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Abstract

Previous studies have studied how religious beliefs may affect economic activity. We extend this literature by examining how Confucianism is linked to innovative activities at the firm level in China. We analyze the relationship between Confucianism and several proxies for inputs and outputs of innovative activities. Our results show that Confucianism is significantly related to lower levels of innovative activities regardless of which measure for firm-level innovation we use. We also find that type of ultimate ownership influences this relationship, with innovation among state-controlled firms being significantly more affected by Confucianism. This study thus adds to the understanding of how traditional belief systems influence behavior at the firm level.

JEL Classification: O30; Z10
Keywords: Confucianism; Beliefs; Religion; Innovation; R&D; Patents; China

I transmit rather than innovate. I trust in and love ancient [ways] - *Analects 7.1*

1 Introduction

Innovation is commonly seen as crucial for a country's ability to grow its economy and to strengthen its competitive advantage. Not surprisingly, there is a large literature on factors that may help explain firms' activities that relate to innovation, including financial constraints (Hall and Lerner, 2010), institutions (Khan and Sokoloff, 2004; van Waarden, 2001), incentive structures (Lerner and Wulf, 2007), institutional ownership (Aghion et al., 2013), and family ownership (Lodh et al., 2014). However, only a few studies have discussed the possible impact of cultural and religious factors. In this paper, we contribute to this modest strand of literature by examining the relationship between Confucianism and innovation at the firm level in China.

Previous studies have argued that different belief systems may influence the ability to innovate. Building on a study on religion and economic attitudes (Guiso et al., 2003), Bénabou et al. (2013) find a significant negative relationship between religiosity and innovation. This result holds up to various robustness tests, including alternative measures for religiosity. In a subsequent study, Bénabou et al. (2015) use five waves of the World Values Study to examine the relationship between openness to innovation and religiosity. Using various measures for both variables, they find that religiosity is clearly associated with a less favorable opinion of innovation. Moreover,

Berggren and Bjornskov (2013) identify a negative relationship between religiosity and institutional quality in the form of property rights and rule of law. As a large literature has shown that the quality of these forms of institutions are crucial for innovation, Berggren and Bjornskov's findings suggest that religiosity indirectly affects innovation by being detrimental to institutional development.

Does the negative relationship between religious beliefs in general and innovation hold up in the case of Confucianism? Confucianism is not easily defined, but is often described as a tradition, philosophy, way of life, and sometimes even religion even though it does not address many of the more traditional religious beliefs. It has been argued that Confucianism holds the process of innovation back, as it emphasizes tradition, character and rituals rather than creativeness. Similarly, it has been said that the traditional way of learning in China is primarily based on repetition of knowledge, leaving little room for creativeness and curiosity. Others have argued that several of the most important inventions (e.g., gunpowder, the compass, paper making, and printing) of mankind originated in Confucian China, which would suggest that adherence to traditions does not necessarily mean that innovation is held back.

We provide an answer to this question by analyzing the relationship between Confucianism and innovation empirically. To do this, we use a manually collected data set for places of Confucian worship together with a hand-collected data set for research and development (R&D) expenditures as well as number of patents the firm

level. To the best of our knowledge, this is the first study that examines the relationship between Confucianism and innovation using a rigorous empirical analysis. We find that Confucianism is negatively associated with both input (R&D expenditures) and output (number of patents, inventions, applications or designs) of innovative activities at the firm level. We also show that these findings hold up for alternative measures of innovative activities. Moreover, we find that ownership type plays an important role. Innovative activities in state-owned enterprises (SOEs) are significantly more negatively influenced by Confucianism than those of private firms. In the case of R&D expenditures, ownership is crucial, as it turns out that the relationship between Confucianism and R&D expenditures is non-significant for private firms, but highly significant for SOEs. For outputs of innovative activities, private firms are also negatively affected by Confucianism, even though SOEs exhibit a much stronger effect of Confucianism. We conjecture that this result is due to the fact that top managers of SOEs also are government bureaucrats. Confucianism is a philosophy used to govern society, emphasizing *zhong yong* (Doctrine of the Mean) with guiding principles focusing on moderation, objectivity, never to act in excess rather than creativity and working outside the box. It is likely that acting based on these principles is stronger within the formal bureaucratic system than in the private sector. Finally, we find that outputs of innovative activities in the form of patents are valued by the market, as the market value of a firm increases when a new patent is

granted. Combined, these findings suggest that Confucianism is negatively associated with firm value, especially in the case of SOEs.

The rest of this paper is organized as follows. Section 2 places the study within the existing literature, after which it discusses Confucianism and develops the research hypotheses. Section 3 first introduces the data and then presents the empirical results. Finally, Section 4 concludes the paper.

2 Literature Review and Hypothesis Development

2.1 Economics and Religion

There is a burgeoning literature on the economics of religious beliefs.[2] This literature can broadly be divided into two strands, one focusing on evidence at the micro level and the other at the macro level. Early macro-level studies primarily focus on the relationship between religion and economic growth.[3] Grier (1997) shows that economic growth in former colonies is related to various religions. Barro and McCleary (2000) find that economic growth is positively associated with religion in general, but negatively related to church attendance. In the same vein, Guiso et al. (2003) show that an active religious system is positively associated with economic

[2] Iyer (2016) provides a comprehensive review of the emerging field of economics of religion.

[3] Related to this literature, Alon and Chase (2005) also find evidence of religious freedom being positively associated with GDP per capita.

development and per capita income.[4] Some studies argue that this relationship depends on the religion in question, with Islam having a significantly more adverse effect on growth. However, several studies find no such effect of Islam (e.g., Noland, 2005; Pryor, 2007). In a related country-specific study, Wang and Lin (2014) analyze how different religions relate to economic development across regions in China and show that Christianity has the most significant effect. Other studies link religion to democratic institutions (Woodberry, 2012), which in turn can have indirect effects on economic growth (e.g. Acemoglu et al., 2016; Doucouliagos and Ulubasoglu, 2008).

Microlevel contributions have analyzed how religious beliefs affect socioeconomic variables. Prominent contributions in this literature have analyzed the relationship between religion and earnings differentials (Tomes, 1985), criminal activities (e.g., Evans et al., 1995), individual health (Ellison, 1991), the consumption of drugs and alcohol (Cochran and Akers, 1989). Closer to our paper, researchers have analyzed religious beliefs and economic decisions. A number of studies have analyzed religion and risk (e.g. Diaz, 2000; Halek and Eisenhauer, 2001; Dehejia et al., 2007). Hilary and Hui (2009) extend this type of analysis and show that organizational behavior is also influenced by the general level of religiosity in the location where the firm operates. There are also a few studies that attempt to shed

[4] It is worth noting that not all studies find a significant relationship between religion and economic growth (see, e.g., Durlauf et al., 2011; Eum, 2011).

light on how religion affects behavior at the firm level in China, including studies on the relationship between religion and owner-manager agency costs (Du, 2013), tunneling (Du, 2014), corporate social responsibility and pollution (Du et al., 2014), minority shareholder expropriation (Du, 2015), earnings management (Du et al., 2015), and corporate philanthropy and political activities (Du, 2017).

There are a limited number of studies that examine the relationship between religious beliefs and innovation. In a pioneering study, Bénabou et al. (2013) builds a formal model for religiosity and innovation. They then use both international and cross-state U.S. data to show that religiosity indeed is negatively associated with patents per capita. In a second study, they instead use five waves of the World Values Study to analyze this relationship. They find evidence of religiosity being associated with a significantly less favorable opinion of innovation. Also, Berggren and Bjornskov (2013) analyze how the relative importance of religion in daily life affects institutional quality as measured by property rights and rule of law. They find that religiosity is negatively associated with these institutional outcome variables, suggesting that religion has a detrimental effect on institutions that are typically regarded as important for the rate of innovation (e.g. Chen and Puttitanun, 2005; Lin et al., 2010). While these studies contribute to our understanding of the relationship between religious beliefs and innovation, they primarily use country-level data. Our study contributes to this literature by providing a micro-level empirical analysis that focuses on the decision to invest in innovative activities and the outputs of these

activities at the firm level. Moreover, by focusing on Confucianism, we contribute to the ongoing debate on how this particular belief system influences innovation.

2.2 Hypothesis Development: Confucianism and Innovation

Confucianism has often been described as a belief system, tradition, religion, philosophy, or way of life.[5] It originates from the teachings of Confucius (551-479 BC), and has evolved over time. Its main principles include *ren* (benevolence), *yi* (maintaining righteousness), *li* (ritual norms), *zhi* (to be able to evaluate what is right and fair), and *xin* (trust). Confucius and his successors emphasized the importance of interpersonal relationships and stressed the importance of family and social harmony. With its importance declining towards the end of the Han dynasty (206 BC – 220 AC) and then increasing again during the Tang (618-907) and Song (960-1297) dynasties, Confucianism came to constitute a key pillar in the way of life in China.

What does Confucianism mean to the Chinese people today? Is it mainly a reminder of a way of life long lost to history? When the Chinese Communist Party (CCP) took power in 1949, Mao Zedong criticized Confucius for being a champion of a feudalistic society with a strong ruling class. His nephew Mao Yuanxin has said that Mao once stated: "If the Communist Party has a day when it cannot rule or has met

[5] For a detailed discussion on the origins and development of Confucianism, see, among others, Yao (2000), Goldin (2011), and Gardner (2014).

difficulty and needs to invite Confucius back, it means it is coming to an end" (Mendis, 2013, p 24). Nonetheless, the Chinese Party-State initiated the work of looking into how Confucian thought should be prioritized during the 1980s (Ford, 2015). As a result, the status of Confucianism has improved dramatically during the twenty-first century (Wu, 2014), with the CCP encouraging a revival of Confucian thought. One reason for this is likely what some have called a lack of spiritual support, which has resulted in a lack of credibility and morality in Chinese society (Xuan, 2010). Others have argued that the CCP, especially under Xi Jinping, is attempting to merge Deng Xiaoping's ideas on market reforms with Marxism and Mao with the country's ancient political system to establish a new nationalist ideology (Page, 2015). By promoting Confucianism, the CCP can discredit Western ideas and principles of democracy and rationalize and legitimize the current one-party rule (Ford, 2015; Kai, 2014). As noted by Ford (2015), this process has "given rise to a curious cadre of Confucio-authoritarian cheerleaders, for as it has progressed, a group of academics and public intellectuals have emerged (or been put forward) to take it upon themselves to advance this discourse still further". As this process continues, the influence of Confucianism is no longer historical in nature, but instead very much part of modern-day Chinese political influence.

Given its importance, both historically and as part of the current political culture, we expect that Confucianism influences activities and decisions in China. Observers have suggested that a conformist Confucian culture is one reason to why China has

fallen short in global comparisons of innovativeness (Jullens, 2014). A famous passage in the Analects is often cited in favor of this argument: The Master said, "I transmit rather than innovate. I trust in and love ancient [ways]" (Analects 7.1).[6] Moreover, and as discussed earlier, related studies have found a negative relationship between traditional belief systems and innovation. Based on this, we hypothesize that Confucianism is negatively associated with innovative activities. Moreover, we argue that Confucianism is likely to have a particularly strong impact on bureaucratic organizations managed by government officials. We therefore hypothesize that Confucianism has a more detrimental effect on innovative activities in state-controlled firms.

3 Empirical Analysis

3.1 Data

First, to measure input of innovative activities, we collect data on R&D expenditures for all listed companies in the sample by hand. The reason we do this

[6] It is worth noting that scholars have criticized readers who interpret that passage as Confucius saying that he does nothing more than handing down the old for being naïve. For example, Yu (2012) compares such a direct interpretation of the passage as taking Socrates' claim of knowing nothing literally. Others have argued that Confucius was highly innovative and perhaps even revolutionary (e.g., Tan, 2013).

manually is because information on R&D expenditures appears in different parts of annual reports in China: (i) under “research and development expenses”, “technology development”, and others in the notes to the financial statements; (ii) under "development expenditures" in the notes to the balance sheets (including the opening amount, closing amount, current increase, current decrease, research or development stage, etc.); (iii) the management discussion and analysis. We thus collect information on R&D expenditures from all these sections in the annual report for each firm and year. Second, to measure outputs of innovative activities, we gather data on patents. We manually collect patent data for all firms and years from the Chinese State Intellectual Property Office (CSIPO).

Third, we gather data on Confucian temples in China. We collect this information from three different websites: *Guoxue Wangzhan*, *Kongmiao Wangzhan*, and *Baidu Baike*. Figure 1 shows the geographic distribution of Confucian temples across the country. Most of these temples were built a long time ago. For example, the Temple and Cemetery of Confucius and the Kong Family Mansion in Qufu, Shandong province, were built in 478 B.C., while the Beijing Temple of Confucius was built during the Yuan Dynasty. The long history of most of the temples means that the risk of reverse causality in our empirical analysis is low.

[FIGURE 1 HERE]

Fourth, we collect financial data from the China Stock Market and Accounting Research (CSMAR) database for all listed A-share firms on China's stock exchanges during the period in question. Following the literature on firm analysis, we delete all observations for firms that operate in the financial industry. We end up with the sample presented in Table 1. Panel A of the table shows the total number of firms each year and the percentage of the listed firms that are controlled by one or several government entities. The number of listed firms increases significantly over the period, from 1,277 firms in 2006 to 2,403 firms in 2014. For the whole sample period, we end up with a total of 16,114 firm observations. The share of firms controlled by the government decreases monotonically during the sample period, beginning with 59.3 per cent in 2006 and ending at 39.0 per cent in 2014. This is expected, as more private firms are allowed to go public and as the government let go of control of some SOEs over time. The average share of SOEs to total listed firms for the sample period is 47.8 per cent.

Panel B in Table 1 displays the distribution of sample firms based on industry. Here, we use the China Securities and Regulatory Commission (CSRC) classification to divide the sample into different industries. As expected, the largest number of firms are active in manufacturing. There are very few firms in some industries, including education, scientific research and technology, and hotel and catering. Columns 2 and 3 again provide information on government control. In some of the industries, government control is much more pervasive. These industries, which tend to be within

infrastructure and/or public services, include: utilities, transportation, water conservancy, environment and public facilities management, and education.

[TABLE 1 HERE]

3.2 Summary Statistics

Table 2 presents the summary statistics for the dependent and explanatory variables used throughout the empirical analysis. The three alternative measures for input of innovative activities show that R&D expenditures vary quite considerably in the sample. For example, R&D over sales vary from a low 0.011 per cent to as high as 29.315 per cent. The three alternative measures for outputs of innovative activities tell a similar story. For example, Patents/(bn)Sales vary from 0 to 117.810. The relatively large variation for all six innovation measures support these initial observations. Note that the number of firm observations is 9,038 for these variables, significantly less than the 16,114 observations in the original sample. The reason for this is that we could not identify all R&D expenditures for the remaining firm observations and therefore ended up with the smaller sample.

Next, we list four alternative proxies for the influence of Confucianism. Here, Confucianism100 measures the number of Confucian temples within a 100 kilometer radius from a firm's headquarter. We use Confucianism100 for the baseline results

throughout the paper, but also check the robustness of our results by using the number of temples within a 50 kilometer, 200 kilometer, and 300 kilometer radius, respectively. The results of these estimations are not reported for the sake of brevity, but the main results hold up for all alternative proxy specifications. Similar to the innovation measures, the proxies for the influence of Confucianism vary noticeably across the sample. For example, the minimum number of temples within a 100 kilometer radius of a firm's headquarter is zero, while the maximum number of temples is 16. Again, the standard deviations are relatively large for all four alternative proxies for the influence of Confucianism. The summary statistics for the remaining explanatory variables are as expected.

[TABLE 2 HERE]

3.3 Confucianism and Innovation

To analyze the relationship between Confucianism and innovative activities, we start our empirical analysis with baseline regressions with measures for innovation as the dependent variable. We use a fixed-effect model that includes year, industry, and province effects. For robustness, we also cluster the standard errors by firm and year. Panel A in Table 3 shows the results for R&D/Sales as the dependent variable. The coefficient for the main explanatory variable, Confucianism, is negative and

significant at the 1 per cent level. This result lends support to the hypothesis that Confucianism is negatively associated with innovative activities.

This initial finding focuses on input of the innovative process. How about outputs from innovative activities? To examine the influence of Confucianism, we run the same baseline regression, this time with the number of patents over the number of employees as the dependent variable. Panel B in Table 3 presents the result for this estimation together with three additional regression results for the alternative measures of outputs from innovative activities. The coefficient for Confucianism is once again negative and significant for all four model specifications. For the measures Patent/(ths)Employee and Invention/(ths)Employee, Confucianism is negative and significant at the 1 per cent level, and for Application/(ths)Employee and Design/(ths)Employee it is significant at the 5 per cent level. These findings lend further support to the hypothesis that Confucianism is negatively associated with innovation at the firm level in China.

[TABLE 3 HERE]

To test the robustness of the baseline results in Table 3, we run new regressions for alternative measures of innovation at the firm level. First, we use R&D/Assets and R&D/(10ths)Employee as alternative measures for input of innovative activities. The new regressions for these two measures as dependent

variables are presented in Panel A of Table 4. The coefficient for Confucianism is again negative and significant in both regressions, but now at the 5 per cent level. Next, we look at two alternative measures for outputs from innovative activities. Instead of Patent/(ths)Employee, we proxy innovation outputs with Patent/(bn)Sales and Patent/(bn)Assets. That is, we divide the number of patents with Sales and Assets in billions, respectively. The new regression results are presented in Panel B of Table 4. The coefficient for Confucianism is once more negative and significant at the 1 per cent level. Based on these additional robustness tests, we can conclude that Confucianism indeed has a negative influence on innovative activities at the firm level in China.

[TABLE 4 HERE]

3.4 The State and Private Sectors

Having examined the general relationship between Confucianism and innovative activities, we now turn to the issue of ownership. As noted in the section on working hypotheses, we conjecture that ownership type will influence how Confucianism impacts innovation at the firm level. More precisely, we expect Confucianism to have a larger impact on firms controlled by the state. To test this hypothesis, we create a new dummy variable which equals one if the firm in question

is ultimately controlled by the state and zero otherwise. We then run new the baseline regressions again, this time including the ownership dummy as an explanatory variable.

The results of the new regressions are presented in Table 5. Panel A shows the results for R&D/Sales as the dependent variable. First, the state ownership dummy variable has a negative and significant impact on input of innovative activities on its own, suggesting that SOEs in general tend to invest less in innovation. Second, the interaction term for Confucianism and state ownership is negative and significant at the one per cent level. This result indicates that Confucianism magnifies the negative effect state control has on innovation. In fact, the regression results in this panel show that Confucianism on its own, while still negative, is no longer significant. This suggests that impact of Confucianism on innovation is primarily found among firms controlled by bureaucrats.

We also run new regressions for the four alternative measures of outputs of innovative activities we looked at in the baseline regressions. The results are presented in Panel B of Table 5. Once more, the coefficient for state ownership is negative and significant. Moreover, the interaction term for Confucianism and state ownership is again negative and significant at the one per cent level. However, for the innovation output variables, the coefficient for Confucianism remains negative and significant in all four cases. Confucianism thus impacts the effect state ownership has on innovation outputs. However, the negative effect of Confucianism still persists

even after considering ownership type, suggesting that outputs of innovative activities among privately controlled firms are also negatively affected by Confucianism.

To sum up the results for firm ownership, we have seen that state control is associated with a larger negative impact of Confucianism on both inputs and outputs of innovative activities in Chinese firms. This supports the hypothesis that state ownership is associated with a more severe impact of Confucianism on innovative activities at the firm level.

[TABLE 5 HERE]

Before summing up our findings, we want to shed some light on the potential economic implications of the negative relationship between Confucianism and innovation. Does the influence of Confucianism have an economic effect? While it is difficult to analyze this directly, we can make tentative inference based on the relationship between innovative activities and firm value. More specifically, we analyze how outputs of innovative activities at the firm level in the form of new patent grants affects firm value. Figure 2 displays cumulative abnormal returns (CARs) around the official announcement date for new patents being granted.[7] The figure

[7] Abnormal returns are the difference between expected returns and actual returns of a stock over a specific time period. CARs are the sum of abnormal returns of abnormal returns and are often used to determine the effect that specific events have on stock prices.

shows a clear relationship between new patents and an increase in firm value. As Confucianism is negatively associated with outputs of innovative activities, we can therefore infer that Confucianism holds back higher firm values resulting from innovative activities.

[FIGURE 2 HERE]

4 Conclusion

Previous studies have examined how religious beliefs may affect economic activity. We extend this literature with an analysis of how Confucianism is linked to innovative activities at the firm level in China. Using the number of Confucian temples in the vicinity of a firm's headquarter as a proxy for Confucian influence at the local level, we examine the relationship between Confucianism and a variety of indicators for inputs and outputs of innovative activities. We find that Confucianism is significantly associated with a lower level of innovative activities across all alternative measures for firm-level innovation. Moreover, we show that type of ownership influences this relationship, with innovation among SOEs being significantly more affected by Confucianism compared to privately controlled firms. Finally, we deduce that Confucianism likely has a detrimental effect on firm value as it holds back innovative activities. This study thus extends and supports the few

existing studies that have identified a connection between religious beliefs and attitudes toward innovation.

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Table 1. The sample

Panel A: Sample by year

This panel presents the distribution of the firm sample by year. SOE refers to firms which are ultimately controlled by one or several government entities.

Year	Total sample	SOE sample	
	Number	Number	As percentage of Total sample
2006	1277	757	59.280%
2007	1340	784	58.507%
2008	1422	805	56.610%
2009	1495	826	55.251%
2010	1610	854	53.043%
2011	1950	898	46.051%
2012	2231	913	40.923%
2013	2386	931	39.019%
2014	2403	936	38.951%
Total	16114	7704	47.809%

Table 1. The sample (continued)
Panel B: Sample by industry
This panel presents the distribution of the firm sample by industry. SOE refers to firms which are ultimately controlled by one or several government entities.

CSRC Industry	Total sample Number	SOE sample	
		Number	As percentage of Total sample (%)
Agriculture, forestry, livestock farming, fishery	262	120	45.802%
Mining	524	333	63.550%
Manufacturing	9698	4012	41.369%
Utilities	730	623	85.342%
Construction	422	230	54.502%
Wholesale and retail	1128	627	55.585%
Transportation	613	527	85.971%
Hotel and Catering industry	90	58	64.444%
Information transmission, software and information technology service	659	164	24.886%
Real estate	1127	533	47.294%
Leasing and commerce service	197	91	46.193%
Scientific research and technology service	59	16	27.119%
Water conservancy, environment and public facilities management	164	116	70.732%
Education	9	9	100.000%
Culture, sports and entertainment	209	137	65.550%
Miscellaneous	223	108	48.430%
Total	16114	7704	47.809%

Table 2. Summary statistics

This table presents summary statistics for the firm sample. *R&D/Employee* is research and development (R&D) investment per employee. *R&D/Sales* is the ratio of R&D over the firm's sales. R&D/Assets is the ratio of R&D to the firm's total assets. R&D/Assets is the ratio of R&D to the firm's net profits. *Patents/(ths)Employee* is the patent per thousand employees. *Patents/(bn)Sales* is the patent per billion renminbi (RMB) in sales. *Patents/(bn)Assets* is the patent per billion RMB in assets. *Firm size* is the natural logarithm of total assets. *Tobin's Q* is the sum of total market value and total net liabilities divided by total assets. *Leverage* is the sum of long-term and short term debt divided by total assets. *ROE* is the ratio of net profits over total equities. *Largest Ownership* is the percentage ownership by the largest owner. *Cash* is the sum of cash and cash equivalent divided by total assets. *Intangible* the ratio of intangible assets to total assets. *State* is a dummy variable which equals one if the firm is ultimately controlled by the government and zero otherwise.

	Number	Mean	Median	STD	Min	Max
R&D/Employee	9038	28906.700	17307.640	34951.880	86.954	193548.320
R&D/Sales	9038	3.875%	2.831%	4.800%	0.011%	29.315%
R&D/Assets	9038	2.083%	1.586%	2.123%	0.006%	11.447%
Patents/(ths)Employee	16114	4.695	0.000	11.568	0.000	74.866
Patents/(bn)Sales	16114	7.050	0.000	18.046	0.000	117.810
Patents/(bn)Assets	16114	3.791	0.000	9.093	0.000	59.180
Confucianism300	16114	23.101	24.000	12.182	0.000	80.000
Confucianism200	16114	12.428	11.000	7.276	0.000	38.000
Confucianism100	16114	4.623	4.000	3.213	0.000	16.000
Confucianism50	16114	1.827	2.000	1.776	0.000	9.000
Firm Size	16114	21.619	21.471	1.240	18.856	25.400
Tobin' Q	16114	3.455	2.556	3.394	0.830	9.255
Leverage	16114	18.573%	16.349%	16.001%	0.000%	68.285%
ROE	16114	5.726%	6.640%	16.780%	-13.530%	22.667%
Largest Ownership	16114	36.515%	34.510%	15.351%	8.940%	74.980%
Cash	16114	17.856%	13.069%	15.659%	0.000%	73.604%
Intangible	16114	4.555%	2.938%	5.517%	0.000%	32.227%
State	16114	0.478	0.000	0.500	0.000	1.000

Table 3. Confucianism and innovative activities

This table presents results for Confucianism and innovative activities. The sample period is 2006-2014. Panel A and B discuss the firm's inputs and outputs of innovative activities, respectively. The dependent variable in Panel A is *R&D/Sales*, defined as the ratio of R&D over the firm's sales. The dependent variable in Panel B is *Patents/(ths)Employee, Invention/(ths) Employee, Application/(ths)Employee, Design/(ths)Employee*, respectively in Column (1)-(4).The independent variables are: *Confucianism*, measure as the number of Confucian temples in a 100-kilometer radius from the firm's headquarter; *Firm size*, measured as the natural logarithm of total assets; *Tobin' Q*, measured as the sum of total market value and total net liabilities divided by total assets; *Leverage*, measured as the sum of long-term and short term debt divided by total assets; *ROE*, measured as the ratio of net profits to total equity; *Cash*, measured as the sum of cash and cash equivalent divided by total assets. *Intangible*, measured as the ratio of intangible assets to total assets, and *Largest Ownership*, measured as the percentage ownership by the largest owner. Year, industry and province fixed effects are included but not reported. *T*-statistics are given in parentheses and computed using heteroskedasticity-robust standard errors clustered by firm and year (Petersen, 2009; Thompson, 2011). ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Innovative input: R&D/Sales (%)

	R&D/Sales (%)
Confucianism	-0.110***
	(-2.74)
Firm Size	-0.674***
	(-8.04)
Tobin' Q	0.010**
	(2.12)
Leverage	-1.443**
	(-2.19)
ROE	0.169**
	(2.39)
Cash	7.466***
	(12.17)
Intangible	-0.859
	(-0.48)
Largest Ownership	2.235***
	(3.78)
Intercept	14.952***
	(7.83)
Year fixed effect	Yes
Industry fixed effect	Yes
Province fixed effect	Yes
Adjusted *R2*	0.158

Observations	9038

Table 3. Confucianism and innovative activities (continued)
Panel B. Innovative output: Patents

	Patent/ (ths)Employee	Invention/ (ths)Employee	Application/ (ths)Employee	Design/ (ths)Employee
	(1)	(2)	(3)	(4)
Confucianism	-0.188***	-0.090***	-0.078**	-0.020**
	(-2.91)	(-3.26)	(-2.47)	(-2.23)
Firm Size	-4.744***	-0.897***	-2.628***	-1.218***
	(-9.04)	(-7.31)	(-9.15)	(-7.85)
Tobin' Q	0.426***	0.125***	0.252**	0.049***
	(20.95)	(26.33)	(22.60)	(8.13)
Leverage	-0.362**	-0.005	-0.252***	-0.104
	(-2.15)	(-0.14)	(-2.73)	(-1.09)
ROE	4.015***	0.672***	1.967***	1.376***
	(47.29)	(33.81)	(42.27)	(54.80)
Cash	0.058	0.159	0.084	0.133
	(1.06)	(0.71)	(0.16)	(0.47)
Intangible	18.440*	4.650**	10.512	3.277
	(1.93)	(2.08)	(1.51)	(1.16)
Largest	15.964*	2.140**	8.300	5.524*
Ownership	(1.80)	(2.08)	(1.61)	(1.84)
Intercept	96.685***	18.600***	54.259***	23.825***
	(8.21)	(6.75)	(8.41)	(6.84)
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Province fixed effect	Yes	Yes	Yes	Yes
Adjusted *R2*	0.154	0.112	0.136	0.172
Observations	16114	16114	16114	16114

Table 4. Confucianism and innovative activities: Alternative definitions

This table presents the regressions results for Confucianism and innovative activities using alternative definitions for robustness checks. The sample period is between 2006 and 2014. Panel A and B discuss the firm's inputs and outputs of innovative activities, respectively. The dependent variable in Panel A are *R&D/Assets (%), R&D/(10ths) Employee*, respectively. The dependent variables in Panel B are *Patent/(bn)Sales* and *Patent/(bn)Assets*, respectively. The independent variable include: *Confucianism*, measured as the number of Confucian temples in a 100-kilometer radius from the firm's headquarter; *Firm size*, measured as the natural logarithm of total assets; *Tobin's Q*, measured as the sum of total market value and total net liabilities divided by total assets; *Leverage*, measured as the sum of long-term and short term debt divided by total assets; *ROE*, measured as the ratio of net profits over total equity; *Cash*, measured as the sum of cash and cash equivalent divided by total assets. *Intangible*, measured as the ratio of intangible assets to total assets, and *Largest Ownership*, measured as the percentage ownership by the largest owner. Year, industry and province fixed effects are included but not reported. *T*-statistics are given in parentheses and computed using heteroskedasticity-robust standard errors clustered by firm and year (Petersen, 2009; Thompson, 2011). ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. R&D expenses

	R&D/Assets (%)	R&D/(10ths) Employee
	(1)	(1)
Confucianism	-0.112**	-0.176***
	(-2.05)	(-3.99)
Firm Size	-0.953***	-2.269
	(-6.56)	(-6.32)
Tobin's Q	0.115***	0.664***
	(16.64)	(38.80)
Leverage	0.768	4.292
	(0.63)	(1.42)
ROE	0.262**	4.459***
	(2.17)	(14.91)
Cash	3.062***	8.618***
	(2.80)	(3.19)
Intangible	-3.413	-7.734
	(-1.06)	(-0.97)
Largest Ownership	0.283**	1.314**
	(4.27)	(3.50)
Intercept	21.668***	53.237***
	(6.42)	(6.39)
Year fixed effect	Yes	Yes
Industry fixed effect	Yes	Yes

Province fixed effect	Yes	Yes
Adjusted *R2*	0.153	0.149
Observations	9038	9038

Table 4. Confucianism and innovative activities: Alternative definitions (continued)

Panel B. Patents

	Patent/(bn)Sales	Patent/(bn)Assets
	(1)	(1)
Confucianism	-0.264***	-0.065***
	(-5.04)	(-2.80)
Firm Size	-17.591	-1.842***
	(-1.60)	(-13.29)
Tobin's Q	18.234***	0.107***
	(40.16)	(19.87)
Leverage	1.374	0.141
	(0.39)	(1.15)
ROE	279.847***	10.499**
	(157.71)	(22.17)
Cash	7.947	0.229
	(0.40)	(0.91)
Intangible	-31.614	-3.946
	(-0.16)	(-1.56)
Largest Ownership	92.872**	5.577**
	(8.06)	(4.31)
Intercept	270.262	37.727***
	(1.09)	(12.12)
Year fixed effect	Yes	Yes
Industry fixed effect	Yes	Yes
Province fixed effect	Yes	Yes
Adjusted *R2*	0.335	0.293
Observations	16114	16114

Table 5. Confucianism and innovative activities: State and private ownership
This table presents the results for Confucianism, firm ownership, and innovative activities. The sample period is 2006-2014. Panel A and B discuss the firm's inputs and outputs of innovative activities, respectively. The dependent variable in Panel A is *R&D/Sales*, defined as the ratio of R&D over the firm's sales. The dependent variable in Panel B is *Patents/(ths)Employee, Invention/(ths) Employee, Application/(ths)Employee, Design/(ths)Employee*, respectively in Column (1)-(4). The independent variables include: *Confucianism*, measured as the number of Confucian temples in a 100-kilometer radius from the firm's headquarter; *State*, which is a dummy variable that equals one if the firm is ultimately controlled by government and zero otherwise; the interaction of *State* and *Confucianism*; *Firm size*, measured as the natural logarithm of total assets; *Tobin's Q*, measured as the sum of total market value and total net liabilities divided by total assets; *Leverage*, measured as the sum of long-term and short term debt divided by total assets; *ROE*, measured as the ratio of net profits to total equity; *Cash*, measured as the sum of cash and cash equivalent divided by total assets. *Intangible*, measured as the ratio of intangible assets to total assets, and *Largest Ownership*, measured as the percentage ownership by the largest owner. Year, industry and province fixed effect are included but not reported. *T*-statistics are given in parentheses and computed using heteroskedasticity-robust standard errors clustered by firm and year (Petersen, 2009; Thompson, 2011). ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. R&D expenses

	R&D/Sales
Confucianism	-0.033
	(-0.48)
State	-1.640***
	(-4.29)
State*Confucianism	-0.248***
	(-5.20)
Firm Size	-0.702***
	(-4.84)
Tobin's Q	-0.003
	(-0.40)
Leverage	-7.680***
	(-6.51)
ROE	0.002
	(1.02)
Cash	6.168***
	(5.81)
Intangible	6.870**
	(2.22)
Largest Ownership	2.777***
	(2.72)
Intercept	17.915***

	(5.42)
Year fixed effect	Yes
Industry fixed effect	Yes
Province fixed effect	Yes
Adjusted *R2*	0.106
Observations	9038

Table 5. Confucianism and innovative activities: State and private ownership (continued)

Panel B. Patents

	Patent/ (ths)Employees	Invention/ (ths)Employees	Application/ (ths)Employees	Design/ (ths)Employees
	(1)	(2)	(3)	(4)
Confucianism	-0.174***	-0.057**	-0.081***	-0.036**
	(-3.70)	(-2.17)	(-3.30)	(2.39)
State	-2.559***	-2.203***	-2.484***	-0.869***
	(-25.11)	(-17.82)	(-21.59)	(-12.23)
State* Confucianism	-1.949***	-1.298***	-0.999***	-1.021***
	(-85.47)	(-37.83)	(-49.89)	(-39.72)
Firm Size	-0.263***	-0.045	-0.172***	-0.046*
	(-3.12)	(-0.97)	(-3.92)	(-1.71)
Tobin's Q	0.201**	0.340**	0.301	0.185**
	(3.28)	(2.16)	(0.47)	(4.04)
Leverage	-0.029	-0.010	-0.015	-0.012
	(-1.11)	(-0.66)	(-1.09)	(-0.55)
ROE	0.001	0.001	0.001	0.001
	(0.29)	(0.47)	(0.10)	(0.38)
Cash	0.656***	0.295***	0.271***	0.090*
	(4.98)	(3.57)	(3.53)	(1.90)
Intangible	2.263	0.211	2.272	0.216
	(1.53)	(0.26)	(0.96)	(0.45)
Largest Ownership	2.072**	0.392**	0.818**	0.862***
	(2.15)	(3.07)	(2.39)	(4.23)
Intercept	8.854***	2.132**	5.644***	1.087*
	(4.76)	(2.06)	(5.84)	(1.82)
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Province fixed effect	Yes	Yes	Yes	Yes
Adjusted *R2*	0.379	0.278	0.281	0.329
Observations	16114	16114	16114	16114

Figure 1. Geographic distribution of Confucian temples

This figure depicts the geographic distribution of Confucian temples in China. The data are collected from three different websites:

guoxue wangzhan (http://www.chinaguoxue.net/),
kongmiao wangzhan (http://www.chinakongmiao.org/), and
baidu baike(http://baike.baidu.com/).

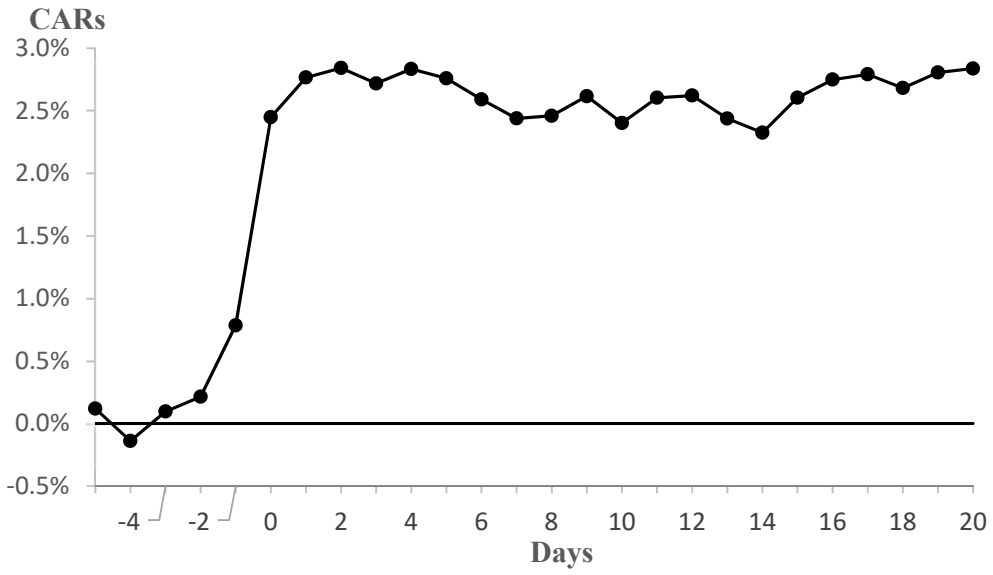

Figure 2. CARs around granted patents

This figure shows the cumulative abnormal returns (CARs) around the official announcement date for granted patents. The period starts on the fifth trading date before the day the patent is granted and ends on the twentieth trading date after the patent is granted. The market benchmark is measured as the tradable value-weighted all A stock shares index.