Log GDP per capita,	-0.006	-0.004	-0.004
mother's country of birth	(0.010)	(0.009)	(0.009)
Age	-0.002	0.006	0.006
	(0.001)**	(0.001)***	(0.001)***
Age squared/100	0.005	-0.004	-0.004
	(0.001)***	(0.001)***	(0.001)***
Female	-0.034	-0.041	-0.042
	(0.020)*	(0.017)**	(0.017)**
Married		-0.059	-0.058
		(0.016)***	(0.016)***
Never married		0.015	0.017
		(0.017)	(0.017)
Upper secondary		-0.007	-0.020
		(0.013)	(0.011)*
College or university		-0.021	-0.011
		(0.011)*	(0.012)
Outside the labor force		0.066	0.065
		(0.012)***	(0.012)***
Unemployed		0.030	0.030
		(0.017)*	(0.017)*
Low income		0.036	0.036
		(0.015)**	(0.016)**
Middle income		0.005	0.005
		(0.010)	(0.010)
Upper secondary education,			-0.004
mother			(0.017)
Tertiary education, mother			-0.040
			(0.016)**
Upper secondary education,			0.015
father			(0.019)
Tertiary education, father			0.036
			(0.012)***
Working mother (at age 14)			0.012
			(0.012)
Working father (at age 14)			-0.008
			(0.010)
F-stat for exclusion of instrument	40.61	39.72	41.39
Country−by−year fixed effects	Yes	Yes	Yes
Observations	5364	5364	5364

Standard errors in parenthesis and clustered on the mother's birth country. Individual data are from the European Social Survey rounds 2–8 (collected between 2004 and 2016). * p<0.1, ** p<0.05, *** p<0.01.

The other predictors of bad self-assessed health, focusing on point estimates with p<0.01, are: age (in a decreasing pattern), being married (lower risk for bad self-assessed health), being outside the labor force (higher risk) and having a father with tertiary education (higher risk).[21] The robustness of the religiosity estimate to these additional controls indicates that the variation in religiosity does not correlate with labor-market-related parental characteristics that could influence child health. Lastly, the GDP per capita of the mother's country of birth does not significantly predict bad health.

4.2 Extended Analysis and Robustness Tests

To verify and enrich our results, we present a set of eleven extensions and robustness tests.

First, since there might be a concern that our main indicator of individual religiosity is not indicative of religious activity that may entail health effects, we replace individual self-assessed religiosity with the individual's religious attendance and replace the instrument in the second stage of the 2SLS analysis with, in one case, the average religious attendance of the mother's country of birth and, in another case, the average religious attendance of the mother's country of birth together with the share of non-religious people in 1970 (i.e., two instruments). We report the findings for the second stage in the new Table S4 in the supplementary material. As can be seen, religious attendance is positively related to bad health, just like self-assessed religiosity in our main analysis, indicating that our central finding is robust to changing the definition of religiosity in this manner. This should be seen in light of our instrumental-variable approach: The religiosity measure captures the culturally transmitted religiosity from the mother's country of birth – and, thus, the result should be interpreted as saying that those who attend many services because of having a mother who originates from a country where many go to church experiences worse health. This does not rule out that social features of religiosity can have a positive effect in other ways: Each study must be interpreted in accordance with its methodology and, in the case of 2SLS regression analysis, in light of the chosen instruments.

[21] The significant estimate on the tertiary education of the father is not a robust finding.

Second, we include health indicators from the mother's country of birth. One concern is that the health of the mother's country of birth is transmitted across generations and explains the result. We, therefore, add three indicators of health – one subjective and two objective – to column 3 of Table 2; see Table S5 in the supplementary material. In column 1, we add average self-assessed health in the mother's country of birth; in column 2, we add life expectancy; in column 3, we add infant mortality; and in column 4, we add them all. None of the measures significantly predicts individual self-assessed bad health, and individual self-assessed religiosity continues to predict it as these indicators are included. The point estimate in column 4 is similar in magnitude and remains strongly significant. We conclude that individual self-assessed religiosity does not proxy for health in the mother's birth country.[22]

Third, we include other characteristics from the mother's country of birth (by adding them to column 3 of Table 2) and report them in Tables S6, S7 and S8 in the supplementary material. In Table S6, we include three measures of formal institutions and a measure of income inequality. GDP per capita correlates with well-functioning institutions, so we include it in all specifications and again find that it does not relate to health in a significant way. Political institutions are captured by whether the regime was communist in 1970 and by the level of democracy. We include the first variable because communist regimes combatted religiosity. We find that the religiosity variable retains its relationship to bad health when controlling for communism, with no significant association between communism itself and bad health. Adding the democracy measure yields similar results: the point estimate is insignificant. Another measure of institutions is the rule of law. The point estimate is not significant, and its inclusion does not dampen the influence of religiosity. Lastly, Wilkinson and Pickett (2009) argue that income inequality leads to worse health, although this claim has been challenged (Bergh, Nilsson and Waldenström 2011). When including the Gini coefficient for income, the point estimate is not significant, and religiosity retains its influence. In the last column of Table S6, we present a cumulative model. Bad health is not significantly associated with any of the added variables, but religiosity is. In Table S7, we include two indicators of culture and one of cognitive ability. We first control for social trust, an influential cultural factor associated with a wide range of social and economic outcomes. Berggren and Bjørnskov (2011) find a negative relationship between religiosity and trust, and Ljunge (2014b) finds that trust predicts health.

[22] The correlation between self-assessed health and the objective health measure life expectancy in the mothers' birth countries is 0.76, indicating that both measures capture an objective dimension of health.

However, we do not find that the average trust of the mother's country of birth predicts bad health in our sample, while religiosity retains its predictive power (column 1). A second cultural characteristic, individualism, might affect people's well-being and health. Including it (in column 2) shows it to be marginally significant of very small magnitude. Religiosity retains its predictive power. We then examine cognitive skills, which are potentially important for how knowledgeable people about how to lead a healthy life. If there are systematic differences between religious and non-religious people with regard to, e.g., IQ, this could influence how people, in each group, view and take in science-based information. There are some indications that IQ is lower and analytic thinking is weaker among religious people (Lynn, Harvey and Nyborg 2009; Gervais and Norenzayan 2012; Zuckerman, Silberman and Hall 2013). If so, this may entail less reliance on evidence, e.g., with regard to how to live in order to achieve certain goals (such as health).[23] This observation raises the possibility that intelligence, rather than religiosity, is associated with health. However, when including IQ in the mother's birth country, we find no support for a strong link to bad health, while religiosity retains its significance. Lastly, we include three indicators of economic preferences: risk-taking, patience and altruism. It is conceivable that religiosity in the mother's country of birth affects individual health through these factors rather than through individual self-assessed religiosity.[24] However, the findings of Table S8 in the supplementary material indicate that this is not the case: none of them are statistically significant predictors of health, neither when included individually or together, while religiosity retains its statistical significance. In all, we think this extensive set of tests should assuage concerns about omitted-variable bias (but note that we, in addition, add maternal birth country fixed effects in an exercise in the section "Effects by gender and evidence of mechanisms" as well to further address this concern).

Fourth, we include more instrumental variables of religiosity, to examine if there is evidence against the exclusion restriction, i.e., that maternal birth country religiosity affects health in other ways than through individual self-assessed religiosity. In Table S9 in the supplementary material, we add four additional instruments from the mother's birth country to our main one. The additional instruments are the non-religious fraction in 1970 and in

[23] There are also indications that cognitive skills are transmitted from parents to children (Coneus, Laucht and Reuß 2012).

[24] For example, Deaton (2011) remarks that time preference, captured by patience here, could affect both religiosity and health.

2000, the share that considers itself to be a religious person and the average attendance at religious services. When adding these, first one at a time and then cumulatively in two specifications, we see that the fitted religiosity measure retains its standing as a predictor of bad health in all cases, with both magnitude and significance levels virtually unchanged. The F-statistic is in each case above 10; and since we now use more than one instrument, we can derive the Hansen J statistic. We see that the p-values in all cases are such that we cannot reject the null (that the overidentification restrictions are valid). This reduces a possible concern that different aspects of religiosity are driving the results (Zimmer, Rojo, Ofstedal, Chiu, Saito and Jag 2019), and the tests provide evidence that the exclusion restriction is not violated.

Fifth, we control for happiness and life satisfaction. One potential problem with self-assessed bad health is that people might report their health status based on how they experience life in general, making self-assessed health a measure of happiness or life satisfaction rather than an indicator of actual health. In addition to controlling for the happiness and life satisfaction of the individuals in our sample, we also use happiness and life satisfaction as outcome variables. We report our findings in Table S10 in the supplementary material. Reassuringly, the results are robust to controlling for individual happiness, subjective well-being and both. When we use happiness and life satisfaction as dependent variables, neither is significantly predicted by religiosity. These results indicate that the baseline results are not due to religiosity changing the individual's mental state in a manner unrelated to health.

Sixth, Zimmer, Rojo, Ofstedal, Chiu, Saito and Jag (2019) find differing effects of religion on health in different countries. Our study compares individuals born and residing in the same European country but with different religiosity as predicted by European maternal birth-country religiosity. We, therefore, investigate what happens to our main result when we change the sample, in four different ways.[25] (i) We apply sample restrictions as reported in Table S11 in the supplementary material. When we, in turn, exclude Russia, Germany, Scandinavia and Turkey as ancestral countries, as well as residents in the Baltics,[26] the results

[25] In addition, we have investigated whether effects differ depending on whether countries of residence are Catholic or not, and we do not find any statistically significant difference. Hence, it seems as if is religiosity as such, rather than belonging to a particular denomination, that is important.

[26] Russia and Germany are the two largest ancestral groups. Scandinavians could be particularly secular, while Turkish ancestry could be particular since most are Muslims and Europe is overwhelmingly Christian. The Baltics are excluded since most immigrants have Russian ancestry.

do not change much – religiosity retains its importance as a predictor of bad health, indicating that the results are not driven by a particular, possibly atypical country or group of countries.[27] (ii) We next expand the set of maternal birth countries from only European countries to all that are available, 80 in total. This includes countries that are quite different culturally and institutionally, but the main results hold for this sample as well – see the last column of Table S10 in the supplementary material. Religiosity is strongly significant ($p<0.01$) with a point estimate of 0.074, which is not statistically different from the European sample. We have undertaken all robustness checks with this sample as well, and they are qualitatively similar (available upon request). (iii) We then change the parental combination such that the father is an immigrant and the mother a native. As seen in Table S12 in the supplementary material, the influence of religiosity from an ancestral country works through the mother, not the father. When the father alone is an immigrant, religiosity is no longer statistically significant, and the point estimate is reduced from 0.066 to 0.015. (iv) We lastly exclude the most and least religious individuals and maternal birth countries. One reason for such an exercise is that minorities are sometimes persecuted in highly religious countries and that the mother migrated because she had different or no religious beliefs and practices. An average measure of religiosity from her birth country may, therefore, be mismeasured as an indicator of the religiosity she brings to her family. There are three reasons for not regarding this potential problem as a reason for worry. First, this would constitute a mismeasurement that would bias the estimated coefficient of religiosity towards zero. Still, we get significant estimates that are substantive. Second, we measure religiosity, not specific religious beliefs, which means that even though a mother may have disagreed with dominant beliefs, she may still be as religious, in terms of the strength of beliefs and in terms of religious practice, as the others of their home country. Third, in Table S13 in the supplementary material, we show that the results stand when we exclude the most and least religious individuals or the most and least religious maternal birth countries. To begin with, we exclude the most religious, the least religious and both the most and least religious individuals (that report their religious degree as 0 or 10 on the 0–10 scale). We exclude the three most religious maternal birth countries (Turkey, Malta and Georgia) in the fourth column. We then exclude the three least religious

[27] There is not much variation in the kind of religion that dominate the mothers' birth countries: Since they all stem from Europe, almost all are from nations characterized by Christianity. When checking, through sample restrictions, whether Protestant, Catholic or Orthodox Christianity display differential effects, we do not find any evidence that they do – it is the strength of the religious commitment or belief that matters.

maternal birth countries (the Czech Republic, Estonia and Germany), and lastly both the three most and three least religious countries. The religiosity variable is still significant in all these cases.[28]

Seventh, there could be a problem if very religious children are atypical in the countries in which they are born, which in itself could affect their health instead of religiosity as such doing so. In other words, it might be the lack of integration that explains our findings. Since we conduct our main analysis on a sample where the father is a native, this problem should be minimal. Still, we undertake a further test by including an indicator of non-integration – if a second language is spoken at home –in our baseline regressions (Bleakley and Chin 2004). Reassuringly, this does not change the result that religiosity predicts bad health in any qualitative sense. The second-language indicator is itself insignificant – see Table S14 in the supplementary material.

Eighth, an alternative to using 2SLS is to use ancestral-country religiosity directly in an OLS regression. This specification corresponds to a "reduced-form" or intention-to-treat model of a two-stage model – see Table S15 in the supplementary material. Religiosity in the mother's country of birth is directly related to individual self-assessed bad health, and the point estimate is 0.035 ($p<0.01$), indicating a positive relationship between a religious background and self-assessed bad health. The overall finding is qualitatively the same as in our 2SLS analysis.

Ninth, according to Ferrier-i-Carbonell and Frijters (2004) it usually does not matter if one defines variables like health in a dichotomous or continuous manner. Still, we have also carried out our analysis with a continuous definition of self-assessed health. The results are the same (as reported in Table S16 in the supplementary material): The more religious the individual, as predicted by maternal birth country religiosity, the worse is the self-assessed health ($p<0.01$).

Tenth, we have added two types of individual control variables to the analysis of Tables 1 and 2: whether the individual is a widow/widower and how urban the kind of place the individual resides in is. The idea is that both could influence both religiosity and health. However, we find that neither matters for individual self-assessed bad health, and the

[28] This exercise also addresses concerns that people do not reply honestly to surveys about religiosity in very religious countries out of fear. Since our results hold when excluding the most religious countries, we consider it likely that the results are not driven by such behavior.

estimated coefficient for self-assessed religiosity remains unchanged and statistically significant. See Table S18 in the supplementary material.

Eleventh, we have used two-way clustering of the standard errors, clustering on the country of residence as well as the mother's country of birth, and the standard errors do not change much when doing this.

4.3 Effects by Gender and Evidence of Mechanisms

As the last analysis, we investigate whether the negative effect of religiosity on health differs by gender. We begin by using the reduced-form or intention-to-treat model of Table S15 in the supplementary material, as described in the section "Extended analysis and robustness tests", to which we add two things: an interaction term between being female and the religiosity of the mother's country of birth and maternal birth country fixed effects. The inclusion of the latter means that we as account for all constant maternal birth country factors, both unobserved and observed such and GDP per capita and religiosity in the maternal birth country. These controls are a powerful way to reduce further concerns that unobserved background factors influence the findings. The interaction term captures the differential effect of maternal religiosity on health for women compared to men. As can be seen in Table S17 of the supplementary material, the interaction term is strongly significant, and the size of the estimate indicates that the whole effect of religiosity on health goes through women.[29]

We next carry out 2SLS regressions separately for women and men, using the model of column (3) of Table 2. The results of are presented in Table S19 in the supplementary material and show that there is a strong effect of religiosity (as transmitted from the maternal side of the family) on women, such that it is related to bad health, while there is no effect for men.[30]

[29] The result is similar when running the ordinary least squares model of column (3), Table 2, separately for women and men: strongly significant and positive estimate for women and close to zero and insignificant for men. We also tested the same model using the entire sample of the ESS (185,000 women and 159,000 men), and again found a positive estimate for how religiosity is related to bad health for women and a close-to-zero estimate for men. Results are available on request.

[30] Due to the smaller samples when separating the genders, the first-stage results are estimated less precisely, which in turn makes it challenging to perform additional robustness checks in the gender subsamples. The point estimate on religious degree becomes higher for women and so does the standard error, resulting in a wide

These results provide further insights into how religion affects health: it seems clear that it concerns females only in our European context. A possible explanation is that a religious culture and family life may be characterized, to a larger degree than a non-religious alternative, by stricter gender roles, entailing an expectation to marry, to have (more) children, to not have abortions, to not use contraceptives, to be less active in the labor market, etc. Such requirements could arguably have health effects. An aspect of this is that men could be more autonomous, in a religious context, to shape their lives as they wish than women, making the latter more influenced by transmission of religion in the family.

What these results imply is that the mechanisms from self-assessed religiosity to self-assessed bad health should involve women differently than men. As a preliminary way to investigate this, we have conducted 2SLS regressions with several outcome variables. First, we look at whether religiosity affects women and men differently along standard socioeconomic lines: income, education, labor-market participation, being married and having children. The only variable we find to differ is marriage, where religiosity indicates a lower probability of women being married. Since marriage tends to be positively associated with health, this is one possible mechanism through which religiosity can lead to bad health for women. Results are available on request.

Second, we look at whether three cultural attitudes are held differently by women and men. As reported in Table S20 in the supplementary material, holding the attitude that it is important to be humble and modest is affected positively by religiosity in the case of women, while there is no significant relationship for men. This finding points at a mechanism whereby religious women subjugate themselves and do not assert themselves in the same way religious men do. The second value is whether it is important to follow traditions and customs. Religiosity reinforces it for both women and men, but the point estimate is 50% higher for women compared to men. This result suggests a mechanism whereby women and men accept traditional gender roles, causing women to take a less assertive and a less autonomous role and men to uphold it from their end. Lastly, we look at whether the value that it is important to live in safe and secure surroundings matters differentially, and it does: while religiosity is negatively linked to it for women, it is not related to this value in men. It may be taken to suggest a mechanism through which women feel more secure by dint of being religious and thus choose to visit and live in neighborhoods that are less safe and secure, although we

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confidence interval for the true effect. The point estimate for men is close to zero with a standard error like the baseline specification, consistent with a zero true effect.

readily admit this is speculative. Conversely, it could be that men tend always to feel safe and secure and are less affected by religiosity in this regard.

Taken together, these findings do not constitute certain evidence of mechanisms relating religiosity to bad health in women, but they are indications consistent with the theoretical idea that the differential results can emanate from religions bestowing women with less autonomy concerning central life choices than men.[31]

5 Discussion and Conclusions

Buddha said: "Without health life is not life; it is only a state of languor and suffering – an image of death." It expresses a common attitude throughout the world: Bad health should be avoided, and good health is valued very highly, as it is thought to contribute to better, happier lives. Hence, it becomes important to clarify what the key determinants of health are. It has been proposed that *religion* is one such determinant of health – and most previous studies suggest that it has a positive effect.

However, our analysis of a large European dataset documents the opposite relationship: individual self-assessed religiosity predicts individual self-assessed *bad* health. The more religious the person is, as evaluated by her- or himself, the more likely he or she is to report very bad or bad health. The result withstands many robustness tests.

One contribution of our study is a design that allows us to make a case for a causal interpretation of the results, from religiosity to health. We accomplish this by focusing on a sample of Europeans with a father born in the same country and an immigrant mother born in

[31] The theoretical idea, and the results, are also broadly consistent with studies that indicate that individuals with strong religious commitments are less likely than secular individuals to hold egalitarian gender-role attitudes (Diehl, Koenig and Ruckdeschel 2009) and that more religious societies are less gender equal (Klingorová and Havlíček 2015; Schnabel 2016). Furthermore, it is certainly conceivable that factors that previous studies have shown can explain how religiosity affects health negatively could affect women more strongly than men, but we cannot test them with our data. For example, a negative effect of religiosity on health could result from religious people being less concerned with life on earth, including physical exercise (Feinstein, Liu, Ning, Fitchett, and Lloyd-Jones 2010; Kortt and Dollery 2014), being more "fatalistic" and not dealing with negative developments (Azaiza, Cohen, Awad and Daoud 2010), having been subjected to bad treatment as children, e.g., corporal punishment, genital mutilation, sexual assault or no vaccination (Grogan-Kaylor and Otis 2007; Jegede 2007; Terry 2008; Gershoff 2010; Cappa, Moneti, Wardlaw and Bissell 2013) or being more mentally strained by internal or external conflicts (Exline 2002; Ellison and Lee 2010; Hill and Cobb 2011).

another European country. We use maternal birth country religiosity as an instrument for individual self-assessed religiosity. Our results indicate that the religiosity transmitted from mother to child is an important determinant of self-assessed health. However, we find that this effect is concentrated among women, suggesting that cultural and family-based transmission of religiosity constrains and shapes women's lives in a particular way, with harmful health effects as result. An important factor here is arguably the degree of autonomy with which women in religious contexts can lead their lives in matters of family and work. Our analysis that explore mechanisms of why religiosity is negatively related to health in women but not in men indicates that more traditional values are reinforced by religiosity, especially in women, which supports such an interpretation.

While we believe that we make a distinct contribution in providing new knowledge about the complex manner in which religiosity can influence health, the results should be interpreted with a realization that the study and methodology have certain limitations. First, we use self-assessed health, and it is a somewhat contested issue to what degree it corresponds to objective health outcomes. Second, we primarily use self-assessed religiosity as our indicator of religiosity, but as previous studies illustrate, there are other indicators, such as activities (attendance, prayer, fasting, social work, etc.) and membership of a particular organization. Even though we religious attendance as well, it bears noting that further research might be needed to shed light on more complex patterns involving other indicators. Third, using an instrumental-variable approach in the way we do is valuable for reducing problems of endogeneity; but one downside is that the interpretation of the results must be carried out carefully, noting that it is the culturally transmitted aspect of religiosity that drive the results. Fourth, our sample has been carefully selected to allow for the ruling out of reverse causality, while retaining a great degree of similarity to the general population. Still, the studied individuals do have an immigrant mother, which may reduce generalizability to some degree and which gives reason for some caution with regard to what can be concluded about other samples.[32] Lastly, our separate study of effects for women and men is still

[32] Still, it bears noting that for generalizability to make sense, one needs to have obtained an interpretable estimate, and we believe we have obtained an estimate that we can interpret as an effect of religiousness on health. This contrasts with much of the literature, as it does not address reverse causality, and for that reason, correlations obtained without an ability to rule out reverse causality cannot readily be generalized in a meaningful way. Hence, it can arguably be claimed that we are in a better position to offer generalizability even with an inclusion of mothers from another European country.

preliminary in that it does not provide causal identification of gender-specific mechanisms. We hope to deepen this analysis in future work.

Our findings do not rule out that religion can also have positive health effects in some ways (e.g., by providing social support, comfort, meaning, rules against certain risky types of behavior and health care) and for certain groups of people, but for with our measures and for our European sample, we find that the negative effects dominate for females. It also bears noting that our instrumental-variable approach singles out the effect of intergenerationally persistent religiosity on health. Such effects could conceivably differ from contextually induced religiosity, such as being paired with religious peers, that could activate benefits of group membership to a greater degree.

One important insight from our research is that it is essential to use empirical methods that allow for a clear interpretation. We not only show that self-assessed religiosity is linked to self-assessed bad health in our European sample, but also, by using an instrumental-variable approach, that this is *not* because people who perceive themselves to be sick turn to religion.

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