Religion and Corporate Innovation

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Abstract

This study represents the first comprehensive analysis of the role of national religiosity in corporate innovation. We divide religiosity into five dimensions: ideological, ritualistic, experiential, intellectual, and consequential. For 1,506 firms in 27 countries during the 2012–2014 period, we find that the ideological and ritualistic dimensions promote corporate innovation, whereas the experiential, intellectual, and consequential dimensions hinder corporate innovation. Furthermore, religiosity overall has a positive impact on corporate innovation. Finally, we show that the positive effect of religiosity is more pronounced for firms in Judeo-Christian countries. Overall, we provide the first guideline to understand the diverse and comprehensive effects of religion on corporate innovation. (JEL G3, O3, Z12)

Keywords: Corporate Innovation; Religiosity; Multidimensionality of Religiosity; Judeo-Christianity.

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1. Introduction

In his seminal work, Schumpeter (1912) views innovation as the commercial application of new technology, new material, new methods, and new sources of energy and, thereby, as the critical dimension of economic change. Since Schumpeter (1912), economists have demonstrated that innovation is essential for the long-run comparative advantage of firms, as well as the long-term economic growth of countries (Baer, 2012; Hall, Jaffe, and Trajtenberg, 2005; Kogan, Papanikolaou, Seru, and Stoffman, 2017; Solow, 1957). Despite their importance, firms are often unwilling to invest in innovative projects due to their inherent issues, such as high failure probability, a long investment horizon, significant uncertainty, and severe information asymmetry (Francis and Smith, 1995; Hall and Lerner, 2010; Holmstrom, 1989; Kumar and Langberg, 2009; Manso, 2011; Tian and Wang, 2014). Furthermore, innovation mostly requires firms to develop a high level of creativity and scientific and technological ways of thinking (Capon, Farley, Lehmann, and Hulbert, 1992; Sarooghi, Libaers, and Burkemper, 2015). These aspects suggest that a firm's innovation is likely to be affected significantly by non-financial characteristics, especially in the cultural context, including the degree of uncertainty avoidance, ethical behavior, creativity, and views on science and technology.

However, few studies have directly linked culture to firm innovation. Rather, most studies examine the role of culture in innovation at the national level (Beteille, 1977; Hofstede, 1980; Kostis, Kafka, and Petrakis, 2018; Lee, 1990; Rothwell and Wissema, 1986; Shane, 1993; 1995). For example, Shane (1993) shows that the cultural values of uncertainty avoidance, power distance, and collectivism are negatively associated with national innovation. Furthermore, Kostis, Kafka, and Petrakis (2018) find that a culture of trust, self-control, work ethic, and honesty promotes innovation, whereas that of obedience hinders innovation. Focusing on attitudes toward

science and technology, Lee (1990) finds a significant positive relationship between the number of scientists and engineers per population and national innovation.

Although these studies provide valuable suggestions that culture has a profound impact on innovation, they have two limitations: first, as mentioned, their findings are not sufficient to argue that culture influences innovation at the firm level;[1] second, and more importantly, they do not account for the deep-rooted cause of cultural variations across countries. Many sociological studies have demonstrated that religions, or religious traditions, are crucial determinants of contemporary culture (Beckford and Demerath, 2007; Carrette, 2000; Clark and Hoover, 1997; Weber, 1905; 1963; Yinger, 1957): religious traditions, including beliefs and practices, shape individual values and attitudes and, thereby, social culture. For instance, Weber (1905) suggests that the Protestant ethic forms a capitalist culture that drives economic prosperity. In these respects, exploring the influence of religion on corporate innovation is highly fundamental and valuable.

Indeed, several studies attempt to account for corporate innovation from national or regional religiosity. Hilary and Hui (2009) find that firms located in regions with higher levels of religiosity exhibit less R&D activity because they are likely to be more risk-averse than those located in regions with lower levels of religiosity. Adhikari and Agrawal (2016) use the ratio of Catholics-to-Protestants as a proxy for gambling preferences (Kumar, Page, and Spalt, 2011) and show that firms headquartered in areas with high gambling preferences tend to spend more on R&D, produce more patents, and generate more patent citations. Finally, Assouad and Parboteeah (2018) argue that national religious beliefs and practices lead individuals to have blind faith, a

[1] Recently, many studies have focused on the relationship between firms' innovativeness and national culture, including individualism (Shao, Kwok, and Zhang, 2013), long-term orientation (Flammer and Bansal, 2017), and language (Liang, Marquis, Renneboog, and Sun, 2018).

hard-work ethic, and self-control, all of which are conducive to corporate innovation. These studies, on the one hand, provide various mechanisms by which religion can affect corporate innovation and, thereby, help us obtain a deeper understanding of the religious effects. On the other hand, such a variety of mechanisms cause confusion, in that religion can imply multiple traits (e.g., risk-aversion, blind faith, work ethic, etc.) rather than a specific one. That is, each study examining the religious effects focuses only on a small part of religiosity. This strongly motivates us to investigate the effect of religiosity on corporate innovation at the comprehensive level.

To conduct a comprehensive analysis, it is necessary to conceptualize religiosity in several dimensions (Faulkner and De Jong, 1966; Glock, 1962). Following the conception suggested by Glock (1962), we empirically generate five dimensions of religiosity using survey data: ideological, ritualistic, experiential, intellectual, and consequential. Further, employing a principal component analysis (PCA), we extract the overall religiosity from the five dimensions. In innovation research, using patent information to measure corporate innovation has become the standard (Aghion, Bloom, Blundell, Griffith, and Howitt, 2005; He and Tian, 2013; Nanda and Rhodes-Kropf, 2013; Seru, 2014), which we also adopt in this study. Specifically, we use the number of patent applications as innovation quantity and their economic values, extracted from stock market reactions, as innovation quality.

Using a panel of 1,506 firms in 27 countries from 2012 to 2014, we find that all corporate innovation measures are related positively to the ideological and ritualistic dimensions of religiosity, whereas they are related negatively to the experiential, intellectual, and consequential dimensions. Our findings are explained as follows: the ideological (ritualistic) dimension represents an individual's blind faith (personal ethics and self-control). Because these traits are conducive to corporate innovation (Assouad and Parboteeah, 2018), the two dimensions of

religiosity foster corporate innovation. Conversely, the experiential, intellectual, and consequential dimensions indicate risk-aversion, negative views on science and technology, and religious intolerance, respectively. As these traits clearly hamper innovation, the three dimensions play negative roles in corporate innovation. Finally, at the aggregate level, we observe that the overall religiosity is positively associated with corporate innovation. This implies that the positive influences of the ideological and ritualistic dimensions significantly surpass the negative influences of the other three dimensions.

One could be concerned that our findings of the relationship between religiosity and corporate innovation can be attributable to reverse causations or confounding factors. For example, a firm manager might experience failure in an innovative project that he had prayed to God would succeed. As a result, he might deny the existence of God or stop praying due to the experience of failure. Conversely, the manager may be more religious when the project is successful because he might believe that his faith and prayers to God lead to project success. This suggests that our previous findings may merely represent the reverse causation from corporate innovation to religiosity. Furthermore, our measure of religiosity may proxy for unobservable national characteristics, such as imagination, affecting corporate innovation. We handle these endogeneity issues by using various instruments for religiosity and find that our results remain intact.

We then extend our analysis by considering the role of religious denominations. We note that all religions have different values and attitudes to consider and, therefore, the degree of the impact of religiosity would depend heavily on the religion to which the religiosity is directed. Specifically, Herbig and Dunphy (1998) consider innovation in connection with Judeo-Christian traditions. They argue that Judeo-Christian viewpoints of both the human domination of nature and the orientation toward high achievement trigger a desire for perpetual progress and the

development of scientific and technological knowledge and skills (White, 1967). In contrast, both the elimination of desires in Hinduism and Buddhism and a fatalistic mindset in Islam significantly discourage believers from innovation. Taken together, they suggest that these value differences between Judeo-Christianity and other religions result in a higher degree of innovation in Judeo-Christian countries. Motivated by this suggestion, we further examine whether the effects of religiosity on corporate innovation have differential influences under Judeo-Christian traditions.

Using the Judeo-Christian country dummy as an interaction variable, we find that the positive effects of religiosity tend to be more pronounced than the negative effects for firms in Judeo-Christian countries. Specifically, for these firms, the ritualistic dimension's positive influence is strengthened and the intellectual and consequential dimensions' negative influences are mitigated. However, the negative impact of the experiential dimension increases for these firms and the impact of the ideological dimension remains statistically the same regardless of the religion. Finally, at the comprehensive level, we find that the positive effect of overall religiosity becomes more pronounced for these firms. In general, our findings are consistent with the argument that Judeo-Christianity plays a pivotal role in promoting innovation.

The remainder of this paper is structured as follows: Section 2 presents a literature review and hypothesis development. Section 3 explains our empirical approach and the associated data, and the empirical results are presented in Section 4. Finally, Section 5 concludes our study.

2. Related Literature and Hypothesis Development

2.1 Religiosity and Corporate Innovation

This study belongs to the growing body of literature connecting religion to innovation. We contribute to the literature by clarifying the costs and benefits and, thereby, identifying the comprehensive effect of religiosity on corporate innovation. Prior studies only address either the positive or negative role of religiosity in innovation, although both sides are compatible. In this section, we briefly summarize the literature and propose possible channels by which religiosity can influence innovation.

Most studies on religiosity support its negative role—by representing risk-aversion, negative views on science and technology, or intolerance, religiosity can hamper innovation (Bénabou, Ticchi, and Vindigni, 2015). First, Hilary and Hui (2009) suggest that regional religiosity affects corporate decision making through the formation of a risk-averse culture and empirically support their argument by showing a significant negative association between regional religiosity and corporate risk-taking behavior, including R&D investment. Next, at the national level, Lee (1990) notes that national innovativeness is positively affected by favorable attitudes toward science and technology. Because most studies investigating religion and science propose a negative association between them (Ellison and Musick, 1995; Mazur, 2004; Miller, Scott, and Okamoto, 2006; Scott, 2004; Sherkat, 2011), religiosity is likely to affect innovation negatively. Finally, religious believers tend to be more intolerant toward differences (Guiso, Sapienza, and Zingales, 2003; Reimer and Park, 2001; Stouffer, 1955; Sullivan, Pierson, and Marcus, 1993). Such intolerant behavior at the individual level lowers creativity and imagination (Florida, 2002; 2003) and at the group level hampers cooperation within a workgroup by causing conflicts (Jehn, Chadwick, and Thatcher, 1997; Jehn, Northcraft, and Naele, 1999). As creativity, imagination, and cooperation play decisive roles in innovation, religiosity hinders innovation by inducing intolerance.

On the other hand, there are several religiosity-associated traits that can promote corporate innovation. Guiso, Sapienza, and Zingales (2003) find that religious people tend to have a better economic attitude: they trust others more, are less willing to break the law, and believe in the fairness of market outcomes. Similarly, Kirchmaier, Prüfer, and Trautmann (2018) note that religious people are more reluctant to accept unethical economic behavior, such as tax evasion and bribery. Because these business ethics and attitudes discourage firm managers from behaving unethically, innovative inputs are likely to be transformed into more innovative outputs (Huang, Lu, and Luo, 2016). In addition, religiosity is also associated with blind faith (Cornwall, Albrecht, Cunningham, and Pitcher, 1986) and self-control (McCullough and Willoughby, 2009). First, blind faith requires strong beliefs in the invisible, such as divine power, an omnipotent being, or an afterlife. Innovative projects also require innovators to have faith in their success, even though such success is distant and unseen. Thus, by encouraging blind faith that projects will be successful as well as believing that divine power will help with success, religiosity is likely to affect innovation positively (Assouad and Parboteeah, 2018). Next, self-control leads individuals to pursue large-scale, long-term goals rather than small-scale, short-term profits. Innovative projects typically need long gestation periods and, therefore, individuals with self-control are better suited to conduct these projects successfully (Assouad and Parboteeah, 2018).

In sum, religiosity can promote or hinder corporate innovation through various channels: risk-aversion, attitude toward science and technology, intolerance, ethical behavior, blind faith, and self-control. There is, however, no comprehensive study exploring the total influence of religiosity on corporate innovation through all these channels. Accordingly, we first question whether general religiosity fosters corporate innovation and set the following hypothesis:

***Hypothesis 1*: Overall religiosity enhances corporate innovation.**

2.2 Five Dimensions of Religiosity

Our comprehensive analysis is based on a multidimensional approach to religiosity. Indeed, studies on religiosity emphasize that its concept should be multidimensional (Faulkner and De Jong, 1966; Glock, 1962; Glock and Stark, 1965; King and Hunt 1972; 1975; Lenski, 1961). Specifically, Glock (1962) proposes five dimensions of religiosity as follows: ideological, ritualistic, experiential, intellectual, and consequential.[2] In this section, we introduce these five dimensions and discuss their effects on corporate innovation.

The ideological dimension of religiosity refers to religious beliefs. As in Glock (1962), all religions essentially serve to ensure the existence of supernatural forces, including the divine, an afterlife, and miracles. Greater religiosity in the aspect of the ideological dimension, therefore, leads individuals and societies to have a higher level of blind faith (Assouad and Parboteeah, 2018). As blind faith causes innovators to have faith in successful innovation, we propose the following hypothesis:

Hypothesis 1-(a): The ideological dimension of religiosity enhances corporate innovation.

The ritualistic dimension of religiosity indicates religious practices. Religious practices are divided into formal and informal. Formal religious practices, such as church attendance, are associated with social network building. Through regular and frequent religious participation, individuals build networks within the religious group that can provide new resources for idea

[2] There are various multidimensional conceptualizations, including Glock's (1962) five dimensions, Lenski's (1961) four dimensions, and Allport and Ross's (1967) extrinsic-intrinsic typology. Among them, we focus on Glock's five dimensions because they are the most comprehensive as well as directly empirical (Cornwall, Albrecht, Cunningham, and Pitcher, 1986).

generation or implementation, inducing successful innovation (Dakhli and De Clercq, 2004). Moreover, informal religious practices, represented by prayer, encourage individuals to have stronger intrinsic values of hard work (McCleary, 2007), self-control (McCullough and Willoughby, 2009), and ethical behavior (Kirchmaier, Prüfer, and Trautmann, 2018). Because such values are conducive to innovation, informal practices also likely promote corporate innovation. Therefore, we posit the hypothesis as follows:

Hypothesis 1-(b): The ritualistic dimension of religiosity enhances corporate innovation.

Religion is often connected with the risk-aversion preference and such a connection is contained in the experiential dimension of religiosity. Some forms of religious expressions, such as experiencing supernatural forces or the afterlife, cause individuals to have concerns and fears about a divine power or life after death (Glock, 1962).[3] As a result, they rely heavily on religion to reduce anxiety about risk and uncertainty in their lives (Miller, 2000; Miller and Hoffmann, 1995). Further, abundant empirical and experimental evidence also supports the positive relationship between religiosity and risk-aversion (Ahmad, 1973; Bénabou, Ticchi, and Vindigni, 2015; Rokeach, 1968). Thus, we expect that the experiential dimension, by forming a risk-averse corporate culture, negatively affects corporate innovation. Based on our expectation, the following hypothesis is set:

Hypothesis 1-(c): The experiential dimension of religiosity hinders corporate innovation.

The intellectual dimension is related to religious knowledge. Including creationism versus

[3] Glock (1962) suggests four feelings regarding the religious experience: concern, cognition, faith, and fear. Because the cognition and faith components closely correspond to the ideological dimension, we focus on the remaining two (i.e., concern and fear components) when considering the experiential dimension. Therefore, we sharply differentiate the experiential dimension from the ideological dimension.

evolution, religious knowledge and scientific knowledge have long been conflicted and disputed (Draper, 1897). As a result, religious people tend to have negative views on scientific and technological knowledge and progress and many studies indeed support this argument. For example, Pew Research Center (2009) observes that, in the US, 83% of the population believes in God, whereas only 33% of scientists believe in God. Gaskell, Einsiedel, Hallman, Priest, Jackson, and Olsthoorn (2005) find that religious people tend to think based on the opinion of the general public rather than that of experts and based on morality rather than scientific evidence. Taking into consideration the significant role of the attitudes toward science and technology in innovation, our next hypothesis is as follows:

Hypothesis 1-(d): The intellectual dimension of religiosity hinders corporate innovation.

Finally, the consequential dimension deals with the outcomes of an individual's religious commitment. Although all aforementioned dimensions of religiosity can be relevant to the consequential dimension, following Faulkner and De Jong (1966), we focus on religious people's intolerance toward (religious) differences as the consequences.[4] As intolerant behavior is directly linked to lowering the degree of both the creativity of an individual and cooperation within a workgroup, we set the following hypothesis:

Hypothesis 1-(e): The consequential dimension of religiosity hinders corporate innovation.

[4] Several studies find that religiosity is positively associated with benevolence (Saroglou, Delpierre, and Dernelle, 2004; Schwartz and Huismans, 1995) and agreeableness (Saroglou, 2002) and these findings possibly imply that religious people are more tolerant toward others. However, Saroglou, Delpierre, and Dernelle (2004) note that such benevolence and agreeableness are only effective within the same religious group and not between groups. Moreover, the majority of studies provide theoretical or empirical evidence supporting the encouraging role of religiosity in intolerance (Guiso, Sapienza, and Zingales, 2003; Reimer and Park, 2001; Stouffer, 1955; Sullivan, Pierson, and Marcus, 1993). Taken together, we regard religiosity as having a positive impact on intolerance.

2.3 The Role of Religious Denominations

Different religions have different values and worldviews and, therefore, the influence of religiosity on corporate innovation may substantially vary with the type of religion. Herbig and Dunphy (1998) indeed note that Judeo-Christianity presents several features conducive to innovation, whereas other religions, including Islam, Buddhism, and Hinduism, lack such features. Accordingly, in this section, we set our next hypotheses based on Judeo-Christian traditions, after discussing these aspects.

In his seminal work, Lynn White Jr. (1967) attributes the crisis of modern ecosystems to Judeo-Christian traditions, based on its stimulating role in the application of science and technology and in the pursuit of continued progress. Specifically, he notes two features of Judeo-Christian traditions: the human domination of nature and a high-achievement orientation. First, the Judeo-Christian scripture says that humans were created to control the rest of God's creations, as delineated in the following words of God: "Let us make man in our image, after our likeness. And let them have dominion over the fish of the sea and over the birds of the heavens and over the livestock and over all the earth and every creeping thing that creeps on the earth." Next, Judaism emphasizes the perfection in following the commandments of God and such emphasis forms a high-achieving orientation in Judeo-Christian traditions (McClelland, 1961). Overall, the high-achievement orientation and human domination of nature jointly and significantly lead Judeo-Christians to have the desire for perpetual progress, employ more natural resources, apply more science and technology and, thereby, be more innovative.

Buddhism and Hinduism, on the other hand, stress the elimination of any type of desire

because desire causes worry: by not striving, individuals enjoy peace of mind without suffering from worry. Furthermore, such dharmic religions idealize and emphasize interconnectedness (Tucker and Williams, 1997). This creates a mindset inducing a cooperative and harmonious relationship between human and nature. Taken together, both limited material aspirations and values promoting harmony with nature do not provide incentives to innovate under the dharmic traditions.

Finally, in Islam, people tend to have a fatalistic mindset whereby everything is determined by Allah. Thus, they should accept things that are given rather than trying to change them. In addition, as the Quran suggests, Muslims are required to respect and preserve nature because it is created by Allah, it contains signs of Allah (or truth), and it is inherently less degenerate than heedless human beings (Muhammad, Shah-Kazemi, and Ahmed, 2010). Hence, Islamic traditions are less likely to promote innovation than Judeo-Christian traditions due to their fatalistic mindset and respectful views on nature.

To sum, we expect that the promoting role of religiosity in corporate innovation will be greater where Judeo-Christian values are more pervasive. Based on this expectation, we set the following hypothesis:

***Hypothesis 2*: The positive effect of the overall religiosity on corporate innovation is more pronounced for firms in Judeo-Christian countries.**

As a final step, we discuss the differential impact of each religiosity dimension in accordance with religions. First, regarding the ideological dimension, each religion has a transcendent being or state, such as a god or afterlife. For example, Christianity, Islam, and Judaism are monotheistic and have the notion of heaven and hell. In Hinduism and Buddhism, there is more

than one deity and they are called "Devas." Further, these dharmic religions believe in the doctrine of reincarnation, emphasizing continued rebirth until a believer reaches ultimate enlightenment and the state of nirvana. Because all religions require believers to believe in invisible beings and states, it is unlikely that the effect of the ideological dimension varies significantly across religions. Thus, we posit the following hypothesis:

Hypothesis 2-(a): The positive effect of the ideological dimension of religiosity on corporate innovation does not vary across religious denominations.

Individuals can effectively develop religious values through religious practices. All religions promote a hard-work ethic and self-control and discourage idleness (McCleary, 2007). However, whereas Judeo-Christianity further fosters the value of perpetual progress, Buddhism and Hinduism seek the elimination of desire and Islam involves a fatalistic mindset. These value differences imply that the impact of the ritualistic dimension is greater for firms in Judeo-Christian countries. This leads to the next hypothesis:

Hypothesis 2-(b): The positive effect of the ritualistic dimension of religiosity on corporate innovation is more pronounced for firms in Judeo-Christian countries.

The degree of association between religion and risk-aversion is dependent on the level of punishment for the absence of faith in religion. In this respect, Miller (2000) and Miller and Stark (2002) note that the link between religion and risk-aversion is stronger for Western religions (including Judaism, Christianity, and Islam) than for Eastern religions (including Buddhism, Hinduism, and Shinto)—Eastern religions have little to do with extreme punishment, such as the hellfire of Western religions. Furthermore, Eastern societies rarely require religious affiliation and consider religious activities as irregular (Iannaccone, 1995; Liu, 2010; Stark, 2004). Thus, contrary

to Herbig and Dunphy's (1998) belief, Judeo-Christianity may promote corporate innovation less than other Eastern religions by representing greater risk-aversion. This conjecture leads to the following hypothesis:

Hypothesis 2-(c): The negative effect of the experiential dimension of religiosity on corporate innovation is more pronounced for firms in Judeo-Christian countries.

As mentioned, due to the value differences between Judeo-Christian traditions and other religions' traditions, Judeo-Christians make use more of natural resources by applying scientific and technological knowledge and skills more aggressively. Accordingly, they are likely to have a more favorable view on science and technology as well as greater scientific and technological knowledge. This implies that the negative influence of the intellectual religiosity dimension can largely be diluted under Judeo-Christian traditions. We, thus, propose the following hypothesis:

Hypothesis 2-(d): The negative effect of the intellectual dimension of religiosity on corporate innovation is less pronounced for firms in Judeo-Christian countries.

The impact of religious intolerance on corporate innovation clearly depends on intolerant religions. In Judeo-Christian countries, Judeo-Christian traditions are less tolerant of the traditions of other religions, simply because the dominant religion is Judeo-Christianity. This indicates that religious intolerance in these countries leads to both the preservation of Judeo-Christian values and the elimination of the values of other religions. Conversely, if one of the other religions is dominant, Judeo-Christian values are more likely to vanish because of intolerance from the other dominant religion. Therefore, our last hypothesis is posited as follows:[5]

[5] To set the hypothesis more precisely, it is necessary to take into consideration that the degree of religious intolerance

<u>Hypothesis 2-(e)</u>: The negative effect of the consequential dimension of religiosity on corporate innovation is less pronounced for firms in Judeo-Christian countries.

3. Data and Empirical Methods

3.1 Data and Variables Description

3.1.1 Measures of corporate innovation

We measure corporate innovation based on patent data taken from the *COR&DIP* database provided by the Organization for Economic Cooperation and Development (OECD).[6] The data covers 1,036,290 published patents (or 351,901 patent families) designed by the top 2,000 corporate R&D investors worldwide from 2012 to 2014.[7] These patents are filed in at least one of the top five patent offices: European Patent Office (EPO), Japan Patent Office (JPO), Korean Intellectual Property Office (KIPO), State Intellectual Property Office of the People's Republic of China (SIPO), and United States Patent and Trademark Office (USPTO). Therefore, the data is scarcely affected by home bias (i.e., the propensity of inventors to file in their home country).

Our first innovation variable is the number of patent families of a firm in a given year, which indicates the quantity of innovation. Although this measure is highly intuitive in describing

can vary in accordance with religions. In their analyses, Guiso, Sapienza, and Zingales (2003) provide empirical evidence that the degree of intolerant behavior of Hindus and Muslims is most pronounced, that of non-religious people and Buddhists is least pronounced, and that of Christians and Jews is in the middle. It is therefore difficult to argue that the intolerant behavior of Judeo-Christianity is more or less severe than that of other religions. Consequently, we ignore the difference of intolerant behavior across religions when positing the hypothesis.

[6] Detailed data generation methods are described in Daiko, Dernis, Dosso, Gkotsis, Squicciarini, and Vezzani (2017).

[7] A family of patents refers to the set of patents indicating the same invention and designed by the same inventors, but just filed in different offices for the purpose of protecting the invention. To avoid counting the same inventions several times, we focus on the number of families rather than that of patents.

firm innovation, it does not account for quality differences across patents. Indeed, Kogan, Papanikolaou, Seru, and Stoffman (2017) propose an empirical method measuring the quality or economic value of patents based on stock market reactions to patent grants. Therefore, we largely follow this method and calculate the economic value of each patent family.[8] We then obtain our second innovation variable, which measures innovation quality, by adding all the economic values of patent families of a firm in a given year.[9] We draw the data on firms' stock prices, market capitalizations, and market indices, which are necessary to measure innovation quality, from Compustat (for the stock price and market capitalization of a firm) and Datastream (for market indices). To unify the unit of innovation quality in dollars, we use exchange-rate data taken from the Institutional Brokers' Estimate System (I/B/E/S) database. Finally, we use the average quality of patent families by a firm in a given year as our third innovation variable.[10] This variable is obtained simply by dividing total quality (i.e., the second variable) by total quantity (i.e., the first variable).

[8] However, there is a critical difference between the method we use and that of Kogan, Papanikolaou, Seru, and Stoffman (2017): we focus on stock market reactions to patent filings rather than patent grants, primarily because our patent data does not provide information about grant dates. As Kogan, Papanikolaou, Seru, and Stoffman (2017) mention, focusing on filing dates can be problematic, in that applications are not published at the time they are filed and, therefore, market participants are unlikely to have information about filings at the filing dates. However, we believe that stock price movements around the filing dates also have essential meanings for the following reasons. First, regardless of successful grants, filings themselves are important because the right to a patent is granted to the first inventors to file the patent (i.e., first-to-file system). This indicates that a firm, through first filing a patent, can outperform direct competitors for any inventions derived from the patent. Furthermore, as filing dates are much closer to the actual time of R&D success than grant dates (Hall, Jaffe, and Trajtenberg, 2001), filing dates are likely to be more informative. Finally, although the information about filings cannot publicly be obtained until publication, such information can be reflected in stock prices around the filing dates, to some extent, through informed trading. Indeed, a recent study of Brennan, Huh, and Subrahmanyam (2018) finds strong evidence of informed trading before corporate announcements, including mergers and acquisitions, dividend initiations, seasoned equity offerings, and earnings. This implies that informed traders can affect a firm's stock price immediately after the filing dates, based on their private information.

[9] In addition to this recent measure, many studies gauge innovation quality based on patent citations. However, we do not use the citation measure, not only because there is no information about citations in the patent database we use but because the number of patent citations is likely to be biased downward, especially for recent patents (Trajtenberg, 1990).

[10] When a firm does not file any patents during a given year, we set the variable to zero.

Panel A of Table 1 presents the averages of our innovation variables as well as the number of firms for each country. We first note that, compared to the initial patent data, the number of countries is reduced from 47 to 27 due to the availability of religiosity data. As a result, the total numbers of firms and patent families are also decreased from 2,000 to 1,506 and from 351,901 to 291,662, respectively. In our sample, the largest number of firms is in the order of the US (641), Japan (296), and China (175), accounting for about 43%, 20%, and 12% of the total. It is obvious that the total number of patent families and their values tend to be proportional to the number of firms. We, however, note that it is not necessarily perfectly proportional: for example, the number of Japanese firms in our sample is about half that of US firms but the total number of their patent families is about twice as many. Furthermore, the aggregate economic value of patent families in South Korea is the third largest in the sample, although the number of firms ranks sixth. These suggest that both the average quantity and quality of patents of a firm varies across countries. Finally, it is noteworthy that the economic value per patent family is highly variable. This implies that the number of patent families of a firm cannot fully capture the degree of the firm's innovation and, thus, their economic values should be taken into consideration together.

[Insert: Table 1]

3.1.2 Measures of religiosity

Religiosity variables are measured based on the survey data provided by the World Values Survey (WVS). Specifically, we first classify religiosity-related questions according to the dimensions of religiosity. For the ideological dimension, we include questions indicating beliefs in a deity, afterlife, soul, hell, and heaven. There are two items regarding the ritualistic dimension, which are religious attendance (formal religious practices) and prayer (informal religious

practices). The experiential dimension is composed of three items representing the degree of a person's reliance on religion: whether one believes that life is meaningful only because God exists, whether God is important in one's own life and whether one gets comfort and strength from religion. We ask two questions regarding views on religion versus science in the intellectual dimension. Finally, three items indicating intolerant behavior toward different religions are included in the consequential dimension. Detailed questions are described in Appendix A.

We then generate the empirical measure of the dimensions of religiosity through the following procedures. First, we take the average of individual responses for each question at the country level (i.e., from the individual–question level to the country–question level).[11] Next, for each question, we standardize these country-level responses to make all questions equally comparable. Finally, for each country, we compute the average of the standardized responses for questions classified in the same dimension and consider the average as religiosity for the corresponding dimension (i.e., from the country–question level to the country–dimension level). Pair-wise correlations for these five dimensions are reported in Appendix C. All correlations are positive and statistically significant, indicating that the religiosity dimensions are interconnected rather than independent.

We employ PCA methods to create the overall religiosity measure. That is, we define the overall religiosity as the first principal component of the five dimensions of religiosity. As a result, the overall religiosity (*Rel*) is calculated by the following formula:

[11] The average value is calculated after excluding respondents who did not answer or answered "Don't know." Some items give higher scores for answers representing lower religiosity. For such cases, we use the negative values of these scores so that high scores indicate high religiosity.

$$Rel = 0.446Ideo + 0.474Ritual + 0.485Exp + 0.457Intell + 0.364Conseq, \quad (1)$$

where *Ideo*, *Ritual*, *Exp*, *Intell*, and *Conseq* refer to the measure of the ideological, ritualistic, experiential, intellectual, and consequential dimensions, respectively. We note that all five coefficients are positive, suggesting that each dimension plays a positive role in forming the overall religiosity. Finally, the overall religiosity captures substantial information for these five dimensions, in that the first principal component (i.e., *Rel*) accounts for about 74% of all variations. We report all religiosity variables in Panel A of Table 1.

3.1.3 Control variables

We include several control variables in our analysis that are likely associated with both religiosity and corporate innovation. First, at the country level, we control for demographic and economic characteristics, including total population, income, education, and trade openness.[12] The information for both population and income (measured by per-capita GDP) is obtained from the Central Intelligence Agency (CIA) World Factbook. Next, we consider the average number of years of total schooling as the level of education of a country. The educational attainment data is drawn from Barro and Lee (2013). Finally, openness to international trade encourages global competition and, thereby, provides incentives to innovate more (Furman, Porter, and Stern, 2002). We define trade openness as the ratio of imports and exports to GDP. The bilateral trade data is taken from the United Nations Comtrade (UNCOMTRADE) database.

In addition to these country characteristics, we also control for firm-specific variables. Specifically, following previous studies (Adhikari and Agrawal, 2016; He and Tian, 2013;

[12] It should be noted that, to mitigate multicollinearity with the religiosity variables, we change these variables to dummy variables.

Hirshleifer, Low, and Teoh, 2012), we include R&D investment, firm size and growth, capital intensity, growth opportunity, performance, leverage, cash holdings, and capital expenditure as control variables. The Compustat database provides corporate financial data that facilitates measuring such firm-level controls. We note that all control variables are lagged by one year for our analysis. In Appendix B, detailed variable descriptions are presented.

3.1.4 Other variables

Several variables are used to extend or strengthen our analysis. First, our second set of hypotheses (i.e., *Hypotheses 2* to *2-(e)*) requires an empirical measure distinguishing Judeo-Christian countries from the others. We take the proportions of adherents for each religious denomination, country, and year from the Association of Religion Data Archives (ARDA). The ARDA covers 100 different religious denominations for almost all countries from 1900 to 2015. For brevity and clarity, we group them into 11 categories as follows: Catholicism, Protestantism (including Anglicanism), Orthodox Churches, Other Christianity, Judaism, Islam, Hinduism (including Jainism and Sikhism), Buddhism (including Shintoism), Other Eastern religions, Other religions, and No-religion (including atheism).[13] Using the proportions data, we measure a dummy variable capturing whether a country is Judeo-Christian or not. Specifically, we set the variable equal to one if the religion that the largest percentage of people in a country follow is included in Judeo-Christianity (i.e., Judaism, Catholicism, Protestantism, Orthodox Churches, and Other Christianity) and zero otherwise.

Next, we use instrumental variables for religiosity to mitigate the endogeneity problem. Barro and McCleary (2003) and McCleary and Barro (2006) find that, consistent with the religion-

[13] We follow the classification method of McCleary and Barro (2006).

market model, religiosity is associated negatively with national regulation of religion and positively with religious pluralism. Further, after controlling for the regulation, the existence of a state religion promotes religiosity due to government subsidies for religion. In this regard, Barro and McCleary (2003) and McCleary and Barro (2006) use measures of state religion, state regulation of religion, and religious pluralism as instruments for the level of national religious beliefs and practices when analyzing the effect of religiosity on economic growth. Accordingly, we also adopt their ideas and use these measures as instruments for the overall religiosity. Data on state religion and regulation is taken from Barro and McCleary (2003). We calculate religious pluralism as one minus the Herfindahl–Hirschman index (HHI), the sum of the squared adherence proportions for each religious denomination.[14]

3.1.5 Summary statistics

Panel B of Table 1 presents summary statistics for the firm–year-level variables used in our analysis. We note that about one-third of observations for the dependent variables are truncated at zero and, therefore, the first quartiles of these variables are all zero. Unlike the country-level religiosity variables reported in Panel A of Table 1, mean values of firm–year-level religiosity variables are not zero because each country constitutes a different number of observations. Although the maximum number of observation is 4,518 (1,506 firms × 3 years), the numbers of observations for firm-specific controls are lower, due to the data limitation. Our sample is appropriate for testing the second hypotheses (i.e., *Hypotheses 2* to *2-(e)*), in that Judeo-Christian countries account for almost half (54.8%) of the entire sample. Finally, there are substantial

[14] Barro and McCleary (2003) also provide a religious pluralism variable in the years 1900, 1970, and 2000. However, we re-estimate pluralism because, as with the other controls, we want to use the one-year lagged variable as an instrument. Our results do not change significantly if we replace our pluralism variable with that of Barro and McCleary (2003).

variations in all variables at the firm–year level.

3.2 Empirical Methods

To examine our first six hypotheses (i.e., *Hypotheses 1* to *1-(e)*) that associate national religiosity with corporate innovation, we model the following test equations:

$$\ln(1+Num)_{ikct} \text{ or } \ln(1+Econ)_{ikct} \text{ or } \ln(1+Econ/Num)_{ikct} = \beta_1 Rel_c + \Theta' X_{ic,t-1} + \alpha_{kt} + \epsilon_{ikct}; \quad (2)$$

$$\ln(1+Num)_{ikct} \text{ or } \ln(1+Econ)_{ikct} \text{ or } \ln(1+Econ/Num)_{ikct} = \beta_1^a Ideo_c + \beta_1^b Ritual_c + \beta_1^c Exp_c + \beta_1^d Intell_c + \beta_1^e Conseq_c + \Theta' X_{ic,t-1} + \alpha_{kt} + \epsilon_{ikct}, \quad (3)$$

where $\ln(1+Num)_{ikct}$, $\ln(1+Econ)_{ikct}$, and $\ln(1+Econ/Num)_{ikct}$ are natural logarithms of one plus the total number of patent families, total economic value of patent families, and economic value per patent family, respectively, of firm i with industry k headquartered in country c in year t; Rel_c is the overall religiosity; $Ideo_c$, $Ritual_c$, Exp_c, $Intell_c$, and $Conseq_c$ are measures of the ideological, ritualistic, experiential, intellectual, and consequential dimensions of religiosity, respectively; $X_{ic,t-1}$ is a vector of both firm-level controls and country-level controls in year $t-1$; α_{kt} is industry–year fixed effects where the industry classification is based on two-digit SIC codes; and ϵ_{ikct} is the error term. In Equation (2), the positive (negative) β_1 indicates that the promoting impact of religiosity on corporate innovation outperforms (underperforms) the inhibiting impact. Thus, the coefficient β_1 should be positive to

be consistent with *Hypothesis 1*. Next, *Hypotheses 1-(a)–(e)* are jointly tested in Equation (3).[15] Under these hypotheses, we expect that coefficients β_1^a and β_1^b are positive and coefficients β_1^c, β_1^d, and β_1^e are negative.

The differential effects of religiosity across religious denominations are tested in the following models:

$$\begin{aligned}\ln(1+Num)_{ikct} \text{ or } \ln(1+Econ)_{ikct} \text{ or } \ln(1+Econ/Num)_{ikct} \\ = \delta_0 Judeo\text{-}Christian_{ct} + (\beta_0 + \beta_2 Judeo\text{-}Christian_{ct}) \times Rel_c \\ + \Theta' X_{ic,t-1} + \alpha_{kt} + \epsilon_{ikct};\end{aligned} \tag{4}$$

$$\begin{aligned}\ln(1+Num)_{ikct} \text{ or } \ln(1+Econ)_{ikct} \text{ or } \ln(1+Econ/Num)_{ikct} \\ = \delta_0 Judeo\text{-}Christian_{ct} + (\beta_0^a + \beta_2^a Judeo\text{-}Christian_{ct}) \times Ideo_c \\ + \left(\beta_0^b + \beta_2^b Judeo\text{-}Christian_{ct}\right) \times Ritual_c \\ + (\beta_0^c + \beta_2^c Judeo\text{-}Christian_{ct}) \times Exp_c \\ + \left(\beta_0^d + \beta_2^d Judeo\text{-}Christian_{ct}\right) \times Intell_c \\ + (\beta_0^e + \beta_2^e Judeo\text{-}Christian_{ct}) \times Conseq_c + \Theta' X_{ic,t-1} + \alpha_{kt} + \epsilon_{ikct},\end{aligned} \tag{5}$$

where $Judeo\text{-}Christian_{ct}$ is a dummy variable equal to one if the dominant religion of country c is included in Judeo-Christianity and zero otherwise. *Hypothesis 2* proposes that the effect of overall religiosity is greater for firms in Judeo-Christian countries. Therefore, we expect a positive sign for coefficient β_2 in Equation (4). Finally, *Hypotheses 2-(a)–(e)* are tested by estimating

[15] It should be noted that Equation (3) might have a multicollinearity issue, due to high correlations among the five dimensions as shown in Appendix C. However, we believe that the issue is not a serious problem, because multicollinearity mostly reduces the statistical significance of estimated coefficients for the correlated variables, rather than exaggerating the results. Moreover, such high correlations imply that each dimension measure can be a proxy for other dimension measures. Therefore, by controlling for all the dimension measures simultaneously, we clearly separate each dimension's role in corporate innovation.

Equation (5). Our expectation based on these hypotheses is that coefficient β_2^a is not significantly different from zero, coefficient β_2^c is negative, and coefficients β_2^b, β_2^d, and β_2^e are all positive.

We note that our dependent variables are censored at zero. Because censored dependent variables cause a downward bias, we estimate Tobit regression models to avoid such a bias. In all the test equations (i.e., Equations (2)–(5)), we include industry–year fixed effects to capture any unobservable industry- and time-specific endogenous influences. Finally, standard errors clustered at the industry–year level are used to account for any correlation among firms within the same industry and year.

4. Empirical Results

4.1 The Effect of Religiosity on Corporate Innovation

Panels A and B of Table 2 show the regression results for the role of religiosity in corporate innovation. The impact of the overall religiosity is reported in Panel A and the effects of the five dimensions of religiosity are presented in Panel B. For each panel, dependent variables are ln(1+*Num*), ln(1+*Econ*), and ln(1+*Econ*/*Num*) in Columns (1)–(2), (3)–(4), and (5)–(6), respectively. We exclude firm-specific controls in Columns (1), (3), and (5) because they can affect estimation results by reducing the sample size from 4,518 to 3,811.

[Insert: Table 2]

The results for the estimation of Equation (2) are shown in Panel A. We note that the coefficients of *Rel* in all columns are positive, although some of them are statistically insignificant

(in Columns (1) and (2)). In terms of economic significance, after controlling for both firm-level and country-level characteristics, as well as industry and year fixed effects, moving from a country at the 1st quartile to 3rd quartile of *Rel* increases ln(1+*Num*) by 2.2%, ln(1+*Econ*) by 4.2%, and ln(1+*Econ*/*Num*) by 5.0%, compared to their respective averages. We interpret these increments as significant, in that the same movement regarding Tobin's Q raises them by 2.5%, 3.0%, and 3.2%, respectively.[16] These findings suggest that the overall religiosity has a positive impact on corporate innovation (*Hypothesis 1*).

Panel B of Table 2 presents the estimated results for Equation (3). In all columns, we observe that corporate innovation is correlated positively with the ideological and ritualistic dimensions and negatively with the experiential, intellectual, and consequential dimensions. In addition, all these correlations are statistically significant. In Column (2), increases in *Ideo* and *Ritual* (*Exp*, *Intell*, and *Conseq*) from the 25th to 75th percentile raise (reduce) ln(1+*Num*) by 47.4% and 26.9% (by 52.2%, 28.9%, and 4.9%), respectively, compared to the mean value of ln(1+*Num*). Considering that the same calculation regarding Tobin's Q indicates a 2.2% increase, these changes according to the movements for the five religiosity dimensions are highly economically significant. We obtain similar degrees of economic significance for the other dependent variables. Overall, these results provide strong evidence that the ideological and ritualistic dimensions of religiosity foster corporate innovation (*Hypotheses 1-(a)–(b)*), whereas the experiential, intellectual, and consequential dimensions hamper corporate innovation (*Hypotheses 1-(c)–(e)*).

We note that the previous findings of association between religiosity and corporate

[16] We select the economic impact of Tobin's Q as the criterion of economic significance because growth opportunity is a crucial determinant of corporate innovation output (Adhikari and Agrawal, 2016; He and Tian, 2013; Hirshleifer, Low, and Teoh, 2012).

innovation display mere correlations rather than causal effects. That is, our results are insufficient to solve possible endogeneity problems, including a reverse causation and omitted-variable bias. For example, as mentioned, it is likely that the experience of the successful completion of innovative projects further enhances an individual's religiosity. If this is the case, the positive relationship between religiosity and corporate innovation can be due to the effect of innovation on religiosity, rather than vice versa.

We use several instrumental variables (i.e., *State_rel, State_regul, Plural*) for the overall religiosity to mitigate such endogeneity issues. The results for the estimation of instrumental variable regressions are reported in Panel C of Table 2. All controls and fixed effects used in Panels A and B are included. The last column presents the first-stage estimation result. Consistent with Barro and McCleary (2003; 2006), the overall religiosity is related positively to the existence of state religion and religious pluralism and negatively with state regulation of religion. Moreover, these instruments have neither under-identification nor weak-identification problems. Therefore, our instruments are valid both intuitively and statistically. Turning to the second-stage regression results, in Columns (1)–(3), we find that all the corporate innovation measures are positively related to the overall religiosity. Further, such relations are statistically significant at the 1% level. These findings provide confidence that our main findings are not simply induced by endogeneity issues.

4.2 Religious Denominations and the Effect of Religiosity on Corporate Innovation

Table 3 shows the estimated results for Equations (4)–(5), testing whether the effect of religiosity varies across religions. The first three columns focus on the overall religiosity and the

last three columns deal with its five dimensions. In Columns (1)–(3), we observe that the effect of religiosity on corporate innovation is significantly dependent on Judeo-Christian traditions. For example, in Column (1), the coefficient of religiosity is 0.197 when sample firms are headquartered in Judeo-Christian countries but -0.273 for firms in other countries. This suggests that religiosity toward Judeo-Christianity fosters innovation, whereas religiosity toward other religions hinders innovation. These findings are consistent with *Hypothesis 2* that the positive influence of religiosity is pronounced for firms in Judeo-Christian countries.

[Insert: Table 3]

Columns (4)–(6) in Table 3 show the differential effects of the dimensions of religiosity in accordance with religious denominations. We find that all coefficients of *Ideo* × *Judeo-Christian* are insignificant and those of *Ideo* are all positively significant. This indicates that the ideological dimension enhances corporate innovation regardless of whether Judeo-Christian traditions are prevalent. In Column (4), the coefficient of *Ritual* × *Judeo-Christian* is positively significant, whereas that of *Ritual* is insignificant. In Columns (5)–(6), however, all the coefficients regarding *Ritual* are not significant. Thus, the estimated coefficients regarding *Ritual* suggest partial support for *Hypothesis 2-(b)* that the ritualistic dimension of religiosity has a more significantly positive impact on corporate innovation under Judeo-Christian traditions. In all three columns, there are negative relationships between the experiential dimension and corporate innovation for firms in Judeo-Christian countries only. This finding is in line with Miller (2000) and Miller and Stark (2002) that, unlike Western religions, Eastern religions are not substantially associated with the risk-aversion preference of individuals and, therefore, it supports *Hypothesis 2-(c)*. The results for the estimated coefficients regarding the last two dimensions present similar patterns: their negative influences on corporate innovation are largely diluted under Judeo-Christian traditions. For

example, in Column (4), the coefficient of *Intell* (*Conseq*) without these traditions is -3.003 (-0.589) but under these traditions is -0.635 (0.975). Overall, all results in Columns (4)–(6) of Table 3 provide strong evidence supporting *Hypotheses 2-(a)–(e)*.

5. Concluding Remarks

Our study belongs to a growing field of research connecting religion and finance. We contribute to the literature by exploring the influence of religion on corporate innovation, which has never been sufficiently studied at the comprehensive level. In a sample of corporate innovation for firms in 27 countries between 2012 and 2014, we find strong evidence that various aspects of religiosity are significantly associated with corporate innovation: corporate innovation is related positively with the ideological and ritualistic dimensions of religiosity and negatively with the experiential, intellectual, and consequential dimensions. In addition, the overall religiosity has a positive impact on corporate innovation, suggesting that the positive influences of the first two dimensions significantly surpass the negative influences of the other three dimensions. Furthermore, using various instruments, we confirm that our findings are not induced by endogeneity issues, including reverse causations and omitted variables.

Finally, we provide sophisticated evidence by focusing on the interaction between religiosity and religious denominations. We find that the extent of the effect of religiosity depends heavily on religions: the positive effect of religiosity is more pronounced for firms in Judeo-Christian countries, as the promoting role of the ritualistic dimension becomes stronger and the inhibiting roles of the intellectual and consequential dimensions become weaker. However, the impact of the ideological dimension does not vary and the negative impact of the experiential

dimension becomes more pronounced under Judeo-Christian traditions.

In short, religiosity has a profound effect on various traits of individuals and, thereby, corporate innovation. Our study thus highlights the crucial importance of the comprehensive understanding of the diverse impact of religion on corporate innovation.

Appendix A: Question Items

Question code [answer interval]	Question
Ideological dimension	
F050 [0, 1]	Which, if any, of the following do you believe in? God.
F051 [0, 1]	Which, if any, of the following do you believe in? Life after death.
F052 [0, 1]	Which, if any, of the following do you believe in? People have a soul.
F053 [0, 1]	Which, if any, of the following do you believe in? Hell.
F054 [0, 1]	Which, if any, of the following do you believe in? Heaven.
Ritualistic dimension	
F028 [1, 8]	Apart from weddings, funerals, and christenings, about how often do you attend religious services these days?
F028B [1, 8]	Apart from weddings, funerals, and christenings, about how often do you pray these days?
Experiential dimension	
F004 [1, 3]	Life is meaningful only because God exists.
F063 [1, 10]	How important is God in your life?
F064 [0, 1]	Do you find that you get comfort and strength from religion?
Intellectual dimension	
E220 [1, 10]	We depend too much on science and not enough on faith.
F202 [1, 4]	Whenever science and religion conflict, religion is always right.
Consequential dimension	
F102 [1, 5]	Politicians who do not believe in God are unfit for public office.
F104 [1, 5]	It would be better for this country if more people with strong religious beliefs held public office.
G007_35_B [1, 4]	Trust: People of another religion.

Appendix B: Variable Definitions

Variable	Definition
Dependent variables	
ln(1+*Num*)	The logarithm of one plus the total number of patent families filed in at least one of the five patent offices, including EPO, JPO, KPO, SIPO, and USPTO, for a firm in a given year (source: OECD).
ln(1+*Econ*)	The logarithm of one plus the total dollar value of patent families filed in at least one of the five patent offices, including EPO, JPO, KPO, SIPO, and USPTO, for a firm in a given year (source: patent data from OECD; stock price data from Compustat; market index data from Datastream; exchange-rate data from I/B/E/S).
ln(1+*Econ*/*Num*)	The logarithm of one plus the ratio of the total number to the total dollar value of patent families filed in at least one of the five patent offices, including EPO, JPO, KPO, SIPO, and USPTO, for a firm in a given year (source: patent data from OECD; stock price data from Compustat; market index data from Datastream; exchange-rate data from I/B/E/S).
Explanatory variables	
Rel	The first principal component of *Ideo*, *Ritual*, *Exp*, *Intell*, and *Conseq*, where the PCA is performed at the country level (source: WVS).
Ideo	*Ideo* is calculated by the following procedure. First, responses for each question, including F050–F054, are averaged at the country level. Second, the averaged variables are standardized. Finally, we define *Ideo* as the national average of the five standardized variables (source: WVS).
Ritual	*Ritual* is calculated by the following procedure. First, responses for each question, including F028 and F028B, are averaged at the country level. Second, the averaged variables are standardized. Finally, we define *Ritual* as the national average of the two standardized variables (source: WVS).
Exp	*Exp* is calculated by the following procedure. First, responses for each question, including F004, F063, and F064, are averaged at the country level. Second, the averaged variables are standardized. Finally, we define *Exp* as the national average of the three standardized variables (source: WVS).
Intell	*Intell* is calculated by the following procedure. First, responses for each question, including E220 and F202, are averaged at the country level. Second, the averaged variables are standardized. Finally, we define *Intell* as the national average of the two standardized variables (source: WVS).
Conseq	*Conseq* is calculated by the following procedure. First, responses for each question, including F102, F104, and G007_35_B, are averaged at the country level. Second, the averaged variables are standardized. Finally, we define *Conseq* as the national average of the three standardized variables (source: WVS).
Control variables	
Pop	A dummy variable equal to one if the total population of a country in a given year is greater than its firm-level cross-sectional median, and zero otherwise (source: CIA World Factbook).
Income	A dummy variable equal to one if per-capita GDP of a country in a year is greater than its firm-level cross-sectional median, and zero otherwise (source: CIA World Factbook).
Educ	A dummy variable equal to one if the average number of years of total schooling of a country is greater than its firm-level cross-sectional median, and zero otherwise (source: Barro and Lee, 2013).
Open	A dummy variable equal to one if the ratio of imports and exports to GDP of a country in a given year is greater than its firm-level cross-sectional median, and zero otherwise (source: UNCOMTRADE).
R&D	R&D expenditure divided by total assets (source: Compustat).
ln(*Sales*)	The logarithm of sales (source: Compustat).
Sales_growth	ln(*Sales*) minus its one-year lagged value (source: Compustat).

ln(*PPE*/*EMP*)	The logarithm of net property, plant, and equipment divided by the number of employees (source: Compustat).
Tobin's Q	Total assets plus market equity minus book equity, all divided by total assets (source: Compustat).
ROA	Operating income before depreciation divided by total assets (source: Compustat).
Leverage	Debt in current liabilities plus long-term debt, all divided by total assets (source: Compustat).
Cash_holdings	Cash and short-term investments divided by total assets (source: Compustat).
CAPEX	Capital expenditure divided by total assets (source: Compustat).
Interacting variables	
Judeo-Christian	A dummy variable equal to one if a religion that most people in a country in a given year belong to is included in Judeo-Christianity, and zero otherwise (source: ARDA).
Instrumental variables	
State_rel	A dummy variable equal to one if a country has a state religion in the year 2000, and zero otherwise (source: Barro and McCleary, 2003).
State_regul	A dummy variable equal to one if there is state regulation of religion, and zero otherwise (source: Barro and McCleary, 2003).
Plural	One minus the HHI for religious proportions. Specifically, $Plural_{ct} = 1 - \Sigma_{j=1}^{11} P_{j,ct}^2$, where $P_{j,ct}$ is the proportion of people adhering to j-th religion in country c in year t (source: ARDA).

Appendix C: Correlations for the Five Dimensions of Religiosity

This table shows pair-wise Pearson correlations for the five religiosity dimensions. The number of observations is 27. Symbols *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Ideo	*Ritual*	*Exp*	*Intell*	*Conseq*
Ideo	1.000				
Ritual	0.752***	1.000			
Exp	0.842***	0.842***	1.000		
Intell	0.666***	0.715***	0.725***	1.000	
Conseq	0.346*	0.552***	0.539***	0.635***	1.000

References

Adhikari, B. K., Agrawal, A., 2016. Religion, gambling attitudes and corporate innovation. Journal of Corporate Finance 37(C), 229-248.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., Howitt, P., 2005. Competition and innovation: an inverted-U relationship. Quarterly Journal of Economics 120(2), 701-728.

Ahmad, M., 1973. Religiosity as a function of rigidity and anxiety. Indian Journal of Experimental Psychology 7(2), 49-50.

Allport, G. W., Ross, J. M., 1967. Personal religious orientation and prejudice. Journal of Personality and Social Psychology 5(4), 432-443.

Assouad, A., Parboteeah, K. P., 2018. Religion and innovation. A country institutional approach. Journal of Management, Spirituality and Religion 15(1), 20-37.

Baer, M., 2012. Putting creativity to work: the implementation of creative ideas in organizations. Academy of Management Journal 55(5), 1102-1119.

Barro, R. J., Lee, J. W., 2013. A new data set of educational attainment in the world, 1950–2010. Journal of Development Economics 104, 184-198.

Barro, R. J., McCleary, R. M., 2003. Religion and economic growth across countries. American Sociological Review 68(5), 760-781.

Beckford, J. A., Demerath, N. J., 2007. The SAGE handbook of the sociology of religion. London: SAGE.

Bénabou, R., Ticchi, D., Vindigni, A., 2015. Religion and innovation. American Economic Review 105(5), 346-351.

Beteille, A., 1977. Inequality among men. Oxford: Blackwell.

Brennan, M. J., Huh, S. W., Subrahmanyam, A., 2018. High-frequency measures of informed trading and corporate announcements. Review of Financial Studies 31(6), 2326-2376.

Capon, N., Farley, J. U., Lehmann, D. R., Hulbert, J. M., 1992. Profiles of product innovators among large US manufacturers. Management Science 38(2), 157-169.

Carrette, J., 2000. Foucault and religion. London: Routledge.

Clark, A. S., Hoover, S. M., 1997. At the intersection of media, culture, and religion. In: Hoover, S. M., Lundby, K. (Eds.), Rethinking media, religion, and culture, pp. 15-36. Thousand Oaks, CA: SAGE.

Cornwall, M., Albrecht, S. L., Cunningham, P. H., Pitcher, B. L., 1986. The dimensions of religiosity: a conceptual model with an empirical test. Review of Religious Research 27(3), 226-

244.

Daiko, T., Dernis, H., Dosso, M., Gkotsis, P., Squicciarini, M., Vezzani, A., 2017. World corporate top R&D investors: industrial property strategies in the digital economy. A JRC and OECD common report. Luxembourg: Publications Office of the European Union.

Dakhli, M., De Clercq, D., 2004. Human capital, social capital, and innovation: a multi-country study. Entrepreneurship and Regional Development 16(2), 107-128.

Draper, J. W., 1897. History of the conflict between religion and science. New York: D. Appleton & Company.

Ellison, C. G., Musick, M. A., 1995. Conservative Protestantism and public opinion toward science. Review of Religious Research 36(3), 245-262.

Faulkner, J. E., De Jong, G. F., 1966. Religiosity in 5-D: an empirical analysis. Social Forces 45(2), 246-254.

Flammer, C., Bansal, P., 2017. Does a long-term orientation create value? Evidence from a regression discontinuity. Strategic Management Journal 38(9), 1827-1847.

Florida, R., 2002. The economic geography of talent. Annals of the Association of American Geographers 92(4), 743-755.

Florida, R., 2003. Cities and the creative class. City and Community 2(1), 3-19.

Francis, J., Smith, A., 1995. Agency costs and innovation some empirical evidence. Journal of Accounting and Economics 19(2–3), 383-409.

Furman, J. L., Porter, M. E., Stern, S., 2002. The determinants of national innovative capacity. Research Policy 31(6), 899-933.

Gaskell, G., Einsiedel, E., Hallman, W., Priest, S. H., Jackson, J., Olsthoorn, J., 2005. Social values and the governance of science. Science 310(5756), 1908-1909.

Glock, C. Y., 1962. On the study of religious commitment. Religious Education 57(4), 98-110.

Glock, C. Y., Stark, R., 1965. Religion and society in tension. Chicago: Rand McNally.

Guiso, L., Sapienza, P., Zingales, L., 2003. People's opium? Religion and economic attitudes. Journal of Monetary Economics 50(1), 225-282.

Hall, B. H., Jaffe, A., Trajtenberg, M., 2001. The NBER patent citations data file: lessons, insights, and methodological tools. NBER Working Paper 8498.

Hall, B. H., Jaffe, A., Trajtenberg, M., 2005. Market value and patent citations. RAND Journal of Economics 36(1), 16-38.

Hall, B. H., Lerner, J., 2010. Chapter 14 – the financing of R&D and innovation. Handbook of the

Economics of Innovation 1, 609-639.

He, J. J., Tian, X., 2013. The dark side of analyst coverage: the case of innovation. Journal of Financial Economics 109(3), 856-878.

Herbig, P., Dunphy, S., 1998. Culture and innovation. Cross Cultural Management: An International Journal 5(4), 13-21.

Hilary, G., Hui, K. W., 2009. Does religion matter in corporate decision making in America? Journal of Financial Economics 93(3), 455-473.

Hirshleifer, D., Low, A., Teoh, S. H., 2012. Are overconfident CEOs better innovators? Journal of Finance 67(4), 1457-1498.

Hofstede, G., 1980. Culture's consequences: international differences in work-related values. Beverly Hills, CA: SAGE.

Holmstrom, B., 1989. Agency costs and innovation. Journal of Economic Behavior and Organization 12(3), 305-327.

Huang, D., Lu, D., Luo, J. H., 2016. Corporate innovation and innovation efficiency: does religion matter? Nankai Business Review International 7(2), 150-191.

Iannaccone, L. R., 1995. Risk, rationality, and religious portfolios. Economic Inquiry 33(2), 285-295.

Jehn, K. A., Chadwick, C., Thatcher, S. M. B., 1997. To agree or not to agree: the effects of value congruence, individual demographic dissimilarity, and conflict on workgroup outcomes. International Journal of Conflict Management 8(4), 287-305.

Jehn, K. A., Northcraft, G. B., Neale, M. A., 1999. Why differences make a difference: a field study of diversity, conflict and performance in workgroups. Administrative Science Quarterly 44(4), 741-763.

King, M., Hunt, R., 1972. Measuring religious dimensions: studies in congregational involvement. Dallas: Southern Methodist University.

King, M., Hunt, R., 1975. Measuring the religious variable: national replication. Journal for the Scientific Study of Religion 14(1), 13-22.

Kirchmaier, I., Prüfer, J., Trautmann, S. T., 2018. Religion, moral attitudes and economic behavior. Journal of Economic Behavior and Organization 148(C), 282-300.

Kleibergen, F., Paap, R., 2006. Generalized reduced rank tests using the singular value decomposition. Journal of Econometrics 133(1), 97-126.

Kogan, L., Papanikolaou, D., Seru, A., Stoffman, N., 2017. Technological innovation, resource allocation, and growth. Quarterly Journal of Economics 132(2), 665-712.

Kostis, P. C., Kafka, K. I., Petrakis, P. E., 2018. Culture change and innovation performance. Journal of Business Research 88(C), 306-313.

Kumar, P., Langberg, N., 2009. Corporate fraud and investment distortions in efficient capital markets. RAND Journal of Economics 40(1), 144-172.

Kumar, A., Page, J. K., Spalt, O. G., 2011. Religious beliefs, gambling attitudes, and financial market outcomes. Journal of Financial Economics 102(3), 671-708.

Lee, C., 1990. Determinants of national innovativeness and international market segmentation. International Marketing Review 7(5), 39-49.

Lenski, G., 1961. The religious factor: a sociological study of religion's impact on politics, economics, and family life. Garden City, NY: Doubleday.

Liang, H., Marquis, C., Renneboog, L., Sun, S. L., 2018. Future-time framing: the effect of language on corporate future orientation. Organization Science 29(6), 989-1236.

Liu, E. Y., 2010. Are risk-taking persons less religious? Risk preference, religious affiliation, and religious participation in Taiwan. Journal for the Scientific Study of Religion 49(1), 172-178.

Manso, G., 2011. Motivating innovation. Journal of Finance 66(5), 1823-1860.

Mazur, A., 2004. Believers and disbelievers in evolution. Politics and the Life Sciences 23(2), 55-61.

McCleary, R. M., 2007. Salvation, damnation, and economic incentives. Journal of Contemporary Religion 22(1), 49-74.

McCleary, R. M., Barro, R. J., 2006. Religion and economy. Journal of Economic Perspectives 20(2), 49-72.

McClelland, D. C., 1961. The achieving society. Princeton, NJ: Van Nostrand.

McCullough, M. E., Willoughby, B. L., 2009. Religion, self-regulation, and self-control: associations, explanations, and implications. Psychological Bulletin 135(1), 69-93.

Miller, A. S., 2000. Going to hell in Asia: the relationship between risk and religion in a cross cultural setting. Review of Religious Research 42(1), 5-18.

Miller, A. S., Hoffmann, J. P., 1995. Risk and religion: an explanation of gender differences in religiosity. Journal for the Scientific Study of Religion 34(1), 63-75.

Miller, A. S., Stark, R., 2002. Gender and religiousness: Can socialization explanations be saved? American Journal of Sociology 107(6), 1399-1423.

Miller, J. D., Scott, E. C., Okamoto, S., 2006. Public acceptance of evolution. Science 313(5788), 765-766.

Muhammad, G. B., Shah-Kazemi, R., Ahmed, A., 2010. The holy Qur'an and the environment. Dabuq, Amman, Jordan: The Royal Aal Al-Bayt Institute for Islamic Thought.

Nanda, R., Rhodes-Kropf, M., 2013. Investment cycles and startup innovation. Journal of Financial Economics 110(2), 403-418.

Pew Research Center, 2009. Religion and science in the United States. <http://www.pewforum.org/2009/11/05/an-overview-of-religion-and-science-in-the-united-states/>

Reimer, S., Park, J. Z., 2001. Tolerant (in) civility? A longitudinal analysis of white conservative Protestants' willingness to grant civil liberties. Journal for the Scientific Study of Religion 40(4), 735-745.

Rokeach, M., 1968. Beliefs, attitudes and values: a theory of organization and change. San Francisco: Jossey-Bass.

Rothwell, R., Wissema, H., 1986. Technology, culture and public policy. Technovation 4(2), 91-115.

Saroglou, V., 2002. Religion and the five factors of personality: a meta-analytic review. Personality and Individual Differences 32(1), 15-25.

Saroglou, V., Delpierre, V., Dernelle, R., 2004. Values and religiosity: a meta-analysis of studies using Schwartz's model. Personality and Individual Differences 37(4), 721-734.

Sarooghi, H., Libaers, D., Burkemper, A., 2015. Examining the relationship between creativity and innovation: a meta-analysis of organizational, cultural, and environmental factors. Journal of Business Venturing 30(5), 714-731.

Schumpeter, J., 1912. The theory of economic development. Cambridge, MA: Harvard University Press.

Schwartz, S. H., Huismans, S., 1995. Value priorities and religiosity in four Western religions. Social Psychology Quarterly 58(2), 88-107.

Scott, E. C., 2004. Evolution vs. creationism. Westport, CT: Greenwood Press.

Seru, A., 2014. Firm boundaries matter: evidence from conglomerates and R&D activity. Journal of Financial Economics 111(2), 381-405.

Shane, S., 1993. Cultural influences on national rates of innovation. Journal of Business Venturing 8(1), 59-73.

Shane, S., 1995. Uncertainty avoidance and the preference for innovation championing roles. Journal of International Business Studies 26(1), 47-68.

Shao, L., Kwok, C., Zhang, R., 2013. National culture and corporate investment. Journal of International Business Studies 44(7), 745-763.

Sherkat, D. E., 2011. Religion and scientific literacy in the United States. Social Science Quarterly 92(5), 1134-1150.

Solow, R. M., 1957. Technical change and the aggregate production function. Review of Economics and Statistics 39(3), 312-320.

Stark, R., 2004. Exploring the religious life. Baltimore, MD: Johns Hopkins University Press.

Stouffer, S. A., 1955. Communism, conformity, and civil liberties: a cross-section of the nation speaks its mind. New York: Doubleday.

Sullivan, J. L., Pierson, J., Marcus, G. E., 1993. Political tolerance and American democracy. Chicago: University of Chicago Press.

Tian, X., Wang, T. Y., 2014. Tolerance for failure and corporate innovation. Review of Financial Studies 27(1), 211-255.

Trajtenberg, M., 1990. A penny for your quotes: patent citations and the value of innovations. RAND Journal of Economics 21(1), 172-187.

Tucker, M. E., Williams, D. R. (Eds.), 1997. Buddhism and ecology: the interconnection of Dharma and Deeds. Cambridge, MA: Harvard University Press.

Weber, M., 1905. The Protestant ethic and the spirit of capitalism. London: G. Allen & Unwin.

Weber, M., 1963. The sociology of religion. Boston: Beacon.

White, L., 1967. The historical roots of our ecologic crisis. Science 155(3767), 1203-1207.

Yinger, J. M., 1957. Religion, society and the individual: an introduction to the sociology of religion. Oxford: Macmillan.

Table 1: Descriptive Statistics

This table shows the descriptive statistics of our data sample and variables from 2012 to 2014. Panel A shows the list of countries in our sample and the information regarding corporate innovation and religiosity for each country. Panel B shows the summary statistics for the firm–year-level variables we use. All variables are defined in Appendix B.

Panel A: Descriptive Information of Corporate Innovation and Religiosity

	Corporate Innovation				Religiosity					
Country	Number of firms	Number of patents	Economic value of patents ($ billion)	Economic value per a patent ($ million)	Overall religiosity	Ideological dimension	Ritualistic dimension	Experiential dimension	Intellectual dimension	Consequential dimension
Argentina	1	0	0.000	0.000	0.574	0.381	0.046	0.514	0.269	-0.084
Australia	12	120	2.657	22.144	-1.186	0.094	-0.681	-0.437	-0.792	-0.620
Brazil	8	82	7.825	95.431	1.789	0.787	1.223	1.429	-0.489	0.722
China	175	9,802	93.131	9.501	-1.780	-1.941	-1.550	-0.940	-0.556	1.525
Colombia	1	0	0.000	0.000	2.867	0.857	1.142	1.473	1.298	1.106
Finland	18	2,409	8.140	3.379	-0.819	0.178	-0.708	-0.570	0.258	-0.889
Germany	68	11,061	162.295	14.673	-1.872	-1.051	-0.667	-0.763	-0.971	-0.389
Hong Kong	18	1,080	21.037	19.479	-1.106	-0.307	-1.121	-1.006	0.290	-0.055
Hungary	1	14	0.019	1.363	-1.163	-1.341	-0.356	-0.469	0.232	-0.558
India	24	1,074	30.581	28.474	1.758	0.154	1.199	0.771	1.007	0.428
Italy	24	595	0.015	0.025	1.038	0.139	1.073	0.203	0.630	0.062
Japan	296	127,139	2,399.508	18.873	-1.358	-0.654	-0.163	-1.372	-0.753	0.332
Malaysia	3	6	0.100	16.745	3.365	1.683	1.787	1.072	1.031	1.472
Mexico	1	6	0.164	27.344	2.192	0.630	1.283	0.932	1.005	0.635
Netherland	23	5,968	92.637	15.522	-2.336	-0.965	-0.963	-0.669	-1.473	-0.759
New Zealand	2	50	0.145	2.910	-1.249	0.252	-0.815	-0.489	-0.622	-0.922
Norway	8	189	4.691	24.819	-2.861	-0.893	-1.008	-0.748	-1.554	-1.821
Russian Fed.	3	64	4.146	64.781	-0.978	-1.251	-0.794	-0.585	0.029	0.664
Singapore	5	553	9.743	17.618	1.342	1.326	0.787	0.834	0.268	-0.549
Slovenia	1	1	0.000	0.020	-1.380	-0.845	-0.073	-0.539	-1.049	-0.325
South Africa	1	31	0.228	7.351	3.197	1.146	1.554	1.263	1.714	0.875
South Korea	55	39,720	288.094	7.253	-0.449	-0.382	0.344	-0.836	-0.007	0.035
Spain	15	304	0.063	0.207	-0.601	-0.148	-0.570	-0.230	0.141	-0.477
Sweden	22	4,605	72.151	15.668	-3.181	-1.016	-1.325	-1.111	-1.622	-1.538
Taiwan	74	19,990	157.469	7.877	-0.038	0.329	-0.616	0.021	0.262	-0.078

Turkey	6	111	0.913	8.224	2.735	1.490	0.451	1.316	1.218	1.195
United States	641	66,688	3,404.991	51.059	1.502	1.348	0.522	0.935	0.236	0.014
Total	1,506	291,662	6,760.743	480.739	0.000	0.000	0.000	0.000	0.000	0.000

Panel B: Summary Statistics of Variables

Variable	Count	Mean	Standard deviation	25th Percentile	Median	75th Percentile
Dependent variables						
ln(1+*Num*)	4,518	2.006	1.927	0.000	1.792	3.401
ln(1+*Econ*)	4,518	12.538	8.918	0.000	16.765	19.302
ln(1+*Econ*/*Num*)	4,518	10.642	7.462	0.000	14.900	16.240
Explanatory variables						
Rel	4,518	0.003	1.527	-1.358	-0.038	1.502
Ideo	4,518	0.159	1.182	-0.654	0.178	1.348
Ritual	4,518	-0.060	0.760	-0.616	0.344	0.522
Exp	4,518	-0.067	0.987	-0.940	0.021	0.935
Intell	4,518	-0.163	0.565	-0.753	0.236	0.236
Conseq	4,518	0.182	0.602	0.014	0.014	0.332
Control variables						
Pop	4,518	0.558	0.497	0.000	1.000	1.000
Income	4,518	0.476	0.499	0.000	0.000	1.000
Educ	4,518	0.523	0.500	0.000	1.000	1.000
Open	4,518	0.579	0.494	0.000	1.000	1.000
R&D	4,249	0.071	0.167	0.012	0.033	0.783
ln(*Sales*)	4,246	9.406	3.169	7.177	8.963	11.747
Sales_growth	4,222	0.159	2.392	-1.442	-0.063	1.478
ln(*PPE*/*EMP*)	3,994	5.597	2.539	3.230	4.803	7.788
Tobin's Q	4,210	2.080	2.662	1.030	1.422	2.207
ROA	4,273	0.088	0.183	0.062	0.101	0.145
Leverage	4,260	0.198	0.169	0.047	0.179	0.305
Cash_holdings	4,219	0.225	0.199	0.087	0.163	0.294
CAPEX	4,226	0.044	0.040	0.019	0.034	0.056
Interacting variables						
Judeo-Christian	4,518	0.548	0.498	0.000	1.000	1.000
Instrumental variables						
State_rel	4,518	0.046	0.211	0.000	0.000	0.000
State_regul	4,518	0.192	0.385	0.000	0.000	0.000
Plural	4,518	0.389	0.210	0.228	0.284	0.609

Table 2: Religiosity and Corporate Innovation

In Panels A and B, the dependent variables are ln(1+*Num*) in Columns (1) and (2), ln(1+*Econ*) in Columns (3) and (4), and ln(1+*Econ*/*Num*) in Columns (5) and (6). For these panels, firm-level controls are (not) included in Columns (2), (4), and (6) (Columns (1), (3), and (5)). Main explanatory variables are *Rel* in Panel A and *Ideo*, *Ritual*, *Exp*, *Intell*, and *Conseq* in Panel B. The instrumental variable estimation results for Equation (2) are reported in Panel C. Columns (1)–(3) present the second-stage results and Column (4) shows the first-stage result. The instrumental variables are *State_rel*, *State_regul*, and *Plural*. The under-identification and weak-identification test statistics are based on Kleibergen and Paap (2006). In all panels, the inclusion of industry–year fixed effects is indicated at the end. Detailed variable descriptions are reported in Appendix B. We use heteroskedasticity-robust standard errors clustered by the industry–year level. The t-statistics are in parentheses. Symbols *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Tobit Regressions of Corporate Innovation on Religiosity

	ln(1+*Num*)		ln(1+*Econ*)		ln(1+*Econ*/*Num*)	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Rel	0.039	0.024	0.392*	0.283*	0.380**	0.287**
	(0.82)	(0.61)	(1.82)	(1.68)	(2.17)	(2.06)
Pop	-2.314***	-1.510***	-10.172***	-6.331***	-8.118***	-5.027***
	(-15.68)	(-11.77)	(-13.71)	(-10.10)	(-11.92)	(-9.06)
Income	0.096	0.790***	1.478**	4.450***	1.437**	3.769***
	(0.64)	(5.00)	(2.19)	(6.50)	(2.54)	(6.49)
Educ	0.609***	1.605***	3.252***	8.591***	2.735***	7.209***
	(4.67)	(13.90)	(5.50)	(10.89)	(5.49)	(9.90)
Open	-0.866***	-0.116	-3.105***	0.699	-2.256***	0.890
	(-6.20)	(-0.88)	(-4.24)	(1.09)	(-3.56)	(1.57)
R&D		1.028		2.123		1.207
		(1.31)		(0.59)		(0.38)
ln(*Sales*)		0.746***		2.530***		1.816***
		(18.68)		(11.11)		(8.73)
Sales_growth		-0.045**		-0.272**		-0.234**
		(-2.21)		(-2.53)		(-2.47)
ln(*PPE*/*EMP*)		-0.240***		-0.158		0.098
		(-5.21)		(-0.73)		(0.53)
Tobin's Q		0.043***		0.324***		0.288***
		(3.85)		(6.92)		(6.95)
ROA		0.381		2.556		2.230
		(0.72)		(1.05)		(1.08)
Leverage		0.985***		5.080***		4.185***
		(3.47)		(3.97)		(3.87)
Cash_holdings		1.853***		5.922***		4.059***
		(8.01)		(3.77)		(2.78)
CAPEX		3.778***		7.311		3.375
		(3.48)		(1.29)		(0.69)
Industry × Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-7,761.225	-5959.761	-12,846.225	-10,713.258	-12,387.354	-10,389.015
Observations	4,518	3,811	4,518	3,811	4,518	3,811

Panel B: Tobit Regressions of Corporate Innovation on the Dimensions of Religiosity

	ln(1+*Num*)		ln(1+*Econ*)		ln(1+*Econ*/*Num*)	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Ideo	1.329***	0.475**	7.324***	3.779***	6.160***	3.419***
	(6.40)	(2.24)	(5.88)	(3.27)	(5.57)	(3.39)
Ritual	0.742***	0.474***	2.914***	1.309**	2.249***	0.906*
	(6.95)	(3.56)	(3.98)	(2.16)	(3.44)	(1.78)
Exp	-1.451***	-0.559**	-6.398***	-1.942*	-5.092***	-1.476*
	(-10.38)	(-2.37)	(-7.12)	(-1.86)	(-6.02)	(-1.69)
Intell	-1.102***	-0.587**	-6.095***	-4.361***	-5.098***	-3.861***
	(-4.35)	(-2.13)	(-4.47)	(-2.77)	(-4.27)	(-2.80)
Conseq	-0.825***	-0.398***	-3.475***	-1.984**	-2.742***	-1.658**
	(-4.88)	(-3.13)	(-3.56)	(-2.53)	(-3.22)	(-2.31)
Pop	0.624*	-0.297	3.716**	0.424	3.147**	0.741
	(1.91)	(-1.07)	(2.30)	(0.29)	(2.31)	(0.58)
Income	-1.618***	-0.047	-7.750***	-1.603	-6.281***	-1.615
	(-5.19)	(-0.17)	(-4.59)	(-1.03)	(-4.30)	(-1.20)
Educ	-0.006	1.077***	0.399	5.389***	0.436	4.442***
	(-0.05)	(6.31)	(0.58)	(4.58)	(0.74)	(4.15)
Open	0.016	0.105	1.144	1.771***	1.202	1.776***
	(0.12)	(0.92)	(1.25)	(2.91)	(1.39)	(3.11)
R&D		0.697		0.696		0.054
		(0.88)		(0.19)		(0.02)
ln(*Sales*)		0.712***		2.365***		1.681***
		(18.81)		(10.96)		(8.48)
Sales_growth		-0.027		-0.189*		-0.165*
		(-1.51)		(-1.89)		(-1.85)
ln(*PPE*/*EMP*)		-0.322***		-0.518**		-0.194
		(-5.26)		(-2.01)		(-0.92)
Tobin's Q		0.037***		0.311***		0.280***
		(3.00)		(6.32)		(6.58)
ROA		0.295		2.249		1.992
		(0.54)		(0.88)		(0.92)
Leverage		1.086***		5.383***		4.403***
		(4.09)		(4.42)		(4.24)
Cash_holdings		1.840***		5.602***		3.748**
		(7.89)		(3.42)		(2.45)
CAPEX		4.829***		11.407*		6.602
		(4.10)		(1.86)		(1.26)
Industry × Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-7,622.674	-5,927.696	-12,721.280	-10,686.073	-12,276.395	-10,364.622
Observations	4,518	3,811	4,518	3,811	4,518	3,811

Panel C: Instrumental Variable Regressions of Corporate Innovation on Religiosity

Variable	ln(1+*Num*) (1)	ln(1+*Econ*) (2)	ln(1+*Econ*/*Num*) (3)	*Rel* (4)
Rel	0.169***	0.830***	0.698***	
	(3.86)	(3.91)	(3.94)	
State_rel				1.898***
				(10.07)
State_regul				-2.074***
				(-20.18)
Plural				1.785***
				(3.74)
Pop	-1.255***	-4.763***	-3.539***	2.033***
	(-10.97)	(-9.63)	(-8.24)	(16.19)
Income	0.339***	2.254***	1.797***	0.178
	(3.01)	(4.86)	(4.71)	(1.65)
Educ	0.963***	5.890***	5.050***	0.346**
	(9.71)	(10.56)	(10.32)	(2.52)
Open	-0.161	0.816*	1.112***	-0.015
	(-1.50)	(1.83)	(2.93)	(-0.16)
R&D	0.414	0.851	0.692	0.212
	(0.61)	(0.31)	(0.30)	(1.26)
ln(*Sales*)	0.621***	2.043***	1.436***	-0.048***
	(19.21)	(15.63)	(11.83)	(-2.67)
Sales_growth	-0.046***	-0.160**	-0.128*	0.026***
	(-3.65)	(-2.08)	(-1.86)	(3.86)
ln(*PPE*/*EMP*)	-0.266***	-0.172	0.095	-0.122***
	(-9.36)	(-1.20)	(0.76)	(-3.83)
Tobin's Q	0.013	0.223***	0.205***	0.020***
	(1.28)	(4.83)	(5.21)	(4.21)
ROA	-0.145	1.837	2.008	0.443***
	(-0.32)	(1.00)	(1.34)	(3.56)
Leverage	0.554***	2.923***	2.524***	0.269**
	(2.64)	(3.13)	(3.22)	(2.36)
Cash_holdings	1.511***	4.913***	3.365***	0.109
	(10.13)	(4.68)	(3.33)	(1.26)
CAPEX	3.371***	4.123	0.377	0.629
	(4.08)	(1.02)	(0.11)	(1.58)
Industry × Year F.E.	Yes	Yes	Yes	Yes
Under-identification test	34.193	34.193	34.193	34.193
P-value	0.000	0.000	0.000	0.000
Weak-identification test	268.721	268.721	268.721	268.721
Observations	3,811	3,811	3,811	3,811

Table 3: Religious Denominations and the Effect of Religiosity on Corporate Innovation

Columns (1)–(3) and (4)–(6) present the Tobit regression results for Equations (4) and (5), respectively. "Controls" indicates that both the firm- and country-level controls we use in Table 2 are included. The inclusion of industry–year fixed effects is indicated at the end. Detailed variable descriptions are reported in Appendix B. We use heteroskedasticity-robust standard errors clustered by the industry–year level. The t-statistics are in parentheses. Symbols *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Overall religiosity			Dimensions of religiosity		
	ln(1+*Num*)	ln(1+*Econ*)	ln(1+*Econ*/*Num*)	ln(1+*Num*)	ln(1+*Econ*)	ln(1+*Econ*/*Num*)
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Judeo-Christian: a	1.033***	3.723***	2.860***	1.523***	7.290***	6.038***
	(3.72)	(2.93)	(2.68)	(3.49)	(3.73)	(3.73)
Rel	-0.273***	-0.693**	-0.428			
	(-3.81)	(-2.00)	(-1.45)			
a ×*Rel*	0.470***	1.526***	1.104**			
	(4.38)	(2.83)	(2.32)			
Ideo				1.809***	9.421***	7.973***
				(3.33)	(3.67)	(3.62)
a × *Ideo*				0.224	0.549	0.197
				(0.25)	(0.14)	(0.06)
Ritual				-0.170	-0.722	-0.562
				(-0.73)	(-0.65)	(-0.61)
a × *Ritual*				0.995**	0.914	-0.028
				(2.33)	(0.41)	(-0.01)
Exp				0.257	0.274	-0.039
				(0.75)	(0.20)	(-0.03)
a × *Exp*				-4.231***	-15.534***	-11.702***
				(-5.41)	(-4.55)	(-3.89)
Intell				-3.003***	-13.094***	-10.492***
				(-5.20)	(-4.85)	(-4.49)
a × *Intell*				2.368***	7.803***	5.740***
				(4.58)	(3.55)	(3.02)
Conseq				-0.589**	-2.468**	-1.958**
				(-2.41)	(-2.22)	(-2.07)
a × *Conseq*				1.564***	9.165***	7.819***
				(3.12)	(3.71)	(3.63)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-5,922.561	-10,696.801	-10,377.340	-5,827.175	-10,624.802	-10,315.480
Observations	3,811	3,811	3,811	3,811	3,811	3,811