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# ABSTRACT

# Religion and Innovation*

In earlier work (Bénabou, Ticchi and Vindigni 2013) we uncovered a robust negative association between religiosity and patents per capita, holding across countries as well as US states, with and without controls. In this paper we turn to the individual level, examining the relationship between religiosity and a broad set of pro- or anti-innovation attitudes in all five waves of the World Values Survey (1980 to 2005). We thus relate eleven indicators of individual openness to innovation, broadly defined (e.g., attitudes toward science and technology, new versus old ideas, change, risk taking, personal agency, imagination and independence in children) to five different measures of religiosity, including beliefs and attendance. We control for all standard socio-demographics as well as country, year and denomination fixed effects. Across the fifty-two estimated specifications, greater religiosity is almost uniformly and very significantly associated to less favorable views of innovation.

JEL Classification: D83, O31, O35, O43, Z1, Z12

Keywords: innovation, creativity, science, technical progress, ideas, risk-taking, growth, religion, beliefs, attitudes, values, tolerance, dogma, culture

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*Nihil Sub Sole Novum. (Ecclesiastes 1:9)*

# 1 Introduction

It would be surprising –perhaps even a miracle– if a social phenomenon as complex as religion had unambiguous effects on economic growth and welfare, rather than relating to it through numerous channels and generating tradeoffs.[1] Two main mechanisms have been emphasized in the economics literature, both with generally positive effects: social norms and trust on one hand, literacy and education on the other. In this and related work we explore a novel one, namely the relationship between *religiosity* and *innovation* –both as an individual propensity and as an aggregate outcome– and find it to be robustly negative.

Guiso, Sapienza and Zingales (2003), using the World Values Survey (WVS), found more religious persons to be more trusting –of other people, public institutions, and market outcomes– as well as more trustworthy: less willing to break the law, accept a bribe, cheat on taxes, and the like. Theoretical models, similarly, have emphasized how beliefs in divine rewards and punishments (or a Calvinistic desire to self-signal one's predestined fate) can induce individuals to behave less opportunistically and more cooperatively, which can in turn make such beliefs self-sustaining at the social level.[2]

Religiosity thus seems to be associated to what Guiso et al. describe as certain "societal attitudes... conducive to higher productivity and growth."[3] The ultimate driver of long-run growth, on the other hand, is technical progress and more generally the whole spectrum of *innovation*: from advances in basic science to the diffusion of new technologies (e.g., Mokyr (2004)), economic practices and even social change, such as the inclusion of women in production and idea-creation. It therefore seems equally important to examine the extent to which religious beliefs, values and institutions may be conducive

[1] In a cross-country analysis, Barro and McCleary (2003) find mixed results: belief in heaven and hell has a positive effect on growth, whereas religious attendance has a negative one.

[2] Bénabou and Tirole (2006, 2011), Levy and Razin (2012).

[3] The relationship with education is much more contrasted and complex; see Section 5 for details.

or detrimental to creativity and innovation. Doing so means, in a sense, revisiting with modern methodologies the age-old theme of religion's often tense relationship with science, free thought and disruptively novel ideas.

## 2 Religion and Innovation: Countries and U.S. States

In Bénabou, Ticchi and Vindigni (2013), we uncovered a striking fact: across countries as well as across U.S. states, there is a significant *negative relationship* between *religiosity and innovation,* where the latter is measured by (log) patents per capita. Although previously unnoticed in the literatures on growth/innovation and on the economics of religion, this finding is very robust: the results hold for alternative measures of religiosity (the same five that will be used here) and persist after controlling for income per capita, population, fraction with tertiary education, patent-rights protection, foreign investment and (across countries) religious freedom.

To analyze the coevolution of religious beliefs and scientific-economic development, we then developed a model with the following key features: (i) the recurrent arrival of discoveries which, if widely diffused, generate productivity gains but sometimes erode existing religious beliefs (a source of utility for some agents) by contradicting important aspects of the doctrine; (ii) a government, endogenously reflecting the interests and strengths of religious versus secular classes, that can allow such ideas and innovations to spread, or act to censor them and impede their diffusion; (iii) a Church or religious sector that can invest in adapting the doctrine to render it more compatible with the new knowledge.

Three types of long-term outcomes emerge. The first is a "Secularization" or "Western-European" regime, with declining religiosity, unimpeded scientific progress, a passive Church and high levels of taxes and secular public spending or redistribution. The second is a "Theocratic" regime with knowledge stagnation, extreme religiosity, a Church that makes no effort to adapt since its beliefs are protected by the state, and also high taxes but now used to subsidize the religious sector. In-between these two is a third,

"American" regime, which generally (not always) combines unimpeded scientific progress and stable religiosity within a range where the state does not block new knowledge and the religious sector finds it worthwhile to invest in doctrinal adaptation. This regime features lower taxation than the other two, together with specific exemptions or other policies (e.g., laws regulating behavior) benefiting religious activities and citizens. Examining how strategic coalitions form across both economic and religious/secular lines, we also show that, in this "American" regime, a rise in income inequality can lead the rich to form a "Religious-Right" alliance with the religious poor and start blocking belief-eroding discoveries and ideas.

# 3 Religiosity and Openness to Innovation: People

In this paper we turn to the relationship, at *the individual level*, between religiosity and a broad set of pro- or anti-innovation attitudes. Working with large-scale individual datasets avoids some of the standard problems of cross-country regressions, and the use of a wide spectrum of attitudinal values broadens our investigation of religiosity and innovation beyond patent outcomes, as well as beyond the political-economy channel emphasized in our earlier work.

## 3.1 Data and Key Variables

Using all available waves of the World Values Survey (1980, 1990, 1995, 2000, and 2005), we regress eleven attitudinal measures of openness to innovation on five alternative measures of religiosity, together with a large number of sociodemographic controls.[4]

The measures of individual religiosity used are: identifying as a *Religious Person, Belief in God, Importance of Religion* and *Importance of God* in your life, and finally

[4]Our focus is with attitudes within the general public. There is also a (highly US-centered) sociology literature on the religious beliefs of scientists and other academics (who, as a whole, are considerably less religious than average), including how these may or may not differ across disciplines, remain stable over time, or result from self-selection versus training. Ecklund and Scheitle (2007) offer a good recent survey and empirical study.

*Church Attendance.* All signs are (re)normalized so that higher values correspond to being more religious. Individual-level controls for which we will report estimated coefficients include *Age, Gender,* self-identified *Social Class, Education* level and *Income* level.[5]

We also include religion-specific dummies at the very fine level of detail provided by the WVS (almost 90) but do not report them in this version, for two reasons. First, our primary aim is to examine the effects of *religiosity as a general phenomenon,* and only later on detail possible differences across faiths.[6] Moreover, the latter step will require aggregating the WVS's numerous denominations of the WVS into a more manageable 10 or so major religions. Further controls in all our regressions (coefficients also not reported) include dummies for the size of the town in which the individual lives, country dummies, and year dummies.[7]

Turning now to left-hand-side variables, we use three main categories, corresponding roughly to concentric circles around the core issue of scientific and technical innovation.

*1. Attitudes toward science and technology.* We use respondents' levels of (dis)agreement with the following three questions:

(i) "We depend too much on science and not enough on faith" (E220).

(ii) "Science and technology make our way of life change too fast" (E219).

(iii) "The world is better off because of science and technology" (E234).

*2. Attitudes toward new ideas, change, and risk-taking.* The next five variables capture a person's more general openness or aversion to novelty and change, originating from themselves or others.

The first two focus on general novelty and personal creativity:

(i) Judging which are better, "Ideas that stood the test of time" or "New ideas" (E046).

[5] For the last three we use the cardinal value of the WVS index (as in, e.g., Guiso et al. (2003)). Including separate a dummy for each category leads to similar results.

[6] Our results on religiosity are robust to including or dropping the denominational dummies.

[7] The regression results including all the coefficients on all (nearly 100) control variables and dummies are not reported here due to space constraints, but are available from the authors upon request.

(ii) Self-recognition in a hypothetical other described as "It is important to this person to think up new ideas and be creative; to do things one's own way" (A189).

The next two questions deal with attitudes toward general change and risk-taking:

(iii) "I worry about difficulties changes may cause", versus "I welcome possibilities that something new is beginning" (E047).

(iv) Self-recognition in a hypothetical other described as "Adventure and taking risks are important to this person; to have an exciting life" (A195).

The fifth variable captures the respondent's perceived "locus of control":

(v) Agreement with "Everything is determined by fate", versus "People shape their fate themselves" (F198).

*3. Child qualities.* WVS respondents were given a list of eleven "Qualities that children can be encouraged to learn at home," and asked to pick the five they considered "especially important". We selected those most directly related to our inquiry, namely *Imagination* (A034), *Independence* (A029) and *Determination / Perseverance* (A039).

For convenience, all eleven attitudinal variables are (re)normalized so that higher values correspond to being more open to science, innovation, change, imagination, etc.

# 4 Results

## 4.1 Science and Technology

For two of the three attitudinal variables examined in Table 1, all five measures of religiosity are consistently associated with more negative views of scientific progress. As shown in Columns 1-8, someone who identifies as a *Religious Person,* or who reports a greater *Importance of Religion, Importance of God* or *Church Attendance,* is significantly more likely ($p < 1\%$) to think that "we depend too much on science and not enough on faith" and that they "make life change too fast". For the third question –whether the "world is better off because of science and technology"– on the other hand, the estimated

# Table 1: Attitudes Toward Science and Technology

| Dependent variable: | (1) *Too much dependence on science vs faith: disagree (E220m)* | (2) *Too much dependence on science vs faith: disagree (E220m)* | (3) *Too much dependence on science vs faith: disagree (E220m)* | (4) *Too much dependence on science vs faith: disagree (E220m)* | (5) *Science & technology change life too fast: disagree (E219m)* | (6) *Science & technology change life too fast: disagree (E219m)* | (7) *Science & technology change life too fast: disagree (E219m)* | (8) *Science & technology change life too fast: disagree (E219m)* | (9) *Science & technology make world better off: agree (E234)* | (10) *Science & technology make world better off: agree (E234)* | (11) *Science & technology make world better off: agree (E234)* | (12) *Science & technology make world better off: agree (E234)* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Religious person* | −0.232*** | | | | −0.181*** | | | | 0.032 | | | |
| | (0.047) | | | | (0.039) | | | | (0.039) | | | |
| *Importance of religion* | | −0.419*** | | | | −0.137*** | | | | −0.019 | | |
| | | (0.024) | | | | (0.021) | | | | (0.020) | | |
| *Importance of God* | | | −0.144*** | | | | −0.094*** | | | | 0.024*** | |
| | | | (0.009) | | | | (0.007) | | | | (0.007) | |
| *Church attendance* | | | | −0.046*** | | | | −0.007 | | | | −0.002 |
| | | | | (0.009) | | | | (0.007) | | | | (0.007) |
| *Female* | −0.080** | −0.038 | −0.038 | −0.091*** | −0.045* | −0.051* | −0.025 | −0.055** | −0.134*** | −0.125*** | −0.139*** | −0.134*** |
| | (0.032) | (0.031) | (0.032) | (0.033) | (0.027) | (0.027) | (0.027) | (0.028) | (0.027) | (0.027) | (0.027) | (0.028) |
| *Age* | −0.004*** | −0.002** | −0.003** | −0.004*** | −0.002** | −0.002** | −0.002* | −0.002** | 0.000 | 0.000 | −0.000 | 0.000 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| *Education* | −0.006 | −0.008 | −0.007 | 0.002 | −0.047*** | −0.049*** | −0.048*** | −0.042*** | 0.056*** | 0.057*** | 0.057*** | 0.059*** |
| | (0.009) | (0.009) | (0.009) | (0.009) | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) | (0.008) |
| *Social class* | −0.037* | −0.038* | −0.032 | −0.048** | 0.004 | 0.003 | 0.010 | 0.004 | 0.028 | 0.029* | 0.026 | 0.043** |
| | (0.020) | (0.020) | (0.020) | (0.021) | (0.017) | (0.017) | (0.017) | (0.018) | (0.018) | (0.018) | (0.017) | (0.018) |
| *Income* | 0.042*** | 0.038*** | 0.035*** | 0.044*** | 0.015** | 0.016** | 0.013 | 0.018** | 0.074*** | 0.075*** | 0.076*** | 0.069*** |
| | (0.009) | (0.009) | (0.009) | (0.010) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) |
| *Constant* | −6.435*** | −7.960*** | −5.908*** | −6.829*** | −7.520*** | −8.051*** | −7.146*** | −7.703*** | 4.743*** | 4.674*** | 4.660*** | 4.746*** |
| | (0.290) | (0.297) | (0.293) | (0.312) | (0.247) | (0.256) | (0.250) | (0.267) | (0.204) | (0.216) | (0.205) | (0.227) |
| *Observations* | 31978 | 32512 | 32466 | 30427 | 32413 | 32983 | 32921 | 30883 | 32651 | 33199 | 33162 | 31198 |
| *Adjusted $R^2$* | 0.140 | 0.148 | 0.149 | 0.141 | 0.067 | 0.067 | 0.072 | 0.069 | 0.098 | 0.096 | 0.098 | 0.094 |

OLS estimates. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%. All regressions include controls (not reported) for country, town size, religious denomination and year. *Belief in God* has not been included because of the absence of observations.

coefficients vary in sign across measures of religiosity and are generally not significant: see Columns 9-12.

Among the main controls, having higher *Income,* a lower *Age* and being *Male* always have the expected "pro-science" sign, with high significance. So does *Education* in seven out of the twelve columns, but in one it has the opposite sign and in four others it is not significant. *Social Class* has an inconsistent sign and is often not significant.

## 4.2 New Ideas, Change and Risk-Taking

We turn in Tables 2a-2b to five more general indicators of openness to new ideas, change, risk-taking and agency. Of the five pro-novelty attitudes, four have a consistently negative and almost always highly significant relationships to *each* of the five indicators of religiosity. Such is the case for *"New Ideas Better than Old Ones", "Importance of Risk Taking",* belief that *"People Shape their Own Fate"* and *"Welcoming vs. Worrying about Change".* The one exception is self-identification with a person described as attaching high importance to *"Having New ideas and Being Creative",* for which religiosity measures have a positive and significant effect.

While it should certainly be kept in mind as a caveat to the other results, this is in fact the *only one* among the eleven "innovation-friendliness" variables analyzed in the paper for which the negative relationship with religiosity reverses, thus representing somewhat of a puzzle.[8]

Throughout Tables 2a-2b, *Income, Education* and *Social Class* always have the predicted signs and high significance. Similarly, *Female* is always associated with a lower taste for risk (in line with the experimental literature) and novelty-seeking. Note, finally, that the last five columns of Table 2b use the same variable (*Welcome Change*) as the preceding five, but with a more restricted set of control variables, for which we are able

[8]One also notes that: (i) the raw correlations of E047 with religiosity indicators are significantly negative; (ii) Unlike the other ten attitudinal questions, its distribution is highly skewed: 75% of people respond "very much like" to "somewhat like", far fewer "a little like", and almost none "not like/not at all like". Whether this variable's extreme skewness bears some relationship to the atypical results obtained with it, or whether the reason lies elsewhere, will be worth examining further.

Table 2a: Attitudes Toward New vs. Old Ideas, Creativity, and Risk-Taking

| Dependent variable: | (1) *New ideas are better than old: agree (E046)* | (2) *New ideas are better than old: agree (E046)* | (3) *New ideas are better than old: agree (E046)* | (4) *New ideas are better than old: agree (E046)* | (5) *New ideas are better than old: agree (E046)* | (6) *Imp. of new ideas & being creative: agree (A189m)* | (7) *Imp. of new ideas & being creative: agree (A189m)* | (8) *Imp. of new ideas & being creative: agree (A189m)* | (9) *Imp. of new ideas & being creative: agree (A189m)* | (10) *Imp. of new ideas & being creative: agree (A189m)* | (11) *Imp. of adventure & risk taking: agree (A195m)* | (12) *Imp. of adventure & risk taking: agree (A195m)* | (13) *Imp. of adventure & risk taking: agree (A195m)* | (14) *Imp. of adventure & risk taking: agree (A195m)* | (15) *Imp. of adventure & risk taking: agree (A195m)* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Religious person* | −0.197*** | | | | | 0.073*** | | | | | −0.094*** | | | | |
| | (0.037) | | | | | (0.020) | | | | | (0.023) | | | | |
| *Importance of religion* | | −0.013 | | | | | 0.039*** | | | | | −0.038*** | | | |
| | | (0.017) | | | | | (0.011) | | | | | (0.012) | | | |
| *Belief in God* | | | −0.131** | | | | | 0.067 | | | | | −0.903* | | |
| | | | (0.063) | | | | | (0.456) | | | | | (0.522) | | |
| *Importance of God* | | | | −0.001 | | | | | 0.015*** | | | | | −0.022*** | |
| | | | | (0.006) | | | | | (0.004) | | | | | (0.004) | |
| *Church attendance* | | | | | −0.022*** | | | | | 0.024*** | | | | | −0.006 |
| | | | | | (0.007) | | | | | (0.004) | | | | | (0.004) |
| *Female* | −0.084*** | −0.098*** | −0.105*** | −0.098*** | −0.082*** | −0.141*** | −0.146*** | −0.156*** | −0.146*** | −0.139*** | −0.309*** | −0.314*** | −0.299*** | −0.310*** | −0.317*** |
| | (0.028) | (0.027) | (0.028) | (0.028) | (0.027) | (0.014) | (0.014) | (0.049) | (0.014) | (0.015) | (0.016) | (0.016) | (0.060) | (0.016) | (0.017) |
| *Age* | −0.018*** | −0.018*** | −0.018*** | −0.018*** | −0.018*** | −0.005*** | −0.005*** | −0.004** | −0.005*** | −0.005*** | −0.016*** | −0.016*** | −0.025*** | −0.016*** | −0.016*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.001) | (0.001) |
| *Education* | 0.013* | 0.011 | 0.014* | 0.012 | 0.010 | 0.059*** | 0.059*** | 0.074*** | 0.059*** | 0.059*** | 0.011** | 0.012*** | 0.019 | 0.012*** | 0.011** |
| | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) | (0.004) | (0.004) | (0.011) | (0.004) | (0.004) | (0.004) | (0.004) | (0.014) | (0.004) | (0.005) |
| *Social class* | 0.054*** | 0.053*** | 0.054*** | 0.053*** | 0.055*** | 0.076*** | 0.075*** | 0.002 | 0.074*** | 0.080*** | 0.063*** | 0.061*** | −0.018 | 0.060*** | 0.058*** |
| | (0.017) | (0.017) | (0.017) | (0.017) | (0.017) | (0.009) | (0.009) | (0.033) | (0.009) | (0.009) | (0.010) | (0.010) | (0.040) | (0.010) | (0.011) |
| *Income* | 0.020*** | 0.025*** | 0.021*** | 0.025*** | 0.025*** | 0.018*** | 0.018*** | 0.023 | 0.018*** | 0.016*** | 0.021*** | 0.021*** | 0.067*** | 0.021*** | 0.025*** |
| | (0.007) | (0.007) | (0.007) | (0.007) | (0.007) | (0.004) | (0.004) | (0.016) | (0.004) | (0.004) | (0.005) | (0.005) | (0.020) | (0.005) | (0.005) |
| *Constant* | 6.928*** | 5.864*** | 6.040*** | 5.887*** | 6.740*** | −2.504*** | −2.339*** | −1.937*** | −2.539*** | −2.319*** | −2.661*** | −2.827*** | −1.403* | −2.622*** | −2.836*** |
| | (0.631) | (0.341) | (0.346) | (0.345) | (0.632) | (0.123) | (0.130) | (0.658) | (0.124) | (0.134) | (0.139) | (0.146) | (0.820) | (0.142) | (0.150) |
| *Observations* | 40006 | 41508 | 39276 | 40634 | 41231 | 35008 | 35667 | 2360 | 35598 | 33279 | 34957 | 35618 | 2361 | 35550 | 33249 |
| *Adjusted $R^2$* | 0.190 | 0.188 | 0.195 | 0.191 | 0.190 | 0.099 | 0.099 | 0.044 | 0.099 | 0.101 | 0.156 | 0.155 | 0.080 | 0.155 | 0.164 |

OLS estimates. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%. All regressions include controls (not reported) for country, town size, religious denomination and year.

# Table 2b: Attitudes Toward Change and Belief in Shaping Own Fate

| Dependent Variable: | (16) *People shape their own fate: agree (F198)* | (17) *People shape their own fate: agree (F198)* | (18) *People shape their own fate: agree (F198)* | (19) *People shape their own fate: agree (F198)* | (20) *People shape their own fate: agree (F198)* | (21) *Attitude toward change: welcome possibility (E047)* | (22) *Attitude toward change: welcome possibility (E047)* | (23) *Attitude toward change: welcome possibility (E047)* | (24) *Attitude toward change: welcome possibility (E047)* | (25) *Attitude toward change: welcome possibility (E047)* | (26) *Attitude toward change: welcome possibility (E047)* | (27) *Attitude toward change: welcome possibility (E047)* | (28) *Attitude toward change: welcome possibility (E047)* | (29) *Attitude toward change: welcome possibility (E047)* | (30) *Attitude toward change: welcome possibility (E047)* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Religious person* | −0.152*** | | | | | −0.113 | | | | | −0.171*** | | | | |
| | (0.041) | | | | | (0.074) | | | | | (0.056) | | | | |
| *Importance of religion* | | −0.163*** | | | | | −0.035 | | | | | −0.075*** | | | |
| | | (0.021) | | | | | (0.034) | | | | | (0.026) | | | |
| *Belief in God* | | | −1.311* | | | | | −0.437*** | | | | | −0.424*** | | |
| | | | (0.750) | | | | | (0.137) | | | | | (0.082) | | |
| *Importance of God* | | | | −0.045*** | | | | | −0.019 | | | | | −0.025** | |
| | | | | (0.008) | | | | | (0.014) | | | | | (0.010) | |
| *Church attendance* | | | | | −0.011 | | | | | −0.037*** | | | | | −0.048*** |
| | | | | | (0.007) | | | | | (0.014) | | | | | (0.011) |
| *Female* | −0.275*** | −0.260*** | −0.410*** | −0.264*** | −0.298*** | −0.198*** | −0.170*** | −0.134** | −0.136** | −0.136** | −0.245*** | −0.221*** | −0.129** | −0.208*** | −0.166*** |
| | (0.029) | (0.029) | (0.115) | (0.029) | (0.030) | (0.058) | (0.058) | (0.061) | (0.061) | (0.056) | (0.048) | (0.047) | (0.054) | (0.049) | (0.046) |
| *Age* | −0.005*** | −0.004*** | −0.016*** | −0.005*** | −0.005*** | −0.022*** | −0.023*** | −0.022*** | −0.022*** | −0.024*** | −0.025*** | −0.025*** | −0.023*** | −0.023*** | −0.027*** |
| | (0.001) | (0.001) | (0.005) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) |
| *Education* | 0.117*** | 0.117*** | 0.080*** | 0.118*** | 0.121*** | | | | | | | | | | |
| | (0.008) | (0.008) | (0.026) | (0.008) | (0.008) | | | | | | | | | | |
| *Social class* | 0.080*** | 0.081*** | 0.185** | 0.082*** | 0.086*** | | | | | | | | | | |
| | (0.019) | (0.019) | (0.080) | (0.019) | (0.020) | | | | | | | | | | |
| *Income* | 0.081*** | 0.079*** | 0.047 | 0.079*** | 0.081*** | | | | | | | | | | |
| | (0.009) | (0.008) | (0.040) | (0.009) | (0.009) | | | | | | | | | | |
| *Constant* | 7.088*** | 6.412*** | 10.373*** | 7.265*** | 6.839*** | 5.564*** | 4.701*** | 5.911*** | 5.690*** | 5.478*** | 8.158*** | 7.230*** | 8.286*** | 8.167*** | 7.878*** |
| | (0.259) | (0.269) | (1.181) | (0.261) | (0.280) | (0.736) | (0.748) | (0.763) | (0.766) | (0.735) | (0.115) | (0.119) | (0.132) | (0.128) | (0.141) |
| *Observations* | 35919 | 36577 | 2360 | 36533 | 34177 | 10362 | 10587 | 9580 | 9758 | 11277 | 14702 | 15853 | 12132 | 14494 | 16107 |
| *Adjusted $R^2$* | 0.191 | 0.191 | 0.029 | 0.191 | 0.164 | 0.056 | 0.058 | 0.048 | 0.049 | 0.060 | 0.066 | 0.061 | 0.059 | 0.057 | 0.068 |

OLS estimates. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%. All regressions in columns (16)−(20) include controls (not reported) for country, town size, religious denomination and year. Regressions in columns (21)-(25) include controls (not reported) for country, religious denomination and year. Regressions in columns (25)-(30) only include controls (not reported) for country and year, allowing for about a 50% increase in sample size.

to expand the sample size by about 50%.

### 4.3 Shaping The Minds of Children

We turn now to the traits and qualities which adults think are most important to impart to children. As emphasized in the theoretical and empirical literatures, the most important channel of persistence in cultural beliefs, values and attitudes, is parental transmission –whether directly at home or indirectly through the choices of school (e.g., secular vs. religious) and extracurricular activities, available sources of information (books, media) and residential location determining the set of local role models and peers.

The results, across all fifteen specifications in Table 3, are very clear-cut: all five measures of religiosity are negatively and significantly associated ($p < 1\%$) with the importance attached to children having *Imagination, Independence, and Determination/Perseverance.* Among the main controls, *Age, Education* and *Income* have the expected positive and significant coefficients; social class has mostly positive coefficients, but they are often not significant. Women appear to value a child's independence more than males, but their imagination and determination/perseverance less.

## 5 Related literature

• *Tolerance and Creativity.* Acceptance of new ideas, change, risk, imagination or personal independence is arguably related to the tolerance of differences, be they in beliefs, cultural practices, or lifestyles. Florida (2005) argues for a link between "social diversity" and innovation, showing that, in the contemporary U.S., the share of coupled gay households in a city's or region's population is a strong predictor of the local concentration of high-tech industries, relative to the national average.[9] At a finer level of detail,

[9] On the theory side, Corneo and Jeanne (2009) model the equilibrium degree of tolerance in society, while Esteban, Levy and Mayoral (2014) study the economic consequences of religious restrictions imposed on everyone's consumption choices.

# Table 3: Most Important Qualities for Children To Have

| Dependent variable: | (1) *Importance of child independence (A029)* | (2) *Importance of child independence (A029)* | (3) *Importance of child independence (A029)* | (4) *Importance of child independence (A029)* | (5) *Importance of child independence (A029)* | (6) *Importance of child imagination (A034)* | (7) *Importance of child imagination (A034)* | (8) *Importance of child imagination (A034)* | (9) *Importance of child imagination (A034)* | (10) *Importance of child imagination (A034)* | (11) *Importance of child determination (A039)* | (12) *Importance of child determination (A039)* | (13) *Importance of child determination (A039)* | (14) *Importance of child determination (A039)* | (15) *Importance of child determination (A039)* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Religious person* | −0.045*** | | | | | −0.032*** | | | | | −0.041*** | | | | |
| | (0.005) | | | | | (0.004) | | | | | (0.005) | | | | |
| *Importance of religion* | | −0.040*** | | | | | −0.024*** | | | | | −0.047*** | | | |
| | | (0.002) | | | | | (0.002) | | | | | (0.002) | | | |
| *Belief in God* | | | −0.054*** | | | | | −0.038*** | | | | | −0.066*** | | |
| | | | (0.010) | | | | | (0.009) | | | | | (0.011) | | |
| *Importance of God* | | | | −0.016*** | | | | | −0.008*** | | | | | −0.013*** | |
| | | | | (0.001) | | | | | (0.001) | | | | | (0.001) | |
| *Church attendance* | | | | | −0.009*** | | | | | −0.006*** | | | | | −0.008*** |
| | | | | | (0.001) | | | | | (0.001) | | | | | (0.001) |
| *Female* | 0.008** | 0.012*** | 0.003 | 0.014*** | 0.007** | −0.010*** | −0.008*** | −0.011*** | −0.008*** | −0.011*** | −0.019*** | −0.014*** | −0.020*** | −0.017*** | −0.022*** |
| | (0.003) | (0.003) | (0.004) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.004) | (0.003) | (0.003) |
| *Age* | −0.002*** | −0.002*** | −0.002*** | −0.002*** | −0.002*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** | −0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| *Education* | 0.014*** | 0.014*** | 0.017*** | 0.014*** | 0.014*** | 0.011*** | 0.011*** | 0.010*** | 0.011*** | 0.011*** | 0.018*** | 0.018*** | 0.016*** | 0.018*** | 0.019*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| *Social class* | 0.001 | 0.002 | −0.001 | 0.002 | 0.002 | 0.004** | 0.004*** | −0.002 | 0.004** | 0.004** | 0.002 | 0.004** | 0.001 | 0.004* | 0.002 |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) |
| *Income* | 0.007*** | 0.007*** | 0.006*** | 0.007*** | 0.007*** | 0.001 | 0.001 | 0.002** | 0.001 | 0.001 | 0.005*** | 0.004*** | 0.008*** | 0.004*** | 0.005*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| *Constant* | 0.276** | 0.159 | 0.298** | 0.370*** | 0.219* | 0.235*** | 0.165* | 0.231*** | 0.278*** | 0.199** | 0.598*** | 0.474*** | 0.631*** | 0.673*** | 0.542*** |
| | (0.127) | (0.129) | (0.129) | (0.128) | (0.129) | (0.087) | (0.087) | (0.087) | (0.087) | (0.086) | (0.133) | (0.130) | (0.133) | (0.132) | (0.132) |
| *Observations* | 93028 | 95902 | 58294 | 94827 | 93242 | 93028 | 95902 | 58294 | 94827 | 93242 | 89348 | 92200 | 55545 | 92078 | 89536 |
| *Adjusted $R^2$* | 0.141 | 0.145 | 0.146 | 0.145 | 0.141 | 0.067 | 0.068 | 0.067 | 0.068 | 0.069 | 0.060 | 0.064 | 0.065 | 0.062 | 0.061 |

OLS estimates. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%. All regressions include controls (not reported) for country, town size, religious denomination and year.

they also find that religious individuals are less risk-tolerant than atheists, and Muslims less than Christians.

• *Risk-Aversion.* A willingness to take risks is clearly important to undertake investments, both individual and collective, especially in new technologies and social arrangements. Using panel data on immigrants to Germany, Bartke and Schwarze (2008) find religiousness to be a significant predictor of risk aversion, whereas nationality of origin is insignificant. At a finer level of detail, they also find that religious individuals are less risk-tolerant than atheists, and Muslims less than Christians.

• *Views and knowledge of science and technology.* Gaskell et al. (2005) analyzed surveys conducted in the United States, Canada, and Europe about what rules should govern science and technology. Religious beliefs were found to be significantly related to thinking that decisions should be: (i) based on the views of the public, rather than left to the experts; (ii) based on moral and ethical issues, rather than on scientific evidence of risk and benefit. Focusing on views about nanotechnology, Brossard et al. (2009) found religiosity ("how much guidance religion plays in your everyday life") to be negatively related with support for funding of these technologies. In the 2006 General Social Survey, respondents were given a 13-item test of basic scientific knowledge and reasoning. Controlling for demographics, education, income, region, and rural residence, Sherkat (2011) found greater religiosity to be clearly associated with lower scientific literacy.[10]

• *Human capital.* Across people as well as places, the strength of religious belief is strongly negatively correlated with education (especially for "literalist" beliefs in miracles, the devil, or the inerrancy of the Bible; e.g., Glaeser and Sacerdote (2009), Sherkat (2011)). Religious attendance, on the other hand, is shown by Glaeser and Sacerdote to be positively correlated with education (except in former communist countries), particularly in the U.S.[11] All our regressions control for education, and using attendance always leads to the same results as the four other, belief-based, measures of religiosity.

[10] In experiments, Gervais and Norenzayan (2012) and Shenhav, Rand and Greene (2011) show that priming analytical thinking reduces feelings of religiosity and belief in God.

[11] Rather than a specifically religious phenomenon, this is seen as reflecting the general impact of education on "sociability", as also measured by most forms of secular social capital.

Historically, religion often played an important role in the spread of general literacy and education (see, e.g., Becker and Woessmann (2009) for Protestantism and Botticini et al. (2012) for Judaism), though this is no longer true after the mid-19th century. Since more educated individuals generally tend, as we showed earlier, to be more open to new ideas, change, risk, etc, this might be seen as an offsetting factor to the direct negative relationship between religiosity and innovativeness –albeit a self-limiting one, since religiosity itself declines with education.

One should also keep in mind that education and openness to novelty do not always go hand in hand, particularly where ideology or doctrine intervenes. For instance, between the 16th and 19th centuries the Jesuits were one of the main forces behind the spread of schools and education through Catholic Europe, but also among the most vigorous opponents of many of the new theories, empirical findings and even mathematical methods of the Scientific Revolution and Enlightenment which they perceived as incompatible with Church doctrine (e.g., Alexander 2014). In a number of Islamic countries education in madrasas still consists largely of rote memorization, and even universities are often high constrained in what can or cannot be taught, or debated.

# 6 Conclusion

Using all five waves of the World Values Survey, we examined the relationships between eleven indicators of openness to innovation, broadly defined (e.g., attitudes toward science and technology, new versus old ideas, general change, personal risk taking and agency, imagination and independence in children) and five measures of religiosity, involving both beliefs and attendance. Across the fifty-two regression specifications (with controls for sociodemographics, country and year), greater religiosity was almost uniformly and very significantly associated to less favorable views of innovation. In follow-up work, we plan to examine differences in these attitudes across denominations. Mechanisms of causality and/or self-selection remain of course very much open issues at this stage, and deserving of further investigation.

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