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Climato-Economic Imprints on Chinese Collectivism

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Abstract

A still unsolved question is why humans create collectivism. New theory proposes that poorer populations coping with more demanding winters or summers become more collectivist. Preliminary support comes from a province-level analysis of survey data from 1662 native residents of 15 Chinese provinces. Collectivism is weakest in provinces with temperate climates irrespective of income (e.g., Guangdong), negligibly stronger in higher-income provinces with demanding climates (e.g., Hunan), and strongest in lower-income provinces with demanding climates (e.g., Heilongjiang). Multilevel analysis consolidates the results by demonstrating that collectivism at the provincial level fully mediates the interactive impact of climato-economic hardships on collectivist orientations at the individual level, suggesting that culture building is a collective top-down rather than bottom-up process.

Keywords: collectivism, climatic demands, climato-economic, China, environmental livability

Climato-Economic Imprints on Chinese Collectivism

Chinese are more collectivist than most other populations on earth. This cultural trait is traced back predominantly to Confucian heritage (Bond & Hwang, 2008; Li, 1986; Nisbett, 2003). But Confucianism falls short in explaining why some Chinese are more collectivist than others. In Japan (Kitayama, Ishii, Imada, Takemura, & Ramaswamy, 2006), and in the United States (Kitayama, Conway, Pietromonaco, Park, & Plaut, 2010; Varnum & Kitayama, 2010), voluntary settlement patterns in frontier regions have created areas where present-day inhabitants are still more independent and less collectivist. However, China hardly has a history of voluntary settlement. Granted, China does have vast rural areas where inhabitants tend to be more collectivist than in urban areas (Freeman, 1997), and some Chinese may be more collectivist than others because of a greater parasitic disease burden (Fincher & Thornhill, 2012; Schaller & Murray, 2011), but single-factor explanations are seldom useful for understanding complex phenomena such as variation in collectivism (Georgas, Van de Vijver, & Berry, 2004; Van de Vliert & Postmes, 2012).

This paper is the first attempt to map and explain geographic differences in the strength of collectivist orientations within the oldest and largest continuous civilization on earth. Going beyond single-factor explanations, we modify climatic determinism (for reviews, see Feldman, 1975; Sommers & Moos, 1976), we amend economic determinism (e.g., Inglehart & Baker, 2000; Inglehart & Welzel, 2005), and we surpass the ecocultural viewpoint that climatic and economic determinants have mutually independent effects on human functioning (Berry, 2011; Georgas et al., 2004). Instead, we set out to examine interactive impacts of climatic and economic hardships on collectivist orientations because income resources can help protect people against the broad misery of cold winters and hot summers (Van de Vliert, 2009, 2011a). Across predominantly poor provinces of still relatively poor China, close

social-psychological ties with members of primary groups may be relatively important to successfully cope with the predominantly continental climate on a daily basis.

Collectivists attach particular importance to the boundaries between ingroups and outgroups; emphasize their connectedness to the ingroups; and are primarily concerned with and motivated by the stresses, goals, means, and outcomes of members of their ingroups (Gelfand, Bhawuk, Nishii, & Bechtold, 2004; Hofstede, 2001; Triandis, 1995; Van de Vliert, 2013). The conceptual section gives an overview of why and how collectivist orientations may be influenced by climato-economic ecologies. We postulate three cumulative axioms as an explanatory foundation, propose climatic demands and income resources as interactive origins of variation in collectivism, review climato-economic covariations of collectivism that support the theory across nations, and apply the empirically supported theory to the Chinese case. The methods and results sections report a multilevel analysis of collectivist orientations of 1662 native residents from 15 climato-economically representative provinces across China. These within-country findings supplement preceding between-country observations in starting to unravel tangled and complex origins of collectivist orientations around the globe.

Climato-Economic Theory of Culture

Axioms: Needs, Demands and Resources

The anthropologic *needs axiom* postulates that humans as a warm-blooded species have existential needs for thermal comfort, nutrition, and health, as exemplified by their natural inclination to seek residence in temperate climates away from arctics and deserts (Rehdanz & Maddison, 2005; Tavassoli, 2009; Van de Vliert, 2013, in press).

The climatic *demands axiom* postulates that colder-than-temperate winters and hotter-than-temperate summers are more demanding to the extent that they deviate from 22^{o}C (about 72^{o}F) as a reference point for optimal psychophysiological comfort, abundant nutritional resources of flora and fauna, and healthy living conditions (Fischer & Van de Vliert, 2011;

Parsons, 2003; Van de Vliert, 2009). Greater climatic demands, due to decreasing natural resources, can be compensated for by increasing income resources.

The economic *resources axiom* postulates that present-day humans use income resources to cope with demanding winters or summers. Liquid cash and illiquid capital can buy a wide variety of climate-compensating goods and services, including clothing, housing, heating and cooling, transportation, meals, and medical cure and care. Articulating the way this is visible in modern human beings, families in richer nations spend up to 50% of their household income on climate-compensating goods and services, a figure that rises over 90% in poorer nations (Parker, 2000, pp. 144-147).

Demands-Resources Effects

The climato-economic explanation of culture (Van de Vliert 2009, 2011a, 2013, in press) belongs to a family of demands-resources theories. Across the disciplines of psychology (e.g., Bandura, 1997; Lazarus & Folkman, 1984; Skinner & Brewer, 2002; Tomaka, Blascovich, Kibler, & Ernst, 1997), sociology (e.g., Ormel, Lindenberg, Steverink, & Vonkorff, 1997), and the organizational sciences (e.g., Ajzen, 1991; Karasek, 1979), it is widely believed that demands placed on people are a double-edged sword. Greater demands in interaction with insufficient resources to meet the demands increase closed-mindedness and risk aversion, whereas greater demands in interaction with sufficient resources increase open-mindedness and risk seeking. Climato-economic theorizing similarly posits that climatic demands in interaction with poor income resources promote risk avoidance and looking for insurance through collectivistic seclusion and control, whereas climatic demands in interaction with rich income resources promote seeking better expected outcomes through individualistic exploration and creation. In other words, the expected utility of collectivist adaptation is higher in habitats with greater climatic and economic hardships.

The climato-economic theory further proposes that inhabitants of lower-income areas

appraise more demanding winters and summers as threatening and adapt to them by falling back more on their ingroups for setting and achieving goals (collectivist orientation; Van de Vliert, 2011a, 2013; Van de Vliert & Postmes, 2012). Existential threats appear to set in motion processes of culture building in directions of closed-mindedness, ingroup commitment, and ingroup favoritism (Richter & Kruglanski, 2004). In a similar vein, the parasite-stress theory asserts that avoiding and managing life-threatening infections cultivate ingroup assortive sociality (Fincher & Thornhill, 2012; Fincher, Thornhill, Schaller, & Murray, 2008; Schaller & Murray, 2011). Gelfand et al. (2011) come closest to our demands-resources notions by arguing and demonstrating that greater environmental threats and a greater dearth of resources promote cultural tightness with clearer norms and stronger sanctions for nonconformity, which are also highly characteristic of collectivist societies (Triandis, 1995).

The theory finally proposes that inhabitants of higher-income areas appraise more demanding winters and summers as challenging and adapt to them by falling back more on their individual selves for setting and achieving goals (individualist orientation; Van de Vliert, 2011a, 2013). Only under relatively challenging environmental conditions "can people have a low enough need for closure to venture out on their own into the ambiguous, uncertain, and often risky realm of individualism" (Richter & Kruglanski, 2004, p. 116). This is the central idea also of the theory that voluntary settlement in challenging frontier regions promotes cultural values and practices of independence and self-reliance rather than collectivism (Kitayama et al., 2006, 2010; Varnum & Kitayama, 2010).

Climato-Economic Covariations of Collectivism

Comparative climato-economic studies of collectivism have been done for familism across 57 nations, nepotism across 116 nations, and compatriotism across 73 nations (Van de Vliert, 2011a). Because the results were highly similar, and because familism, nepotism and

compatriotism were indeed tapping the same underlying construct (Cronbach's $\alpha = .89$), the analysis was repeated predicting overall collectivism across 121 nations (Van de Vliert & Postmes, 2012). As predicted on the basis of threat appraisals versus challenge appraisals, greater climatic demands were associated with stronger collectivism in lower-income nations (e.g., Kyrgyzstan and Chad) but with weaker collectivism in higher-income nations (e.g., Finland and Bahrain). However, the validity of these findings can be critically questioned on the following grounds.

One critical concern we have is for larger countries (e.g., China, Russia, and the United States) where climatic demands and income resources arguably span several climate and income zones. In addition, living with the nuclear family, nepotism and compatriotism are sociological outcomes rather than psychological manifestations of collectivism, and can be further criticized for assuming measurement equivalence across language boundaries and national borders (see Van de Vijver & Leung, 1997). Perhaps the most serious shortcoming of the above cross-national studies is that many alternative explanations of the findings can never be ruled out convincingly because countries differ in numerous characteristics. Although the potential impacts of parasitic disease burden, state antiquity, language diversity, ethnic heterogeneity, religious fractionalization, and being rooted in Christianity or Islam were statistically excluded (Van de Vliert, 2011a; Van de Vliert & Postmes, 2012), firm conclusions about the origins of geographic variation in collectivism do not yet exist. A replication study within a large country would reduce all of these concerns about averaging out climate and income variations, using sociological indicators, assuming psychometric equivalence, and overlooking alternative explanations.

The Case of China

China was chosen as an appropriate venue to better test the climato-economic covariation of collectivism because it has the climatic feature of large variations in cold winters and hot

summers, and the economic feature of poor areas in the north and the west and fast economic growth in some eastern provinces (The Economist, 2011). As most Chinese provinces have demanding continental climates and poor populations, overall livability will be appraised as threatening rather than challenging. For inhabitants of those habitats, the theory predicts that greater climatic demands are associated with stronger collectivist orientations in the poorest (henceforth *lower-income*) areas but that this tendency will be weaker in the moderately poor (henceforth *higher-income*) areas. Confirmation of that prediction would provide strong support for the validity of the climato-economic theory of culture as the predominantly collectivist Chinese cover only a limited range of the worldwide variation in the strength of collectivist versus individualist orientations.

Method

Sampling

During 2008 and 2009, we sampled 15 Chinese provinces that differ in climate (temperate vs. demanding) and income per head (lower vs. higher), and are not significantly different from all provinces in these two respects (see below). As former colonies with distinct cultural histories, the special administrative regions of Hong Kong and Macao were left out of consideration. Within provinces, we concentrated on Han Chinese in order to standardize ethnicity. Even more specifically, we concentrated on Han Chinese as employees of medium-sized enterprises in smaller towns to minimize the number of cross-provincial migrants. Achieving a 72.3% response rate, the final sample consisted of 972 males and 690 females working in 20 private-owned enterprises located in 20 towns across the 15 provinces (see Table 1 for details). The average age was 32, ranging from 18 to 65, 64.8% was married, and the average period of tenure was 8.55 years (SD = 8.17). Respondents were highly educated: 53.6% completed high school, 24.8% received higher education of up-to-three years of college, and 26.6% held a bachelor's or higher degree.

Insert Tables 1 and 2 about here

Measures

Individual level: Collectivist orientation. Using the common translation-back-translation procedure, a Chinese 14-item measure of that broad constellation of psychological attributes associated with collectivism was constructed on the basis of previously published instruments and reviews (Brewer & Chen, 2007; Oyserman, Coon, & Kemmelmeier, 2002; Triandis et al., 1986, 1993; Triandis & Gelfand, 1998). To minimize acquiescence bias, 2 of the 14 items listed in Table 2 were reversely formulated and coded. Confirmatory factor analysis demonstrated a one-factor structure ($\chi^2 = 606.84$; $df = 70$; CFI = .90; IFI = .90; NFI = .89; GFI = .95; RMSEA = .06; standardized RMR = .06), producing an internally consistent score for collectivist orientation (Cronbach's $\alpha = .74$).

Provincial level: Cultural collectivism. Collectivist orientations were measured assuming that the underlying construct generalizes across provinces. To check the validity of this assumption, we randomly chose Gansu as a reference group and compared the factor loadings of Gansu with those of the other provinces. Reflecting factorial similarity and construct equivalence across provinces, Tucker's φ ranged from .85 in Hebei to .97 in Shanxi (M_{φ} = .91). Additionally, the reliability of the provincial means estimated by intraclass correlation was .88, the interrater agreement within provinces ranged from .82 to .97 (*Mdn* $R_{wg(j)}$ = .93), and one-way analysis of variance indicated that cultural collectivism differed much more between provinces than within provinces ($F = 8.66$, $df = 14$, $p < .001$). These coefficients support the aggregation of collectivist orientations at the individual level into distinct estimates of cultural collectivism at the provincial level (see last column in Table 1).

Provincial level: Climatic demands. In line with past research (e.g., Van de Vliert, 2009, 2011a, 2011b), provincial climates are considered more demanding to the extent that

temperatures in the coldest and hottest months deviate from 22°C. Specifically, climatic demands were operationalized as the sum of the four absolute deviations from 22°C for the average lowest and highest temperatures in January and in July (data available for the capital city of each province from http://cdc.cma.gov.cn). In Heilongjiang, for example, the average temperature ranges from -24.6°C to -13.0°C in January, and from 18.0°C and 27.7°C in July, so the climatic demands are | -24.6 – 22.0 | + | -13.0 – 22.0 | + | 18.0 – 22.0 | + | 27.7 – 22.0 | = 91.3 (see Table 1 for the approximately normally distributed measures of climatic demands). There is no indication that the 15 provinces sampled do not represent all province-level regions with respect to the lowest (t = 0.01, *ns*) and highest (t = 0.18, *ns*) temperatures in January, and the lowest (t = 0.20, *ns*) and highest (t = 0.44, *ns*) temperatures in July. Nor is there any empirical indication that somewhat lower or higher reference points than 22°C lead to other results.

Provincial level: Income resources. For each province, the average annual wage of employees in private-owned enterprises over the latest available year (2007) was taken from www.stats.gov.cn. The 15 indices listed in Table 1 are thought to be representative of all province-level parts of China (t = 0.06, *ns*). Income resources and climatic demands were insignificantly related predictors (r = -.40, n = 15, *ns*).

Control variables. At the individual level, gender (1 = *male*; 2 = *female*), age, marital status (1 = not married; 2 = married), educational status (1 = *below junior middle school*; 5 = *post-graduate and above*), and professional status (1 = *operational worker*; 6 = *top-level manager*) served as control variables. At the provincial level, following Vandello and Cohen (1999, pp. 286-287), we controlled for population density (inhabitants per km^2), and for the percentage of minorities, because both of these living conditions press "toward tightness and a need for coordination, hence collectivism."

Results

Zero-Order Correlations

The well-documented tendency among Europeans and Americans that older people are more collectivist than younger people (for an overview, see Triandis, 2009), is replicated among Chinese individuals (see Table 3). Also, the cross-national observation that cultural collectivism is stronger in lower-income populations (Hofstede, 2001; Van de Vliert, 2011a), is replicated across Chinese provinces. Table 3 additionally shows that population density and percentage of minorities have negligible associations with cultural collectivism. By contrast, climatic demands and cultural collectivism are so strongly entwined (r = .80, n = 15, p < .001), that we first explored whether income resources can have any statistical effect on cultural collectivism over and above the extremely strong impact of climatic demands.

Insert Table 3 about here

Preliminary Analysis

We ran a regression analysis with standardized predictors at the provincial level to inspect both additive and interactive effects of climatic and economic hardships on collectivism. The results revealed that climatic demands (b = .06, ΔR^2 = .64, p < .01), income resources (b = -.05, ΔR^2 = .06, p < .05), and the interaction of climatic demands and income resources (b = -.06, ΔR^2 = .15, p < .05), all had significant impacts, irrespective of whether or not population density and percentage of minorities were controlled for. As predicted, and as illustrated in Figure 1, cultural collectivism is positively influenced by climatic demands in lower-income provinces (simple slope test: b = .12, p < .01) but not in higher-income provinces (b = .01, *ns*). All 15 Cook's Distances were below 1, indicating that there were no serious outliers; when Heilongjiang (D = .64) was removed from the analysis, main effects (two-tailed) and interaction effect (one-tailed) remained significant (p < .05).

Insert Figure 1 about here

Consolidating Analysis

Concentrating on individuals, we next conducted a multilevel analysis with collectivist orientation as the dependent variable and climatic demands, income reources and their interaction as predictors. We also controlled for the effects of gender, age, marital status, educational status and professional status at the individual level, and population density and minority percentage at the provincial level. The results showed that, apart from population density (b = .03, p < .05), none of the control variables had a significant effect on collectivist orientation. By contrast, climatic demands (b = .07, p < .01), income resources (b = -.03, p < .05), and their interaction (b = -.04, p < .05) all reached significance, predicting an extra 7.3% of the individual-level variation. However, when cultural collectivism at the provincial level was then entered into the equation, it appeared to be the only significant predictor (b = .11, p < .01), accounting for 17.3% of the individual-level variation in total. Consolidating and extending the results of the preliminary analysis, these findings imply that collectivism at the provincial level fully mediates the interactive impact of climatic and economic hardships on collectivist orientation at the individual level (see Table 4 for detailed results).

Insert Table 4 about here

Supplementary Analysis

The above analyses neglect the "psychological geography" (Rentfrow, in press) of Chinese collectivism by neglecting the couplings between collectivist orientations and provincial locations. Cultural orientations and geographic locations can be coupled in descriptive and predictive ways (Lobao, Hooks, & Tickamyer, 2007; Van de Vliert, 2011a, 2013). In our case, descriptive coupling results in a map of observed cultural collectivism across 15 provinces resting on a single data point for each of the 15 provinces studied. Predictive coupling, by contrast, results in a map of estimated cultural collectivism across all

provinces whose climato-economic conditions can be used to make theory-based guesses about each province's position in the cloud of all 15 data points for provincial collectivism.

For three reasons, we used the regression equation from the preliminary analysis to estimate cultural collectivism across 31 provinces. First, the climato-economic conditions in the sample of 15 provinces are an approximately adequate representation of the climato-economic conditions in all 31 provinces for which climatic demands and wages in private-owned enterprises are available for analysis (see *t* tests in the method section; www.stats.gov.cn does not provide income data for Hong Kong and Macao). Second, the 15 provincial measures of cultural collectivism are highly reliable (see interrater agreement and intraclas correlation in the method section), not in the least because aggregation of individual-level orientations to the provincial level reduces measurement error by smoothing out personal idiosyncracies. Third, climato-economic conditions appear to accurately predict province-level variation in cultural collectivism (R^2 = .85; see preliminary analysis).

These considerations of sample representativeness, measurement reliability, and predictive accuracy provided methodological grounds for predicting the strength of cultural collectivism in 31 province-level regions across China. Table 5 reports the 31 estimated baseline scores in descending order, the regression equation on which they are based, and the 15 observed baseline scores with which they may be compared. Further emphasizing the accuracy of the prediction model, visual inspection reveals that the predicted and the observed baselines in the sample provinces are almost identical (r = .89, n = 15, p < .001). The display of regional patterns of cultural collectivism in Figure 2 shows that collectivist orientations tend to be weakest in the south, moderately weak to moderately strong in China's heartlands, and strongest in the north.

Insert Table 5 and Figure 2 about here

Discussion

Theoretical Implications

Scientific progress. The novel insight that the interaction of climatic and economic hardships leads humans to jointly create mutually shared collectivism goes beyond purely economic explanations of collectivist cultures (e.g., Inglehart & Baker, 2000; Inglehart & Welzel, 2005). Moreover, this interactive explanation goes beyond additive effects of climatic and economic conditions on human functioning advocated by adherents of the ecocultural framework (e.g., Berry, 2011; Georgas et al., 2004). Most importantly, the support we found for the covariation of ecological hardships and collectivism also goes beyond earlier work on the climato-economic origins of collectivism (Van de Vliert, 2009, 2011a, 2013; Van de Vliert & Postmes, 2012) in three salient ways.

First, climato-economic imprints on Chinese collectivism reduce criticisms of cross-national support for climato-economic theorizing. These criticisms concern measurement errors in averages for large countries, sociological indicators of collectivism, and psychometric equivalence across distinct populations. There are also fewer confounding variables affecting cross-provincial findings than confounding variables affecting cross-national findings. Second, no preceding research has provided such a stringent and conservative test of the climato-economic theory of collectivist culture within a carefully sampled geographic area. Third, this is the first study ever to compare climato-economic impacts on individual-level collectivist orientation and higher-level collectivist culture. The finding that collectivism at the provincial level fully mediates the interactive impact of climatic and economic hardships on collectivist orientation at the individual level suggests that culture building is a collective process. Apparently, exposed to the same winters, summers, and financial standard of living, populations are gradually pushing and pulling every member toward a shared culture—a top-down rather than bottom-up process.

Chinese collectivism is often traced back to Confucianism, Taoism, and Buddhism (Bond & Hwang, 2008; Li, 1986; Nisbett, 2003). There is little doubt that these philosophical-religious traditions have influenced stresses, goals, means, and outcomes in contemporaneous China. Additionally, it is also likely that Chinese are no exception to the rule that millennia-long evolution of collectivist culture in humans, just like evolution in animals and plants, has climatic underpinnings (Van de Vliert & Postmes, 2012). So perhaps it should have come as no surprise that we discovered climate-collectivism links, that collectivism at the provincial level and through it collectivist orientations at the individual level are positively associated with climatic demands. However, these climate-collectivism links are influenced by the financial standard of living: collectivism is weakest in provinces with temperate climates irrespective of income (e.g., Guangdong), negligibly stronger in higher-income provinces with demanding climates (e.g., Hunan), and strongest in lower-income provinces with demanding climates (e.g., Heilongjiang).

Theoretical consolidation: Population density. "When the number of people per unit of area is large, people have to develop many rules for social behavior to reduce the probability of conflict … Population density presses toward tightness, hence collectivism" (Triandis, 1995, pp. 58, 100). The evidence for this hypothesis is becoming stronger and stronger. Cross-nationally, societies with higher population density are tighter and more collectivist (Gelfand et al., 2011). Similarly, within the United States, higher density of population, which should not be confused with greater urbanism, is associated with stronger collectivism (Vandello & Cohen, 1999). Our study now adds that Chinese subpopulations, too, are more collectivist in more densily populated areas. All in all, the positive link between population density and cultural collectivism robustly holds across nations (Gelfand et al, 2011), across regions within a relatively rich country, which is home to the largest individualist civilization on earth

(Vandello & Cohen, 1999), and across regions within a relatively poor country, which is home to the largest collectivist civilization on earth (this study).

Theoretical application: Percentage of minorities. While we defined collectivists on the basis of the importance attached to the boundaries between ingroups and outgroups, so far we highlighted membership of ingroups, leaving non-membership of outgroups in the background. This one-sided emphasis, however, ignores the fact that the climato-economic theory of culture can be used to further clarify the causal order of ingroup loyalty and outgroup antagonism in explaining intergroup conflict. "Findings from both cross-cultural research and laboratory experiments" now seem to support the hypothesis "that much ingroup bias and intergroup discrimination is motivated by preferential treatment of ingroup members rather than direct hostility toward outgroup members" (Brewer, 1999, p. 429; see also Brewer & Chen, 2007). If negative outgroup discrimination is, in many cases, an epiphenomenon of positive ingroup discrimination, it follows that a better understanding of intergroup conflict, and especially of interethnic violence in China, must be primarily sought in ultimate sources of ingroup loyalty.

For example, this study might shed extra light on the age-old quarrels, scuffles, and fights between Uighur people of Turkic Muslim descent and Han Chinese inhabiting Xinjiang (www1.american.edu/ted/ice/xinjiang.htm). Of course, these intergroup conflicts have deep historical roots and are created and maintained through sociostructural and psychological factors. But how sure are we that remote ecological origins cannot trigger off or complicate a causal trajectory leading to ingroup loyalty and outgroup antagonism? Xinjiang has a demanding continental climate with very cold winters and very hot summers, and economic inequality between lower-income Uighurs and higher-income Han Chinese. These climato-economic circumstances in Xinjiang predict that the Uighurs will attach more importance to the boundaries between themselves and the Han Chinese than vice versa. If ingroup love

drives outgroup hate, climato-economic circumstances in Xinjiang further predict that the Uighurs will discriminate and confront the Han Chinese rather than the other way round, although retaliatory actions by the Han Chinese may sometimes suggest otherwise.

Mutatis mutandis, the same hypotheses apply to the inhabitants of the Tibetan roof of the world with its cold winters and income inequality between citizens of Mongoloid blood and Han Chinese. These climato-economic circumstances predict that positive ingroup discrimination and negative outgroup discrimination will both be stronger among Mongoloid Tibetans than among local Han Chinese. If these hypotheses about interethnic relations in Xinjiang and Tibet hold true after attempts to prove them wrong, the proposition that climatic hardships trigger conflict (e.g., Burke, Miguel, Satyanath, Dykema, & Lobell, 2009; Lee, 2009; Tol & Wagner, 2010; Welzer, 2012; Zhang, Jim, Lin, He, Wang, & Lee, 2006) can be refined into the proposition that climato-economic hardships trigger conflict (e.g., Van de Vliert, 2011b; Van de Vliert, Van der Vegt, & Janssen, 2009).

Theoretical generalization. Because the explanation of collectivism in terms of climatic *demands* and income *resources* belongs to a family of demands-resources theories, as outlined above, it is pertinent to also ask to what extent the present findings reflect a more general reality. Is the mechanism of meeting environmental demands through using income resources generalizable from threatening winters and summers to other threatening circumstances? Moving us further beyond single-factor determinism, it may be an innovative avenue for future research to examine whether there are social-psychological adaptations to interactions of income and demandingness of, for example, natural disasters, food deprivation, disease prevalence, population density, domestic political violence, or territorial threats from neighboring nations. If the climato-economic explanation of collectivism survives tests against these alternative demands-resources interactions, one next question is how climato-economic habitats are related to evolutionary processes.

Evolutionary psychologists (e.g., Baumeister, 2005; Buss, 2005; Plotkin, 2002; Yamagishi, 2011) may read the empirical results reported here as extra evidence for the validity of models of biotic niche construction within predominantly abiotic habitats. Cash and capital were gradually constructed as ingenious tools that exist independently of place, time, and items they can buy. In turn, these tools are now intensively used to collectively shape the environment by altering direct and indirect impacts of adverse winters and summers on meeting shared existential needs. All of these niche-construction activities lead to new feedback cycles and become the basis for continuous further adaptation, including gradual moves from collectivist to individualist orientations.

Methodological Considerations

The strength of conservative testing of climato-economic imprints on collectivism in the Chinese context came with the weakness of convenient access to only 15 out of the 31 province-level regions. The strength of homogeneous sampling of Han Chinese employed with medium-sized enterprises in smaller towns came with the weakness of leaving non-employed people, self-employed entrepreneurs with small enterprises, and farmers out of consideration. The strength of using multilevel analysis came with the weakness of analyzing cross-level data to tackle the basically longitudinal problem of collectivist adaptation (for longitudinal evidence across nations, see Van de Vliert, 2011a).

Likely Changes in China

Our measures and messages are not about global warming, nor about culture change. Nevertheless, the climato-economic covariations of collectivism found may be bound to have implications for the cultural consequences of global warming in the long run, which charges us with the ethical obligation to mention these implications (Swim et al., 2011; Doherty & Clayton, 2011). On the basis of data generated by the Intergovernmental Panel on Climate Change, Cline (2007) has forecasted temperature changes in China's seven climatic subzones

between the end of the 20th century (1961-1990) and the end of the 21st century (2070-2099). His global warming projections, broken down for winter months and summer months, imply that climatic demands will decrease all over China, but especially in a diagonal slice of provinces and counties stretching from the Tibetan plateau in the southwest through Central China to Heilongjiang in the northeast.

Thus, during the current century, climatic demands are expected to decrease relatively strongly for Chinese living in regions with continental climates where collectivism is still relatively strong (cf. Figure 2). To the extent that our findings, pictured in Figure 1, reflect causality rather than cross-sectional simultaneity, especially collectivism around this southwest-northeast diagonal is bound to weaken in times to come. Figure 1 also suggests that economic growth will reinforce the link between weakening climatic demands and weakening collectivism. Indeed, the present findings propose, at least for China to begin with, that decreases in climato-economic hardships and decreases in collectivism are in flux together.

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Table 1

Sample Composition, Climatic Demands, Income Resources, and Cultural Collectivism for 15 Chinese Provinces

	Number of towns and organizations *n* = 20	Number of participants *n* = 1662	Climatic demands	Income resources (Yuan/cap)	Cultural collectivism
North and Northeast China					
Shanxi	2	140	65.8	14,141	3.58
Hebei	1	101	57.8	12,443	3.61
Heilongjiang	2	184	91.3	10,779	3.86
East China					
Shandong	1	94	56.2	15,636	3.64
Zhejiang	1	55	49.0	25,462	3.51
Jiangxi	1	101	48.5	12,574	3.55
Fujian	1	85	36.6	18,853	3.50
Central and Southeast China					

Henan	1	92	53.9	15,850	3.60
Hubei	1	57	50.5	12,921	3.63
Hunan	2	262	48.5	16,071	3.58
Guangdong	2	119	29.9	16,328	3.48
Southwest China					
Guizhou	2	158	41.6	16,893	3.57
Sichuan	1	74	39.7	15,176	3.41
Northwest China					
Gansu	1	73	66.6	12,979	3.61
Xinjiang	1	79	82.4	17,780	3.61
M	1.33	112	54.45	15,592	3.58
SD	0.49	55	16.67	3,523	0.10

Table 2

Items in the order of descending factor loadings on collectivist orientation

Item (1 = *strongly disagree*, 5 = *strongly agree*)	Factor loading
I view myself as a member of a social group	.65
If I have done an excellent job, I attribute my success to collective effort	.60
It is my duty to defend the reputation of my organization	.59
As an employee, I have to respect decisions made by my organization	.55
The happiness of those who are closely related to me is more important than my own happiness	.50
What is good for my organization is also good for me	.47
Having harmonious relationships with colleagues is my path to success	.43
The most important thing in my life is to have good friends and easygoing colleagues	.42
My close interpersonal relationships reflect who I am	.39
In the workplace, disagreement should be avoided because it damages harmonious relationships with colleagues	.37
My work success depends more on networks and relationships than on my own abilities and efforts	.36
I cannot think of myself without relating myself to close friends and family	.28
I never rely on my friends and colleagues to help me out with difficulties (reversed)	-.25
If the group is slowing me down, it is better to leave it and work alone (reversed)	-.30

Table 3

Correlation Matrix for Variables at the Individual Level and at the Provincial Level

Variables	1	2	3	4	5
Chinese Individuals (n = 1662)					
1. Collectivist orientation	—				
2. Gender	-.01	—			
3. Age	.16**	.10**	—		
4. Marital status	.07*	.05*	.53**	—	
5. Educational status	-.05*	.09*	.03	-.16**	—
6. Professional status	.01	.07*	.22**	.06*	.41**
Chinese Provinces (n = 15)					
1. Cultural collectivism	—				
2. Population density	-.23	—			
3. Percentage of minorities	.10	-.53*	—		
4. Climatic demands	.80**	-.51*	.35	—	
5. Income resources	-.50*	.34	.15	-.36	—

Table 4

Multilevel Model Testing: Effects of Climatic Demands and Income Resources on Collectivist Orientation at the Individual Level (N = 1662 Participants Nested in 15 Provinces)

	Model 1	Model 2	Model 3	Model 4
Intercept	3.59** (.02)	3.59** (.01)	3.58** (.01)	3.60** (.01)
Control variables: Individual level				
Gender	.00 (.01)	.00 (.01)	.00 (.01)	.00 (.01)
Age	.04 (.01)	.05 (.02)	.04 (.02)	.04 (.02)
Marital status	.01 (.02)	.01 (.01)	.01 (.01)	.01 (.01)
Educational status	-.01 (.02)	-.01 (.02)	-.01 (.02)	-.01 (.02)
Professional status	.01 (.02)	.01 (.02)	.01 (.02)	-.01 (.02)
Control variables: Provincial level				
Population density	-.04 (.03)	.01 (.02)	.03* (.01)	-.01 (.02)
Percentage of minorities	- .01 (.03)	-.01 (.01)	.02 (.01)	-.01 (.02)
Predictors				
Climatic demands (CD)		.09** (.01)	.07** (.01)	-.00 (.02)
Income resources (IR)		-.02 (.01)	-.03* (.01)	.00 (.02)
CD * IR			-.04* (.01)	.01 (.02)
Mediator: Provincial level				
Cultural collectivism				.11** (.03)
χ^2	1381.66	1361.48	1352.52	1342.14
$\Delta\chi^2$	211.52**	20.18**	8.96**	10.38**
R_1^2	.095	.145	.168	.173

Note. In the null model, the value of the intercept is 3.58, $p < .01$; $\chi^2 = 1593.18$. Values in brackets refer to Standardized Errors.

* $p < .05$. ** $p < .01$.

Table 5

Estimated and Observed Baselines of Cultural Collectivism for 31 Climato-Economic Regions of China

Rank	Province-level regions of China	Climatic demands	Income resources	Cultural collectivism	
				Estimated	Observed
1	Heilongjiang	91.3	10,779	3.927	3.86
2	Jilin	83.7	11,135	3.858	
3	Liaoning	74.4	12,242	3.763	
4	Inner Mongolia	79.7	14,338	3.737	
5	Qinghai	69.9	13,228	3.713	
6	Gansu	66.6	12,979	3.699	3.61
7	Shanxi	65.8	14,141	3.673	3.58
8	Tibet	59.2	11,770	3.672	
9	Hebei	57.8	12,443	3.654	3.61
10	Xinjiang	84.2	17,780	3.644	3.61
11	Shaanxi	53.8	11,289	3.640	
12	Shandong	56.2	15,636	3.608	3.64
13	Hubei	50.5	12,921	3.605	3.63
14	Henan	53.9	15,850	3.597	3.60
15	Jiangxi	48.5	12,574	3.596	3.55
16	Anhui	50.9	15,340	3.590	
17	Hunan	48.5	16,071	3.576	3.58
18	Jiangsu	51.2	18,837	3.565	

19	Beijing	61.0	20,379	3.557	
20	Chongqing	41.6	15,149	3.552	
21	Guizhou	40.1	16,893	3.547	3.57
22	Sichuan	39.7	15,176	3.544	3.41
23	Fujian	36.6	18,853	3.543	3.50
24	Zhejiang	49.0	25,462	3.523	3.51
25	Yunnan	34.5	14,054	3.517	
26	Tianjin	59.5	23,465	3.514	
27	Guangdong	29.9	16,328	3.512	3.48
28	Guangxi	31.5	14,266	3.503	
29	Shanghai	48.2	30,923	3.497	
30	Ningxia	71,1	25,362	3.448	
31	Hainan	22.9	12,069	3.431	

Note. Baselines were estimated (S_{est} = .02) using the following regression equation: CC = 3.60 + (.06 x CD) + (-.05 x IR) + (-.06 x CD x IR), where CC is cultural collectivism, CD is standardized climatic demands, and IR is standardized income resources.

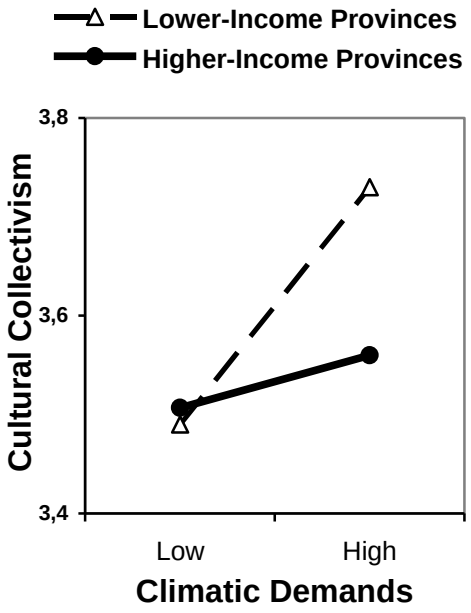

Figure 1. Effect of climatic demands on cultural collectivism at the provincial level, broken down for lower-income and higher-income provinces.

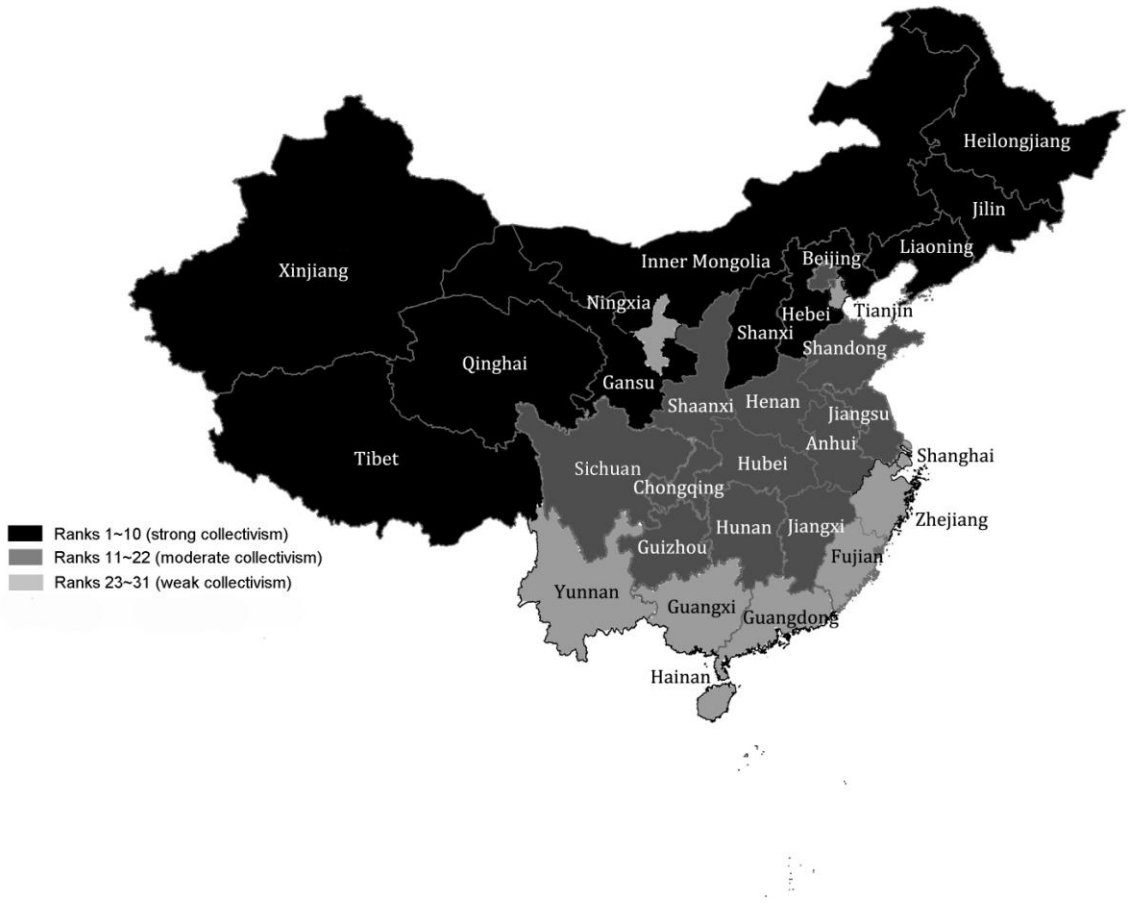

Figure 2. Regional patterns of cultural collectivism in China.