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MORAL VALUES AND ECONOMIC BEHAVIOR‡

Religion and Innovation†

By ROLAND BÉNABOU, DAVIDE TICCHI, AND ANDREA VINDIGNI*

Nihil Sub Sole Novum.
—Ecclesiastes 1:9

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 trade-offs.[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 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.

I. Religion and Innovation across Countries and US States

In Bénabou, Ticchi, and Vindigni (2013), we uncovered a striking fact: across countries as well as across US states, there is a significant

‡*Discussants:* Theodore Bergstrom, University of California-Santa Barbara; Rodney Garratt, Federal Reserve Bank of New York; Judd Kessler, University of Pennsylvania; Andrei Shleifer, Harvard University.

*Bénabou: 320 Bendheim Hall, Princeton University, Princeton, NJ 08544, CIFAR, NBER, CEPR, and IZA (e-mail: rbenabou@princeton.edu); Ticchi: IMT Institute for Advanced Studies Lucca, Piazza San Ponziano, 6, 55100 Lucca, Italy (e-mail: davide.ticchi@imtlucca.it); Vindigni: IMT Institute for Advanced Studies Lucca, E.I.E.F., and IZA (e-mail: andrea.vindigni@imtlucca.it). We are grateful to Sascha Becker, Carlo Dal Maso, and Andrei Shleifer for valuable comments, and to Alessandro Belmonte for excellent research assistance.

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[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 link with education is more contrasted. Historically, religion often played a key role in the spread of literacy and education (e.g., Becker and Woessmann 2009; Botticini and Eckstein 2012), though this is no longer true after the mid-nineteenth century. At the individual level, the strength of religious beliefs nowadays has a clear negative correlation with education, as well as with scientific literacy; see Section IV for further details.

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 quite robust: the results hold for alternative measures of religiosity and persist after controlling for income per capita, population, fraction with tertiary education, patent-rights protection, and foreign investment.

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 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.

II. Religiosity and Openness to Innovation across Individuals

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.

A. *Data and Key Variables*

Using all available waves of the World Values Survey (1980, 1990, 1995, 2000, and 2005), we regress 11 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 *Church Attendance.* All signs are (re)normalized so that higher values correspond to being more religious.

Control variables include *Age*, *Gender*, self-identified *Social Class*, *Education* level, *Income* level, and dummies for religious denomination (the WVS has almost 90), country and year.

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

Attitudes Toward Science and Technology.— We use respondents' levels of (dis)agreement with the following three statements: (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).

[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). Ecklund and Scheitle (2007) offer a recent survey and empirical study.

TABLE 1—SCIENCE AND TECHNOLOGY, NEW VERSUS OLD IDEAS, CREATIVITY, RISK-TAKING, SHAPING OWN FATE, AND CHANGE

Dependent variable	Too much dependence on science versus faith: disagree (E220m) (1)	Science and technology change life too fast: disagree (E219m) (2)	Science and technology make world better off: agree (E234) (3)	New ideas are better than old: agree (E046) (4)	Importance of new ideas and being creative: agree (A189m) (5)	Importance of adventure and risk taking: agree (A195m) (6)	People shape their own fate: agree (F198) (7)	Attitude toward change: welcome possibility (E047) (8)
Religious person	−0.232***	−0.181***	0.032	−0.197***	0.073***	−0.094***	−0.152***	−0.171***
	(0.047)	(0.039)	(0.039)	(0.037)	(0.020)	(0.023)	(0.041)	(0.056)
	31,978	*32,413*	*32,651*	*40,006*	*35,008*	*34,957*	*35,919*	*14,702*
	0.140	*0.067*	*0.098*	*0.190*	*0.099*	*0.156*	*0.191*	*0.066*
Importance of religion	−0.419***	−0.137***	−0.019	−0.013	0.039***	−0.038***	−0.163***	−0.075***
	(0.024)	(0.021)	(0.020)	(0.017)	(0.011)	(0.012)	(0.021)	(0.026)
	32,512	*32,983*	*33,199*	*41,508*	*35,667*	*35,618*	*36,577*	*15,853*
	0.148	*0.067*	*0.096*	*0.188*	*0.099*	*0.155*	*0.191*	*0.061*
Belief in God				−0.131**	0.067	−0.903*	−1.311*	−0.424***
				(0.063)	(0.456)	(0.522)	(0.750)	(0.082)
				39,276	*2,360*	*2,361*	*2,360*	*12,132*
				0.195	*0.044*	*0.080*	*0.029*	*0.059*
Importance of God	−0.144***	−0.094***	0.024***	−0.001	0.015***	−0.022***	−0.045***	−0.025**
	(0.009)	(0.007)	(0.007)	(0.006)	(0.004)	(0.004)	(0.008)	(0.010)
	32,466	*32,921*	*33,162*	*40,634*	*35,598*	*35,550*	*36,533*	*14,494*
	0.149	*0.072*	*0.098*	*0.191*	*0.099*	*0.155*	*0.191*	*0.057*
Church attendance	−0.046***	−0.007	−0.002	−0.022***	0.024***	−0.006	−0.011	−0.048***
	(0.009)	(0.007)	(0.007)	(0.007)	(0.004)	(0.004)	(0.007)	(0.011)
	30,427	*30,883*	*31,198*	*41,231*	*33,279*	*33,249*	*34,177*	*16,107*
	0.141	*0.069*	*0.094*	*0.190*	*0.101*	*0.164*	*0.164*	*0.068*

Notes: OLS estimates for alternative measures of religiosity. Robust standard errors in parentheses, followed by *number of observations* and *Adjusted* R^2 both in italics. All regressions include controls (not reported) for sex, age, education, social class, income, town size, religious denomination, country, and year. Because of the absence of observations, specifications with *Belief in God* have not been included in columns 1–3 and regressions in column 8 only include controls for sex, age, country, and year.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

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); (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 personal 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": agreement with "Everything is determined by fate," versus "People shape their fate themselves" (F198).

Child Qualities.—WVS respondents were presented with a list of 11 "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 11 attitudinal variables are (re)normalized so that higher values correspond to being more open to science, innovation, change, imagination, etc.

TABLE 2—MOST IMPORTANT QUALITIES FOR CHILDREN TO HAVE

Dependent variable	Importance of child independence (A029) (1)	Importance of child imagination (A034) (2)	Importance of child determination (A039) (3)
Religious person	−0.045***	−0.032***	−0.041***
	(0.005)	(0.004)	(0.005)
	93,028	*93,028*	*89,348*
	0.141	*0.067*	*0.060*
Importance of religion	−0.040***	−0.024***	−0.047***
	(0.002)	(0.002)	(0.002)
	95,902	*95,902*	*92,200*
	0.145	*0.068*	*0.064*
Belief in God	−0.054***	−0.038***	−0.066***
	(0.010)	(0.009)	(0.011)
	58,294	*58,294*	*55,545*
	0.146	*0.067*	*0.065*
Importance of God	−0.016***	−0.008***	−0.013***
	(0.001)	(0.001)	(0.001)
	94,827	*94,827*	*92,078*
	0.145	*0.068*	*0.062*
Church attendance	−0.009***	−0.006***	−0.008***
	(0.001)	(0.001)	(0.001)
	93,242	*93,242*	*89,536*
	0.141	*0.069*	*0.061*

Notes: OLS estimates for alternative measures of religiosity. Robust standard errors in parentheses, followed by *number of observations* and *Adjusted* R^2 both in italics. All regressions include controls (not reported) for sex, age, education, social class, income, town size, religious denomination, country, and year.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

III. Results

Tables 1 and 2 show estimates and standard errors for each of the five alternative religiosity variables, estimated from separate regressions. Those for the control variables are not reported here due to space constraints, but can be found in tables provided in the online Appendix.

Science and Technology.—For two of the three attitudinal variables, all five measures of religiosity are consistently associated with more negative views of scientific progress. As shown in columns 1–3 of Table 1, 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 ($p < 1$ percent) to think that "we depend too much on science and not enough on faith" and that these "make life change too fast." For the third question—whether the "world is better off because of science and technology," in contrast, the results vary in sign across measures of religiosity and are generally not significant.

New Ideas, Change, and Risk-Taking.—In columns 4–8 of Table 1 we turn to 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 relationship 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 versus 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 11 "innovation-friendliness" variables for which the negative relationship with religiosity reverses, thus representing somewhat of a puzzle.[5]

Shaping The Minds of Children.—We turn now to the traits and qualities which adults think are most important to impart to children. The results, across all 15 specifications in Table 2, are very clear-cut: all five measures of religiosity are negatively and significantly ($p < 1$ percent) associated with the importance attached to children having *Imagination, Independence, and Determination/Perseverance.*

Sociodemographic Controls.—In all 52 specifications we estimated, having higher *Income*, a lower *Age*, and being *Male* always have the expected sign—pro-science, innovation, change, risk, etc. The same is true for *Education*, with only a handful of exceptions, while the sign for *Social Class* is less consistent but most of the

[5] 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 percent of people respond "very much like" to "somewhat like," far fewer "a little like," and almost none "not like/not at all like."

time positive. Women display a lower taste for risk (in line with the experimental literature) and novelty-seeking; they value a child's independence more than males, but their imagination and determination/perseverance less.

IV. 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 United States, the share of coupled gay households in a city or region's population is a strong predictor of the local concentration of high-tech industries, relative to the national average.[6]

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.

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. 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.[7]

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; see, e.g., Glaeser and Sacerdote 2008 and Sherkat 2011). Religious attendance, on the other hand, is shown by the first set of authors to be positively correlated with education (except in former communist countries), particularly in the United States.[8] All our regressions control for education, and using attendance always leads to the same results as the four other, belief-based, measures of religiosity.

V. Conclusion

Using all five waves of the World Values Survey, we examined the relationships between 11 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 52 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.

REFERENCES

Barro, Robert J., and Rachel M. McCleary. 2003. "Religion and Economic Growth across Countries." *American Sociological Review* 68 (5): 760–81.

[6] 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.

[7] 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.

[8] 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.

Bartke, Stephan, and Reimund Schwarze. 2008. "Risk-Averse by Nation or by Religion? Some Insights on the Determinants of Individual Risk Attitudes." DIW Berlin, SOEP Papers on Multidisciplinary Panel Data Research 131.

Becker, Sascha O., and Ludger Woessmann. 2009. "Was Weber Wrong? A Human Capital Theory of Protestant Economic History." *Quarterly Journal of Economics* 124 (2): 531–96.

Bénabou, Roland, Davide Ticchi, and Andrea Vindigni. 2013. "Forbidden Fruits: The Political Economy of Science, Religion, and Growth." Princeton University, William S. Dietrich II Economic Theory Center Research Paper 065-2014.

Bénabou, Roland, and Jean Tirole. 2006. "Belief in a Just World and Redistributive Politics." *Quarterly Journal of Economics* 121 (2): 699–746.

Bénabou, Roland, and Jean Tirole. 2011. "Identity, Morals, and Taboos: Beliefs as Assets." *Quarterly Journal of Economics* 126 (2): 805–55.

Botticini, Maristella, and Zvi Eckstein. 2012. *The Chosen Few: How Education Shaped Jewish History, 70–1492*. Princeton, NJ: Princeton University Press.

Corneo, Giacomo, and Olivier Jeanne. 2009. "A theory of tolerance." *Journal of Public Economics* 93 (5–6): 691–702.

Ecklund, Elaine Howard, and Christopher P. Scheitle. 2007. "Religion among Academic Scientists: Distinctions, Disciplines, and Demographics." *Social Problems* 54 (2): 289–307.

Esteban, Joan, Gilat Levy, and Laura Mayoral. 2014. "Liberty, Equality, Religiosity." Unpublished.

Florida, Richard. 2005. *Cities and the Creative Class*. New York: Routledge.

Gaskell, George, Edna Einsiedel, William Hallman, Susanna Hornig Priest, Jonathan Jackson, and Johannus Olsthoorn. 2005. "Social Values and the Governance of Science." *Science* 310 (5756): 1908–1909.

Gervais, Will M., and Ara Norenzayan. 2012. "Analytic Thinking Promotes Religious Disbelief." *Science* 336 (6080): 493–96.

Glaeser, Edward L., and Bruce I. Sacerdote. 2008. "Education and Religion." *Journal of Human Capital* 2 (2): 188–215.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2003. "People's opium? Religion and economic attitudes." *Journal of Monetary Economics* 50 (1): 225–82.

Levy, Gilat, and Ronny Razin. 2012. "Religious Beliefs, Religious Participation, and Cooperation." *American Economic Journal: Microeconomics* 4 (3): 121–51.

Mokyr, Joel. 2004. *The Gifts of Athena: Historical Origins of the Knowledge Economy*. Princeton, NJ: Princeton University Press.

Shenhav, Amitai, David G. Rand, and Joshua D. Greene. 2011. "Divine Intuition: Cognitive Style Influences Belief in God." *Journal of Experimental Psychology: General* 141 (3): 423–28.

Sherkat, Darren E. 2011. "Religion and Scientific Literacy in the United States." *Social Science Quarterly* 92 (5): 1134–50.