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DOI: https://doi.org/10.1073/pnas.1815723116

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Citation

Mapping cultural tightness and its links to innovation, urbanization, and happiness across 31 provinces in China

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We conduct a 3-y study involving 11,662 respondents to map cultural tightness—the degree to which a society is characterized by rules and norms and the extent to which people are punished or sanctioned when they deviate from these rules and norms—across 31 provinces in China. Consistent with prior research, we find that culturally tight provinces are associated with increased governmental control, constraints in daily life, religious practices, and exposure to threats. Departing from previous findings that tighter states are more rural, conservative, less creative, and less happy, cultural tightness in China is associated with urbanization, economic growth, better health, greater tolerance toward the LGBT (lesbian, gay, bisexual, and transgender) community, and gender equality. Further, analyzing about 3.85 million granted patents in China (1990–2013), we find that provinces with tighter cultures have lower rates of substantive/radical innovations yet higher rates of incremental innovations; individuals from culturally tighter provinces reported higher levels of experienced happiness.

culture | innovation | creativity | norms | China

Cultural tightness refers to the degree to which a society is characterized by rules and norms and the extent to which people are punished or sanctioned when they deviate from these rules and norms (1). Scholars have thus far mapped global variations in cultural tightness (2) as well as within country (United States) differences (3). A society's cultural tightness could be influenced by sociopolitical and geopolitical factors such as population profile, governmental regulations, religion, education systems, and exposure to threats (2, 3).

To what extent does existing knowledge about cultural tightness apply to China, the world's largest emerging economy and home to about one-fifth of the world population? Given China's unique economic and political model, existing findings about cultural tightness may not completely apply. Over the past two decades, provinces in China have undergone substantially different developmental stages in terms of economic, social, institutional, and science and technology (S&T) reforms (4, 5). Social conventions, cultural practices, language, and labor mobility also vary across provinces due to historical reasons (6). Thus, regional variations in cultural tightness are expected. This research maps how cultural tightness varies across the 31 provinces of China, providing evidence that advances the theorizing of cultural tightness as well as our understanding of China. Through this work, we investigate how cultural tightness manifests in Chinese societies and its association with provincial level outcomes such as innovation tendencies and individual-level outcomes such as problem-solving styles, personality, and happiness. [Consistent with previous studies (7, 8), the two special administrative regions of Hong Kong and Macau are excluded in the present analysis because these regions are not considered part of domestic China due to the intrinsic differences in their historical and technological developments, and government systems.]

Provincial Level Cultural Tightness

This study is approved by the Institutional Review Board of the authors' institution [Singapore Management University IRB-15-008-A008(215)]. All participants read and signed an online informed consent form before completing our survey. We administered a six-item measure on cultural tightness developed by Gelfand et al. (2) in all of the 31 provinces in mainland China at three points in time between 2014 and 2017. Sample items included "There are many social norms that people are supposed to abide by in this province/city" and "In this province/city, if people behave in an inappropriate way, others will strongly disapprove." These measures tap the perception of tightness of social norms in each province. A total of 11,662 individuals (e.g., students, housewives, corporate executives, and professionals such as scientists, engineers, and teachers) responded to our online survey. On average, each province has 376 respondents. Results suggest significant regional variations (Fig. 1 and *SI Appendix*, Table S1).

Additionally, we collected a host of variables such as perception of governmental control, perception of LGBT (lesbian, gay, bisexual, and transgender) tolerance, perception of religious practices, degree of behavioral constraints, personality, cultural values, happiness, and innovation-related thinking style (see *SI Appendix*, Table S2

Significance

This study extends existing theories of cultural tightness by mapping cultural tightness and its relationship to innovation across 31 provinces in China. Consistent with prior research, we find that tighter provinces are associated with increased governmental control, constraints in daily life, religious practices, and exposure to threats. However, prior findings about cultural tightness do not fully apply to China. Departing from prior findings that tighter states are more rural, conservative, less creative, and less happy, cultural tightness in China is associated with urbanization; economic growth; better health; greater happiness; tolerance toward the lesbian, gay, bisexual, and transgender community; and gender equality. Provinces with tight cultures exhibit lower rates of substantive/radical innovation yet higher rates of incremental innovation.
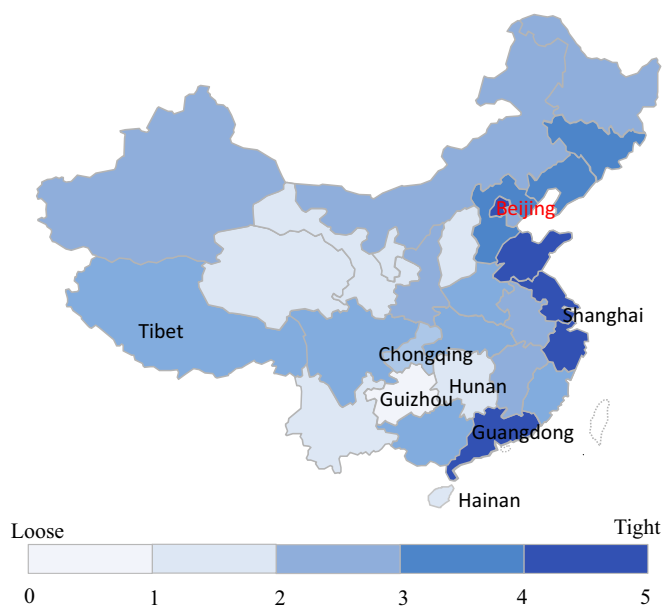

Fig. 1. Cultural tightness in Chinese provinces.

for variables collected). These variables tap sociopolitical and sociocultural factors that have been found to correlate with cultural tightness (2, 3). Drawing on prior research (1–3), we expect some of these factors such as degree of behavioral constraints and governmental control to converge with existing findings on tightness: Tighter provinces should have greater behavioral constraints and governmental controls. For other factors such as tolerance toward LGBT and innovative thinking, deviation from existing findings are likely given China's context. For example, tighter controls and constraints could be associated with greater regulation the Chinese government places on economically important regions; these highly developed and urbanized regions paradoxically might have more tolerant social attitudes (e.g., toward women and sexual orientation diversity) due to greater exposure to the outside world. Additionally, the Chinese government's emphasis on innovation combined with a cultural preference for conformity and gradual change (7) means that tighter provinces might be especially productive at incremental innovation. [Chinese President Xi Jinping on the 12th National People's Congress and the 13th Chinese People's Political Consultative Conference emphasized innovation as the core thrust of future economic development in China (2015).]

Construct and Convergent Validity

Analyses demonstrated construct validity for our measure of cultural tightness in China. Cultural tightness is moderately correlated with cultural values such as group collectivism ($r = 0.21$, 95%CI[0.18, 0.25], $P < 0.001$), relational collectivism ($r = 0.05$, 95%CI[0.02, 0.09], $P = 0.003$), uncertainty avoidance ($r = 0.23$, 95%CI[0.19, 0.26], $P < 0.001$), power distance ($r = -0.23$, 95% CI[−0.27, −0.20], $P < 0.001$), and traditionality ($r = 0.22$, 95%CI[0.19, 0.26], $P < 0.001$) (*SI Appendix*, Table S3). Consistent with the central tenet that cultural tightness is associated with threats exposure, provincial level cultural tightness is positively correlated with various measures of threats such as percentage to which a province was destroyed and occupied by the Japanese during World War II ($r = 0.59$, 95%CI[0.29, 0.78], $P < 0.001$) and whether a province is located along a national border with another country ($r = 0.37$, 95%CI[0.02, 0.64], $P = 0.04$). Importantly, we found that cultural tightness perceptions significantly predict people's attitudes toward behavioral constraints (such as smoking,

public display of affection, or swearing in public) across different settings (such as in hospitals, malls, parks, and classrooms). r ranges from −0.04 to −0.12, with an average P value of 0.0001. Thus, culturally tighter provinces appear to place more constraints on individuals' daily behaviors.

Consistent with findings that culturally tighter states in the United States have stronger local law enforcement (3), culturally tighter Chinese provinces have stronger governmental controls measured by number of government employees per capita ($r = 0.44$, 95%CI[0.11, 0.69], $P = 0.01$), number of provincial level local laws ($r = 0.59$, 95%CI[0.30, 0.78], $P < 0.001$), and publication rate of government-owned newspapers ($r = 0.37$, 95%CI[0.02, 0.64], $P = 0.04$). In addition, we collected people's perceptions of governmental control in their daily life. A multilevel regression found that provincial level cultural tightness is positively associated with individuals' perception of governmental control ($\gamma = 0.06$, 95%CI[0.03, 0.08], $P < 0.001$). [Gammas (γ) denote level-2 regression coefficients in multilevel modeling.] Related to governmental control, the number of cases of corruption that violated the "eight-point code" of the Chinese Communist Party ($r = -0.34$, 95%CI[−0.62, 0.01], $P = 0.06$) and corruption that harmed interests of general public ($r = -0.32$, 95%CI[−0.61, 0.04], $P = 0.08$) are both negatively associated with provincial level cultural tightness. (Eight-point code regulation is a set of rules proposed by President Xi aimed at instilling more discipline among the Chinese governmental officials. The regulation includes eight codes of conduct for governmental officials, for example, the practice of thrift during officials' visits to foreign countries.) Drawing on recent data published at the 19th National Congress of the Communist Party of China, we also found that provincial level cultural tightness is positively associated with the number of times President Xi visited each province between 2012 and 2017 ($r = 0.33$, 95%CI[−0.03, 0.61], $P = 0.07$) and the length (days) of his stay ($r = 0.32$, 95% CI[−0.04, 0.60], $P = 0.08$). Interestingly, before controlling for provincial level gross domestic product (GDP), cultural tightness is negatively associated with distance from Beijing—China's political capital (furthest distance: $r = -0.32$, 95%CI[−0.61, 0.04], $P = 0.08$; average distance: $r = -0.30$, 95%CI[−0.59, 0.06], $P = 0.10$), lending credence to an old Chinese adage stating that "when the mountains are high, the emperor is far" (the influence of central government fades over geographic distance from the capital).

Furthermore, consistent with prior findings that culturally tighter countries have stronger religious practices ($r = 0.54$, $P = 0.01$) and greater emphasis on the importance of god ($r = 0.37$, $P = 0.05$) (3), culturally tighter Chinese provinces have a greater number of Buddhist and Taoist temples ($r = 0.39$, 95%CI[0.05, 0.66], $P = 0.03$) and mosques and churches ($r = 0.51$, 95%CI[0.19, 0.73], $P < 0.001$).

Previous findings have linked cultural tightness with environmental vulnerabilities (2, 3). Similarly, we found that tighter provinces have more environmental problems such as water pollution ($r = 0.75$, 95%CI[0.54, 0.87], $P < 0.001$), air pollution ($r = 0.45$, 95%CI[0.12, 0.70], $P = 0.01$), and environmental emergencies ($r = 0.40$, 95%CI[0.05, 0.66], $P = 0.03$).

Taken together, these findings suggest many points of convergence with prior findings on cultural tightness in the United States and around the world. However, there are also important differences that we elaborate upon below.

Urbanization a Key Factor

Unlike previous research that found that cultural tightness in the United States was associated with rural population, poverty, and poor health (3), we found the reverse relationships in China (*SI Appendix*, Table S5): Tighter Chinese provinces are associated with greater degree of urbanization ($r = 0.52$, 95%CI[0.18, 0.72], $P < 0.001$). Many indicators supported this conclusion. For instance, tighter provinces have higher population density ($r = 0.47$,

95%CI[0.19, 0.71], $P = 0.01$), higher economic growth (GDP per capita: $r = 0.64$, 95%CI[0.36, 0.81], $P < 0.001$), lower production of grains—an indicator of lower agricultural activities ($r = -0.31$, 95%CI[−0.60, 0.06], $P = 0.09$), lower poverty rate ($r = -0.47$, 95%CI[−0.71, −0.12], $P = 0.01$), higher rates of university education ($r = 0.42$, 95%CI[0.08, 0.67], $P = 0.02$), lower fertility rate ($r = -0.68$, 95%CI[−0.83, −0.43], $P < 0.001$), higher contraception rate after controlling for provincial GDP per capita ($r = 0.39$, 95%CI[0.03, 0.60], $P = 0.04$), and better health (e.g., higher life expectancy: $r = 0.61$, 95%CI[0.33, 0.79], $P < 0.001$; lower infant mortality: $r = -0.57$, 95%CI[−0.77, −0.27], $P < 0.001$).

Social attitudes commonly associated with urbanization are also positively correlated with cultural tightness in China. Specifically, tighter provinces have higher gender equality (women-to-men ratio in higher education: $r = 0.34$, 95%CI[−0.02, 0.62], $P = 0.06$; percentage of people reported having no preference for children's gender: $r = 0.34$, 95%CI[−0.04, 0.63], $P = 0.08$). A multilevel regression analysis found that provincial level tightness is positively associated with a measure we collected on individual's perception of attitudes toward the LGBT community ($\gamma = 0.25$, 95%CI[0.19, 0.32], $P < 0.001$). These more positive attitudes toward diversity are likely due to increased exposure to foreign ideas in urban areas. By contrast, previous research on cultural tightness indicates that tighter countries tend to be more conservative with lower latitude for sexual orientation diversity (2).

Impact on Innovation

A central consequence of cultural tightness is that people in tight cultures prefer incremental as opposed to radical changes (1, 10). This is because cultural tightness socializes people to be cautious and motivated to avoid mistakes, decreasing their tendency to experiment with highly novel ideas. By this logic, there should be a negative relationship between tightness and creativity/innovation as prior research has found (3, 10, 11). However, this line of argument neglects two issues. First, there is little explicit differentiation between radical and incremental creativity/innovation in prior research linking tightness and creativity. As a result, the positive link between tightness and creativity might be obscured by the negative link between tightness and creativity. Some scholars however have begun to speculate that cultural tightness might engender incremental innovation but there is no empirical evidence to date (1, 12). For instance, Muthukrishna and Henrich (12) argued that in tight societies, because of the discouragement of deviation or risk-taking, there is less variation in terms of transmitting, passing on, and learning of cultural practices and knowledge. Consequently, there is a greater common understanding and less diversity in the knowledge base among people. Innovation in these societies is therefore more likely to happen in an incremental manner, given the emphasis on making things work rather than overhauling them. In contrast, in loose societies, there is more transmission variance because the culture encourages deviations and tolerates mistakes. These seemingly deleterious mistakes in turn give rise to radical innovations. Hence, the stronger the local cultural preference for conformity, continuity, and gradual change (11), the more likely innovators are to engage in incremental innovation. Second, prior research on cultural tightness did not explicitly consider the larger sociopolitical context in which the link between tightness and creativity/innovativeness is situated. Empirical evidence suggests that sociopolitical and institutional factors can play a key role in driving innovation. For example, Bettencourt et al. (13), found that innovation is positively associated with population size in urban areas. This is because urbanization drives divisions of labor and the growth of labor force in innovation-related fields. Thus, increasing population in urban cities facilitates the flow of information, resources, and knowledge creation, i.e., innovation. Therefore, in studying the link between tightness and creativity/innovativeness, the larger sociopolitical context in which a region is situated needs to be considered. Specifically, in the Chinese

context, there has been strong emphasis on innovation in the past decades as the government identified it as the key to China's next stage of development. Many initiatives have been implemented to promote innovation in China (14). Research and development (R&D) workers in China are given ample resources as well as pressure to innovate. Under this context, a strong "innovation norm" is created. Combining this innovation norm (set by the government) with the general norm of cultural tightness wherein people fall in line and obey authority's directions, we expect that a culturally tight province would ramp up its innovation output. However, because of the impact of tightness on creative cognition favoring incremental as opposed to radical changes, the innovations that arise are likely to be incremental in nature.

To investigate how cultural tightness influences innovation at the provincial level, we collected the entire set of patent data from the State Intellectual Property Office of China (SIPO), which includes about 3.85 million granted patents between 1990 and 2013 for analysis. We focus on two distinct types of patents in the Chinese patenting system: invention patents and utility model patents. [We followed prior studies (7, 15, 16) to exclude design patents because these patents are of a very different nature and are less relevant to scientific and technological inventions, which are our focus in this study.] Invention patents relate to substantive and sometimes radical innovations as they are granted for major discoveries and inventions of technology and products. To be granted an invention patent by the SIPO, the level of inventiveness must be high—incorporating prominent substantive features, ideas, or functions that represent "notable progress" compared with existing technology before the date of filing the patent. Conversely, utility model patents represent more incremental innovations and marginal improvements as they are granted primarily for refinements and modification to shapes and structures of existing technology and products, and the level of inventiveness required by the SIPO is typically lower.

We analyzed the impact of cultural tightness on patented innovations—either the number of granted "invention patents per scientist and engineer" or the number of granted "utility model patents per scientist and engineer"—at the provincial level. The effect of cultural tightness on production of innovation in each provincial region is likely to vary depending on the region's level of economic development (i.e., "GDP per capita"), accumulated innovative capability (e.g., "cumulative patents per scientist and engineer"), scientific and engineering human resources (i.e., "scientist and engineer per capita"), funding for education, S&T and innovation (i.e., "education spending per GDP", "university S&T funding per GDP", "national program funding per GDP"), financial resources allocated for R&D (e.g., "enterprise R&D per total R&D", "university R&D per total R&D") and foreign investment [i.e., "foreign direct investment (FDI) per GDP"]. Therefore, we collected and computed these variables to control for the differences in regional innovation attributes for the years from 1990 to 2013 from the China Statistical Yearbook (1991–2015) and the China Statistical Yearbook on Science and Technology (1991–2015), which are published, respectively, by the National Bureau of Statistics of China and the Ministry of Science and Technology of China (see *SI Appendix* for details on each control variable). In our regression models, we have also included year fixed effects and incorporated robust SEs clustered for provinces. As shown in Table 1, results in Model 1–1 indicate a positive and significant relationship between cultural tightness and utility model patents (i.e., incremental innovation) per scientist and engineer ($b = 0.004$, 95%CI[0.001, 0.007], $P < 0.001$) and in Model 2–1, a negative and significant relationship between cultural tightness and invention patents (i.e., substantive/radical innovation) per scientist and engineer ($b = -0.001$, 95%CI[−0.001, −0.000], $P = 0.05$). These results suggest that for every unit increase in cultural tightness, there is on the average an increase of 307 utility model patents produced in a province; for

Table 1. Analyzing the effects of culture on patented innovation output

Variables	Model 1–1 b (SE)	Model 1–1 95% CI	Model 1–2 b (SE)	Model 1–2 95% CI	Model 2–1 b (SE)	Model 2–1 95% CI	Model 2–2 b (SE)	Model 2–2 95% CI
Cultural tightness	0.004** [0.001]	0.001, 0.007	0.003* [0.001]	0.000, 0.006	−0.001* [0.000]	−0.001, −0.000	−0.001** [0.000]	−0.002, −0.000
Scientist and engineer per capita	−0.787 [0.573]	−1.958, 0.384	−1.128 [0.790]	−2.742, 0.487	0.549*** [0.141]	0.262, 0.836	0.145 [0.286]	−0.440, 0.729
Cumulative patents per scientist and engineer	0.007* [0.003]	0.001, 0.013	0.005 [0.003]	−0.001, 0.010	0.001** [0.000]	0.000, 0.002	0.001+ [0.000]	−0.000, 0.002
Education spending per GDP	−0.020 [0.019]	−0.058, 0.018	−0.168 [0.119]	−0.410, 0.074	−0.003 [0.004]	−0.012, 0.005	−0.019 [0.033]	−0.085, 0.048
Enterprise R&D per total R&D	0.000** [0.000]	0.000, 0.000	0.000* [0.000]	0.000, 0.000	0.000 [0.000]	−0.000, 0.000	−0.000 [0.000]	−0.000, 0.000
University R&D per total R&D	0.000 [0.000]	−0.000, 0.000	0.000 [0.000]	−0.000, 0.000	0.000 [0.000]	−0.000, 0.000	−0.000 [0.000]	−0.000, 0.000
University S&T funding per GDP	0.210 [0.917]	−1.663, 2.083	0.581 [0.779]	−1.009, 2.171	−0.078 [0.209]	−0.505, 0.348	0.283 [0.326]	−0.382, 0.948
National program funding per GDP	0.005 [0.152]	−0.305, 0.314	0.139 [0.206]	−0.281, 0.559	0.033 [0.045]	−0.058, 0.125	0.069 [0.056]	−0.045, 0.182
FDI per GDP	0.032 [0.027]	−0.023, 0.088	0.024 [0.032]	−0.040, 0.089	0.002 [0.010]	−0.018, 0.022	0.004 [0.014]	−0.025, 0.032
GDP per capita	0.000 [0.000]	−0.000, 0.000	0.000+ [0.000]	−0.000, 0.000	0.000 [0.000]	−0.000, 0.000	0.000*** [0.000]	−0.000, 0.000
Year fixed effects	Included		Included		Included		Included	
Constant	0.015+ [0.008]	−0.002, 0.031	0.011 [0.010]	−0.010, 0.033	0.008*** [0.002]	0.004, 0.012	0.005* [0.003]	0.000, 0.011
Observations	241		153		241		153	
R^2	0.616		0.674		0.653		0.701	

Model 1–1, utility model patents per scientist and engineer (1990–2013). Model 1–2, utility model patents per scientist and engineer (1999–2013). Model 2–1, invention patents per scientist and engineer (1990–2013). Model 2–2, invention patents per scientist and engineer (1999–2013). Robust SEs, clustered for provinces, are in brackets. All tests are two-tailed. ***$P < 0.001$, **$P < 0.01$, *$P < 0.05$, + $P < 0.1$.

every unit increase in cultural tightness, there is on the average a decrease of 77 invention patents produced in a province. For better causal inference, all of the dependent variables in Table 1 are "forward by 3 y" i.e., all of the independent variables (and control variables) are lagged by 3 y relative to the dependent variables. The results are robust to 2-y and 1-y lags.

Given that China has undergone major transformation since opening up, cultural norms might have shifted in the more recent years. For robustness check, we conducted the same analyses focusing on patents in more recent years (1999–2013) and found consistent results: a positive and significant relationship between cultural tightness and utility model patents per scientist and engineer in Model 1–2 ($b = 0.003$, 95%CI[0.000, 0.006], $P = 0.04$) and a negative and significant relationship between cultural tightness and invention patents per scientist and engineer in Model 2–2 ($b = −0.001$, 95%CI[−0.002, −0.000], $P = 0.007$).

Multilevel regression on individual-level innovator-adaptor thinking style corroborated with these findings (*SI Appendix*, Table S7). Individuals in tighter provinces reported lower innovator thinking styles ($\gamma = −0.01$, 95%CI[−0.02, −0.00], $P = 0.04$). A closer analysis reveals that this effect is driven by individuals' tendency to emphasize control, consistency, detail orientation, and graduality during the problem-solving process ($\gamma = 0.04$, 95%CI[0.02, 0.06], $P = 0.001$). This problem-solving approach, conditioned by a tight society's emphasis on conformity, promotes incremental innovation but hurts substantive/radical innovation. This finding departs from the existing view that cultural tightness is generally detrimental for innovation and creativity (2, 3).

Impact on Personality and Happiness

How is a province's cultural tightness related to the personality and sense of subjective happiness of its people? We measured the Big-Five personality, self-monitoring tendency, and subjective happiness. Table 2 shows that, provincial level cultural tightness is associated with lower individual level openness to experiences ($\gamma = −0.08$, 95%CI[−0.14, −0.01], $P = 0.02$), higher conscientiousness ($\gamma = 0.16$, 95%CI[0.10, 0.21], $P < 0.001$), and lower

extraversion ($\gamma = −0.08$, 95%CI[−0.15, −0.00], $P = 0.04$); there is however no association with neuroticism and agreeableness. Importantly, results also indicated that individuals in tighter provinces have higher self-monitoring ($\gamma = 0.02$, 95%CI[0.00, 0.03], $P = 0.03$), suggesting that tighter cultures condition its people to pay closer attention to how they interact with society. These findings are consistent with current theorizing about cultural tightness.

We measured happiness in two ways. First, we asked respondents to indicate on a 10-level ladder where they personally stand at the present time (the top of the ladder represents the best possible life and the bottom represents the worst possible life) (17). We found that provincial level cultural tightness has a positive and significant relationship with individual level happiness after controlling for age, gender, and education as well as wealth (provincial level GDP per capita) (sample born and raised in the given province: $\gamma = 0.22$, 95%CI[0.12, 0.33], $P < 0.001$; full sample including respondents who have lived in the province for 3 y or more: $\gamma = 0.25$, 95%CI[0.18, 0.33], $P < 0.001$). Second, we also asked participants to reflect on their positive affect and negative affect experienced the day before they answered our survey. Results indicate that respondents in tighter provinces reported to have experienced more positive affects (laughter, joy, and happiness) ($\gamma = 0.01$, 95%CI[0.00, 0.02], $P = 0.03$), but less negative affects (worrisome, sadness, and anger) ($\gamma = −0.05$, 95%CI[−0.06, −0.04], $P < 0.001$).

Additionally, we regressed the dependent variable life satisfaction (question b1109) reported in the Chinese General Social Survey (2013) on provincial level cultural tightness, controlling for individual level social economic status. Results indicate a positive and significant association between cultural tightness and life satisfaction ($\gamma = 0.03$, 95%CI[0.00, 0.05], $P = 0.05$). To mitigate potential endogeneity between cultural tightness and life satisfaction, we conducted instrumental variable analyses, i.e., two-stage least squares (2SLS) regression analyses, using percentage area occupied by Japan during World War II and lawyers per capita as separate instruments for cultural tightness in the first stages. For the test of F statistics, both percentage

Table 2. Predictive validity of tightness-looseness on perceptions of LGBT tolerance, religious activities, governmental control, personality, and happiness (results of multilevel regression models)

Outcome variables	Cultural tightness as the Level 2 predictor						Correlations with cultural tightness in United States, r(P)*
	Full sample			Local only			
	γ_{01} (P)	95%CI	R^2	γ_{01} (P)	95%CI	R^2	
Perceptions of governmental control	0.06(0.00)	0.03, 0.08	0.31	0.06(0.00)	0.02, 0.11	0.23	
Perceptions of societal tolerance toward LGBT community	0.25(0.00)	0.19, 0.32	0.66	0.27(0.00)	0.20, 0.33	0.64	0.81(<0.001)[†]
Perceptions of prevalence of religious activities	0.07(0.24)	−0.04, 0.18	0.04	0.08(0.18)	−0.04, 0.19	0.05	−0.42(<0.01)[‡]
Personality							
Openness to experience	−0.03(0.13)	−0.07, 0.01	0.07	−0.08(0.02)	−0.14, −0.01	0.15	−0.37(<0.001)
Conscientiousness	0.14(0.00)	0.09, 0.19	0.52	0.16(0.00)	0.10, 0.21	0.43	0.40(<0.001)
Neuroticism	−0.03(0.31)	−0.08, 0.03	0.04	−0.04(0.22)	−0.11, 0.03	0.05	0.20(0.16)
Extraversion	−0.09(0.03)	−0.17,−0.01	0.14	−0.08(0.04)	−0.15, −0.00	0.11	0.27(0.06)
Agreeableness	0.01(0.57)	−0.03, 0.05	0.01	−0.01(0.87)	−0.06, 0.05	0.00	0.34(0.006)
Self-monitoring	0.01(0.04)	0.00, 0.02	0.12	0.02(0.03)	0.00, 0.03	0.14	
Happiness							
Life satisfaction[§]	0.25(0.00)	0.18, 0.33	0.76	0.22(0.00)	0.12, 0.33	0.66	−0.61(0.00)
Positive affect (yesterday)[§]	0.01(0.03)	0.00, 0.02	0.28	0.02(0.01)	0.00, 0.03	0.01	
Negative affect (yesterday)[§]	−0.05(0.00)	−0.06, −0.04	0.77	−0.05(0.00)	−0.07, −0.03	0.57	
Life satisfaction—General Social Survey China[¶]				0.03(0.05)	0.00, 0.05	0.07	

All analyses used provincial level cultural tightness score reported earlier in the paper. Personality variables were collected in Round 3, n = 3,495. For local only outcome variables, we used data from participants who reported they were born and raised in the province. n = 1,401. Life satisfaction data were collected in both Round 1 and Round 2, (full sample: n = 8,167; local respondents only: n = 3,074). Positive affect and negative affect data were collected in Round 1 (Full sample: n = 4,863, local respondents only: n = 1,897).
*For comparison, correlation coefficients between personality and happiness in the United States were taken from Harrington and Gelfand (3).
[†]Desire not to have same-sex marriage.
[‡]Baron and Straus's social disorganization index. Percentage of population lacking religious affiliation.
[§]The results are controlled for individual-level demographic variables (gender, age, and education) and provincial level GDP per capita. Detailed regression reports with control variables can be found in *SI Appendix*, Table S8.
[¶]Life satisfaction measure was taken from the General Social Survey-China (2013), (n = 6,795), total number of provinces is 28 (missing data from Tibet, Xinjiang, and Hainan). The results are controlled for individual-level demographic variables (gender, age, education, and household annual income). Detailed regression reports with control variables can be found in *SI Appendix*, Table S8.

area occupied by Japan during World War II [$F(1, 30) = 22.30$] and lawyers per capita [$F(1, 30) = 12.87$] passed the recommended value of 10 (18), providing evidence of strong instruments. In the second stage, cultural tightness remains as a significant predictor to life satisfaction. (Due to space constraint, we provide the detailed theoretical reasoning and justification for the instruments we used, empirical checks, and regression table for the instrumental variable analyses in *SI Appendix*.) Taken together, our findings revealed a positive relationship between cultural tightness and happiness. In contrast, Harrington and Gelfand (3) found that within the United States, cultural tightness was negatively correlated with happiness. Our finding, though different from that in the United States, is consistent with China's cultural context where people have relatively higher interdependence self-construal (19, 20) compared with the west and find security and comfort in belonging to a predictable and regulated social group (21–23). Recent research also suggests that people experience positive subjective well-being when there is a match between their personality and the cultural norms of their society (24, 25).

Implications

This study shows that the construct of cultural tightness appears valid in the Chinese context and consistent with prior conceptualizations in many ways. However, there are important differences in terms of what drives tightness in China and the impact on both society and individuals. First, cultural tightness appears to be associated with urbanization and economic growth. The tightest provinces (e.g., Guangdong, Shanghai, Beijing, and Zhejiang) are economically well developed and, thus, strongly regulated by the government. On the contrary, research in the United States found that tighter states tend to have more rural population, more conservative values, and higher poverty rate. Collectively, these findings highlight that cultural tightness may be associated with different factors in different cultural contexts, revising our theoretical conception of tightness-looseness.

Second, the current analysis sheds light on the impact of culture on how China innovates. China's innovation approaches and trends vary across regions, depending in part on the local society's tightness in social norms. Thus, rather than assessing China's inventiveness based on national level trends, it is useful to be aware of local provincial region variations. Some provinces with relatively low cultural tightness such as Hunan (tightness = 2.01) and Hainan (tightness = 1.84) appear especially adept at generating invention patents compared with other provinces (invention patents per 10,000 scientists and engineers is 70 for Hunan and 96 for Hainan, compared with a median of 30 across all of the provinces). [These (nonmunicipality) provinces have the most number of years with the highest number (top 20%) of invention patents produced per scientist and engineer.] These provinces, some of which have not been given sufficient attention to, might be promising regions to focus on if China aspires to generate more substantive and breakthrough innovations to become a leading innovative country and a global scientific power (26, 27). The relatively loose cultural norms in such locality can be a valuable enabler for more radical innovation.

More generally, the finding that cultural tightness is positively associated with the production of utility model patents (incremental

innovations) and negatively associated with the production of invention patents (substantive/radical innovations) suggests that culture's impact on innovation is more complex than what existing theories on culture and creativity would predict. A tight culture is not necessarily an impediment for innovation if the outcome of interest is incremental innovation, which may provide a stable and steady income stream to firms and organizations. However, if substantive or radical innovation that can allow firms and organizations to move to the next technology trajectory is required, our analyses suggest that a tight culture could be detrimental. Societies that emphasize innovation and enhancing their innovation capabilities should consider not only investing in innovation infrastructures but also shaping the cultural and psychological makeup of its people.

Third, this research found that although tightness necessarily constrains and limits behaviors in society, people in these societies are not necessarily unhappy as prior research suggests. In the Chinese context, our data showed that provincial level tightness is associated with individual-level subjective happiness and life satisfaction. Thus, as far as China is concerned, this finding adds happiness to the list of other benefits that tight cultures bring, such as stability, efficiency, and implementation effectiveness. From a practical perspective, this finding also raises the question of how the Chinese government should balance these beneficial effects of cultural tightness and the imperative to promote substantive, breakthrough innovations that could put China ahead of its rivals in the global race to innovate.

Limitations, Future Research, and Conclusion

We acknowledge the following limitations that could present interesting avenues for future studies. First, we only have cross-sectional data on the norms of cultural tightness. Although we have included lagged measures and conducted various analyses to mitigate potential reverse causality and endogeneity issues (see *SI Appendix* for detail), we are cautious in our interpretation of causal inference. In addition, although cultural values have been found to be relatively stable over time (20), specific norms and practices might have changed over sufficiently long periods of time. However, even when focusing on different periods of patenting data, our analyses suggest that the results hold. Future research could investigate how current measures of cultural tightness influence various outcomes in future years.

Second, cultural tightness is only one aspect of culture and certainly not the sole driver that influences innovation. Other cultural elements, institutional factors, and governmental-level initiatives are also likely to play important roles. Future research could examine how norms of cultural tightness interact with these factors to influence the rate of innovation. For example, many governments are aggressively promoting entrepreneurship. But how effective are these initiatives if the local culture promotes conformity and sanctions deviation from the norm?

Third, our survey platform is computer-based. Despite this limitation, our sample included a large age range—18–69 y, suggesting that the use of computers for data collection has not inadvertently excluded older people. Further analyses on our sample characteristics (Dataset S1) show that our findings are not affected by sample's age, gender, and education level.

The above limitations notwithstanding, the current analyses provide an important step toward understanding patterns of cultural tightness across the Chinese provinces and how these local norms of social regulation and control relate to individual and provincial level outcomes. Understanding these regional variations can shed new light on the process of cultural change in China and its future development directions. More generally, the current analyses deepen existing theorization about cultural tightness and advance our understanding of the relationship between cultural tightness, innovation, urbanization, and happiness in important directions.

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