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Hidden Climato-Economic Roots of Differentially Privileged Cultures

Evert Van de Vliert



ABSTRACT

This theory-based study tests the interactive impacts of the demands of thermal climate and wealth resources on variations in *privileged culture* represented by mental health, personal freedom, and political democracy. Multiple regression analysis of aggregated survey data covering 106 countries shows that cultures vary from minimally privileged in poor countries with demanding climates (e.g., Azerbaijan and Belarus) to maximally privileged in rich countries with demanding climates (e.g., Canada and Finland). In between those extremes, moderate degrees of privileged culture prevail in poor and rich countries with undemanding climates (e.g., Colombia and Singapore). Rival explanations and competing predictors, including degrees of agrarianism versus capitalism, latitude and longitude, and parasitic disease burden, could not account for these findings in support of the burgeoning climato-economic theory of culture.

KEYWORDS

Agrarianism-capitalism, cold, heat, income per capita, mental health, personal freedom, political democracy



Introduction

Arctics and deserts are products of nature. Deserted arctics and deserted deserts, however, are products of culture. This is a basic cultural truth for at least three reasons. First, as a warm-blooded species, humans tend to seek thermal comfort and prefer to stay away from cold or hot spots. Second, warm-blooded humans also need to eat and drink a lot, with the consequence that we shun places with withering flora and fauna, especially places where the availability of safe drinking water is a problem. Third, we have to protect our health against colder and hotter climates given that we can so easily be frozen or burned to death. Indeed, harsher winters and summers require more cultural adjustments to meet needs for thermal comfort, nutrition, and health.

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Misled by these overly obvious facts, many classic scientists, such as Hippocrates, Ibn Khaldun, Quetelet, Sorokin, and Huntington, have all tried in vain to relate climate to culture (Feldman 1975; Sommers and Moos 1976). Moving beyond climatic determinism, the climato-economic theory of culture (Van de Vliert 2009, 2013a, 2013b) successfully proposes that available money should be taken into account as it can make life bearable even in places with freezing winters or sweltering summers. A further critique, scrutinized here for the first time, is that the degree of wealth is confounded with major determinants of economic performance (Maddison 1982). Poor countries tend to have agrarian economies whereas rich countries tend to have industrial and service economies. The consequence is that the climate-dependent effect of wealth resources may be an epiphenomenon of the relative sizes of a country's agrarian, industrial, and service sectors.

The current study is devoted to the joint impacts of climatic demands (undemanding versus demanding), wealth resources (poor versus rich), and economic activities (agrarianism versus capitalism) on societal culture. It aims to move our understanding of the origins of societal functioning not only beyond unconditional climatic determinism (e.g., Huntington 1945; Vanhanen 2009), but also beyond unconditional economic determinism (e.g., Inglehart and Baker 2000; Sen 2001; Inglehart and Welzel 2005; Abdollahian et al. 2012) and unconditional agrarian determinism (e.g., Wells 2010). Additionally, this research challenges the recent single-factor explanation of culture in terms of a country's parasitic disease burden (Schaller and Murray 2011; Fincher and Thornhill 2012).

The theoretical section introduces and discusses climatic demands and economic compensations of these demands as conceptual foundations of privileged culture marked by mental health, personal freedom in the form of self-expression and individual leeway of choice, and political democracy. The methodological section then describes the country-level measures used for climatic demands, wealth resources, agrarianism-capitalism, and privileged culture. The results section reports and validates a multiple regression analysis that estimates the extent to which the three climato-economic conditions can jointly predict degrees of privileged culture in 106 countries. The concluding discussion section highlights the need for appropriate explanatory complexity and accuracy in studies of cultural adaptations to climatic conditions.

Climato-Economic Theory of Culture

Points of Departure

This research is built around three recently developed definitions and assumptions (Van de Vliert 2013c: 229). First, balancing on the shoulders of Triandis (1995), Hofstede (2001), Inglehart et al. (2004), House et al. (2004), and Leung and Bond (2004), cultures are conceptualized here as stable sets of stresses that reflect needs-based problems, goals that reflect values, means that reflect beliefs, and outcomes that reflect practices. Second, stresses, goals, means, and outcomes are created to adapt to threatening, comforting, or challenging combinations of climatic demands and economic compensations of these demands. Third, stresses, goals, means, and outcomes are not interrelated in a strictly sequential way but are assumed to be continuously and simultaneously in flux, converging into a more or less privileged cultural system that is characteristic of the inhabitants of a given place of residence. Following are descriptions and discussions of climatic demands, economic compensations, and resulting cultural adaptations.

Climatic Demands

When our ancestors stayed away from cold arctics and hot deserts, they were not the only species on the move to avoid extreme temperatures. Most plants and animals did the same (Darwin 1859), thereby jointly creating bare and sparsely inhabited places around the poles and the equator. These virtually empty spaces reflect the broader fact of human life that colder and hotter places of residence entail larger deviations from physiological homeostasis, fewer nutritional resources, and greater health problems. Colder winters and hotter summers require more and better clothing, shelter structures, heating or cooling systems, increasing investments of time and effort in the pursuit of food and water, and more measures to safeguard family health. In short, in order to exist humans need thermal comfort, good nutrition, and good health; needs that are better met by undemanding climates (Rehdanz and Maddison 2005; Tavassoli 2009; Van de Vliert 2009; Maddison and Rehdanz 2011).

Extreme temperatures, be they cold or hot, influence societal functioning in multiple ways. For example, in addition to short-term impacts on agriculture (Cline 2007) and on the risks of many types of conflict (Hsiang et al. 2013), there is a long-term impact on the



“airco of language” (Van de Vliert 2009: 13–14). The articulation of consonants (such as d, f, p) is characterized by constriction or closure at one or more points in the breath channel, with heat preservation as a result. By contrast, in the articulation of vowels (such as a, o, u), the oral part of the breath channel is exposed to the air, with heat release as a result. Hence, it would serve thermoregulation if words with many consonants evolved in cold climates whereas words with many vowels evolved in hot climates. Also, there would be evolutionary advantage in higher frequencies of constricted vowels in cold climates (for example, i, e, ē, ū), and higher frequencies of open vowels in hot climates (for example, a, o, á, ó). That is exactly what anthropologists have found across fourteen classes of sounds and across six major world regions (Fought et al. 2004).

As yet another long-term impact, atmospheric cold and heat tend to undermine collective productivity and wealth (Maddison 1982; Sachs 2000; UN Development Programme 2007), sometimes to the point where initially flourishing economies eventually collapse. Dotted around the globe are many ancient buildings and structures left behind by societies as stark evidence of the part extremely cold and hot climates can play in human civilizations (Burroughs 1997). From the Norse who once lived by the shores of iceberg-strewn fjords on Greenland’s west coast to the Maya who once lived in the seasonal-desert environment of the Copán Valley in western Honduras, many economies of past societies seem to have been overwhelmed and degraded by the effects of prolonged adverse temperatures (Diamond 2005).

Indeed, in the long run, climatic demands have wealth-mediated effects on the extent to which a particular societal culture waxes or wanes. Unfortunately, the very fact that this is common knowledge by now may hamper further scientific progress. The insight that national wealth mediates the main effect of climate on culture may blind us to the very real possibility that the effect of climate on culture is different in poor and rich countries or, put statistically, that national wealth moderates or conditions the effect of climate on culture. There is even a chance that the main effect of climatic demands on societal culture is an optical illusion caused by the interactive impact of climatic demands and wealth resources on variations in cultural characteristics. For these reasons, the following study estimates the relative importance of the mediating and moderating functions of wealth resources in shaping privileged culture marked by mental health, personal freedom, and political democracy.

Economic Compensations

Climato-economic theorizing (Van de Vliert 2009, 2013a, 2013b) posits that monetary resources play a vital role in coping with bitter winters and scorching summers. As a rule, necessities of life needed to secure thermal comfort, nutrition, and health are for sale and have a price. In consequence, cash as liquid money and capital as illiquid money can alter the effects of colder-than-temperate winters and hotter-than-temperate summers through purchases of climate-compensating goods and services, including clothing, housing, transportation, meals, and medical cure and care. As an example of the way in which this is visible in present-day communities, families in richer nations spend up to 50 percent of their household income on climate-compensating goods and services, a figure that rises to 90 percent in poorer nations (Parker 2000). In a similar vein, working for money increases in poorer countries with more demanding climates, whereas working for achievement and fun increases in richer countries with more demanding climates (Van de Vliert 2009).

So far, climato-economic research has implicitly assumed that a country's wealth resources are independent of its economic history and its current economic activities. But these are questionable assumptions. Each country passes through distinct phases of economic activities and development, and scattered around the world are many examples of countries at each of these stages of economic performance (Inglehart and Welzel 2005; Nolan and Lenski 1999). Perhaps the best-known development sequence has four characteristic levels of production activities and generated wealth: agrarianism, advancing agrarianism, merchant capitalism, and capitalism (Maddison 1982). Using this development sequence as a point of orientation, the present cross-sectional study aims to examine the unique impacts of wealth resources and of agrarianism versus capitalism on societal culture.

Cultural Adaptations

Much cultural adaptation starts with an appraisal process. Drawing on deep evolutionary roots, humans continuously appraise their environmental situation with respect to its significance for their well-being (Lazarus and Folkman 1984; Bandura 1997; LePine et al. 2004). Primary appraisal relates to the extent a situation is stressful because need satisfaction is potentially in danger; secondary appraisal is about the extent personal or social resources are available to meet stressful



environmental demands. The resulting balance is threatening or challenging and underlies subsequent behavioral responses. As a spinoff of these widely accepted insights, climato-economic theorizing (Van de Vliert 2009, 2013a, 2013b) proposes that primary appraisals of climatic demands and secondary appraisals of economic compensations shape cultural adaptations.

Primary appraisals involve the extent to which winters and summers are comforting or more or less demanding and stressful given existence needs for thermal comfort, nutrition, and health. Undemanding climates are almost always appraised as relatively comfortable; climates with colder winters, hotter summers, or both are experienced as relatively stressful. Secondary appraisals deal with the extent to which wealth resources are sufficient to cope with atmospheric cold and heat. The seldom explicitly posed, yet implicitly answered, question is how well owning and buying climate-compensating goods and services can help prevent and dispel discomfort, hunger, thirst, and illness by satisfying existence needs. All inhabitants of a certain area are exposed to the same winters, summers, and economic compensations; are assessing and discussing this situation frequently; and are gradually pushing and pulling each other toward a shared appraisal of climato-economic livability. The following three environmental appraisals are visualized in Figure 1.

Poor populations in countries with colder-than-temperate winters, hotter-than-temperate summers, or both, are expected to appraise liv-

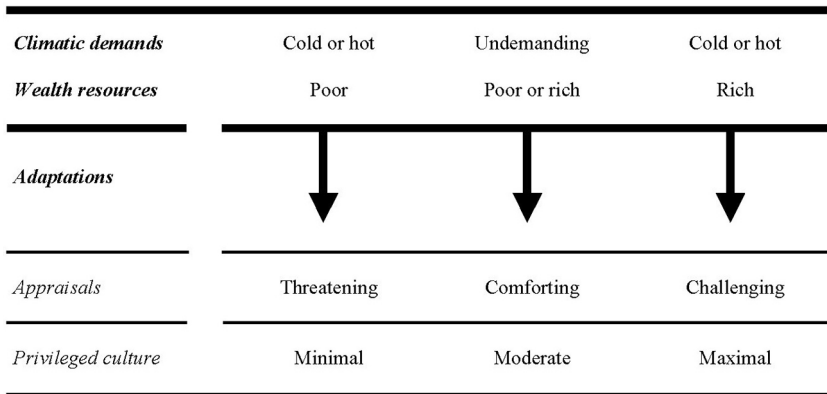


Figure 1 ■ Adaptations of privileged culture marked by mental health, personal freedom, and political democracy to threatening, comforting, and challenging combinations of climatic demands and wealth resources.

ability as stressful because climatic demands are high, and to appraise wealth resources to cope with the high stress as insufficient (*threatening environments*). Stress is expected to be relatively low in undemanding climates, making wealth resources less important for how well existence needs are satisfied in those climates (*comforting environments*). Rich populations in countries with colder-than-temperate winters, hotter-than-temperate summers, or both, are expected to appraise livability as stressful because climatic demands are high, and to appraise wealth resources to cope with the high stress as sufficient (*challenging environments*).

Based on the climato-economic theory of culture (Van de Vliert 2009, 2013a, 2013b), the last row of Figure 1 provides predictions of the degrees of privileged culture in these distinct environments. Mental health, personal freedom in the form of self-expression and individual leeway of choice, and political democracy will range from minimally privileged in threatening environments to maximally privileged in challenging environments. Cultures in comforting environments will be more privileged than in threatening environments and less privileged than in challenging environments. The fact that the confounded degree of agrarianism versus capitalism is not mentioned implies the further disconfirmatory prediction that the relative sizes of a country's agrarian, industrial and service sectors do not play a part.

Methods

Sample

Sufficient data on the study variables were available for analysis for 106 nations from all inhabited continents. From a worldwide viewpoint, there was an underrepresentation of countries with undemanding climates ($t = 3.38$, $p < .001$) and poorer wealth resources ($t = 3.58$, $p < .001$), which ensured a conservative test of the prediction model in Figure 1.

First Predictor: Climatic Demands

Annual mean temperature is an inaccurate predictor of national culture because it averages seasonal variations in cold demands and heat demands. Nowadays, 22°C (about 72°F) is adopted as a point of reference for optimal climatic livability to meet existence needs for thermal comfort, nutrition, and health. Climatic demands were opera-



tionalized across each country's major cities, weighted for population size, as the sum of the absolute deviations from 22°C for the average lowest and highest temperatures in the coldest month and in the hottest month (Van de Vliert 2013b).

Some critics view 22°C as a questionable point of reference for undemanding seasons and optimal climatic livability. However, somewhat lower or higher reference points than 22°C always yield almost identical research results (Van de Vliert 2009). The climatic-demands index has also been criticized because of the inadequacy of a single score for large countries spanning multiple climatic subzones. But adjusting for error-inducing temperature variations within nations, or even excluding large countries, strengthens rather than weakens the effects (Van de Vliert 2009, 2013a).

Second Predictor: Wealth Resources

National wealth in the form of income per head was measured with reference to the capacity of a country's currency to buy a given basket of basic goods and services (purchasing power parity in 2002, log transformed to reduce the skewed cross-national distribution; UN Development Programme 2004).

Third Predictor: Agrarianism-Capitalism

Each country's current position on Maddison's (1982) historical continuum from agrarianism toward capitalism was approximated by the national percentages of sectoral employment (UN Development Programme, 2004 for OECD countries, 2007 for non-OECD countries). Employment in the agrarian sector refers to activities in agriculture, fishing, and hunting. Employment in the industrial sector refers to manufacturing, mining, building, and public utilities (gas, water, and electricity). Employment in the service sector refers to trade, transport, restaurants, hotels, finances, communications, and community and personal services. The percentages for agriculture (0.99), industry (-0.58), and services (-0.91) loaded on a single factor that accounted for 72 percent of the common variation. National factor scores were saved as a new variable and reversed to represent the extent to which each country is engaged in capital-intensive industrial and service activities rather than agrarian activities.

It is insightful to note that agrarianism-capitalism tends to be a measure of world-system position (Clark 2013, building on Wejnert

2005; $r = .43$, $n = 119$, $p < .001$). Agrarianism-capitalism was chosen over world-system position as a predictor of culture for theoretical, methodological, and communicative reasons. Theoretically, compared to international export and import data, employment and production are more basic indicators of a country's structural location in the world economy. Methodologically, compared to the trichotomy of world-system positions (periphery, semiperiphery, core), agrarian-capitalism offers a more sophisticated interval-level measure of a country's relative standing in the economic world. Finally, the immediately meaningful agrarianism-capitalism dimension offers greater communicative clarity than the rather abstract world-system position.

Dependent Variable: Privileged Culture

Parallel measures of stresses, goals, means, and outcomes were integrated into an overarching index of privileged culture. Specifically, threatening versus challenging stresses, representing mental ill-being versus mental wellbeing, were aggregated scores for perceived ill health, burnout, anxiety, and depression (Fischer and Van de Vliert 2011). Survival goals versus self-expression goals were retrieved from the World Values Surveys (Inglehart et al. 2004). Achieving goals by means of ingroups or by means of one's own individual leeway of choice was measured as collectivism versus individualism (Van de Vliert 2011a). Finally, as elaborated in the next paragraph, outcomes of political autocracy versus democracy were represented by Pemstein et al.'s (2010) Unified Democracy Scores (UDS).

The UDS combines measures of (1) participation, inclusiveness, competitiveness, and coerciveness (Arat 1991); (2) political liberties, competitive elections, inclusive participation, civilization supremacy, and sovereignty (Bowman et al. 2005); (3) political liberties and sovereignty (Bollen 2001); (4) political rights and civil liberties (Freedom House 2007); (5) elections and political freedoms (Hadenius 1992); (6) executive elections, legislative elections, and party competition (Przeworski et al. 2000); (7) competitiveness of participation and executive recruitment, openness of executive recruitment, and constraints on the executive (Marshall et al. 2006); (8) fair elections, freedom of organization and expression, and pluralism of the media (Coppedge and Reinicke 1991); (9) competitiveness, inclusiveness, and political liberties (Gasiorowski 1996; Reich 2002); and (10) competition and participation (Vanhanen 2003). The UDS was chosen over other indices for its careful development, breadth of domain, reduction of measure-



ment error, and internal consistency (the intercorrelations of the ten subscales range from 0.60 to 0.95; $M_r = 0.79$).

As detailed elsewhere (Van de Vliert 2013c), the problems of mental ill-being versus wellbeing, values of survival versus self-expression, beliefs of ingroup agency versus individual agency, and practices of political autocracy versus democracy are mutually integrated components of a broad cultural system. The common denominator of these four indicators of national stresses, goals, means, and outcomes ($R^2 = .73$; Cronbach's $\alpha = .87$) was interpreted as an appropriate overall index of privileged culture (Van de Vliert 2013c).

Results

Descriptives

Standardized country scores of the predictors and the dependent variable are provided in Table 1. As expected, the zero-order correlations in Table 2 show that wealth resources and agrarianism-capitalism are

Table 1 ■ Standardized scores of the predictors and the dependent variable for 106 countries.

| <i>Countries</i> | <i>Climatic demands</i> | <i>Wealth resources</i> | <i>Agrarianism-Capitalism</i> | <i>Privileged culture</i> |
|------------------|-------------------------|-------------------------|-------------------------------|---------------------------|
| Albania | -0.024 | -0.374 | -1.521 | -0.926 |
| Algeria | -0.325 | -0.206 | 0.198 | -0.812 |
| Argentina | 0.106 | 0.402 | 0.992 | 0.419 |
| Armenia | 1.138 | -0.792 | -0.956 | -0.913 |
| Australia | 0.579 | 1.315 | 0.688 | 1.980 |
| Austria | 0.880 | 1.347 | 0.627 | 1.599 |
| Azerbaijan | 1.138 | -0.765 | -0.767 | -1.662 |
| Bangladesh | -0.798 | -1.373 | -1.252 | -0.939 |
| Belarus | 1.654 | -0.247 | 0.257 | -1.319 |
| Belgium | 0.708 | 1.291 | 0.623 | 1.206 |
| Bolivia | -0.497 | -1.019 | 0.890 | -0.634 |
| Botswana | 0.192 | 0.128 | -0.053 | 0.584 |
| Brazil | -0.841 | 0.080 | 0.119 | 0.203 |
| Bulgaria | 0.665 | -0.002 | 0.820 | -1.002 |
| Cambodia | -1.013 | -1.189 | -2.064 | -1.230 |
| Cameroon | -1.142 | -1.217 | -1.871 | -0.964 |
| Canada | 1.826 | 1.355 | 0.745 | 1.650 |

| <i>Countries</i> | <i>Climatic demands</i> | <i>Wealth resources</i> | <i>Agrarianism-Capitalism</i> | <i>Privileged culture</i> |
|--------------------|-------------------------|-------------------------|-------------------------------|---------------------------|
| Chile | -0.024 | 0.304 | 0.481 | -0.431 |
| China | 0.837 | -0.425 | -1.341 | -0.977 |
| Colombia | -1.185 | -0.110 | 0.046 | -0.012 |
| Costa Rica | -1.013 | 0.204 | 0.382 | 0.571 |
| Croatia | 0.880 | 0.344 | 0.411 | -0.012 |
| Cuba | -1.056 | -0.293 | 0.066 | -1.624 |
| Cyprus | -0.239 | 0.891 | 0.827 | 0.318 |
| Czech Republic | 1.224 | 0.758 | 0.952 | 0.647 |
| Denmark | 0.880 | 1.401 | 0.813 | 2.576 |
| Dominican Republic | -1.185 | -0.070 | 0.325 | 0.305 |
| Ecuador | -0.454 | -0.661 | 0.635 | -0.469 |
| Egypt | -0.110 | -0.601 | -0.269 | -0.977 |
| El Salvador | -0.325 | -0.362 | 0.249 | 0.241 |
| Estonia | 1.525 | 0.516 | -0.986 | 0.356 |
| Ethiopia | -0.368 | -2.118 | -3.120 | -1.218 |
| Finland | 1.525 | 1.242 | 0.710 | 1.840 |
| France | 0.536 | 1.268 | 0.818 | 1.282 |
| Georgia | 0.106 | -1.100 | -1.456 | -1.142 |
| Germany | 0.923 | 1.275 | 0.856 | 1.092 |
| Ghana | -1.228 | -1.157 | -1.397 | 0.419 |
| Greece | -0.282 | 0.921 | 0.100 | 0.660 |
| Guatemala | -0.841 | -0.536 | -0.704 | -0.736 |
| Guyana | -1.701 | -0.494 | -0.160 | -0.304 |
| Honduras | -1.701 | -0.966 | -0.625 | -0.964 |
| Hong Kong | -0.970 | 1.268 | 0.891 | -0.431 |
| Hungary | 0.923 | 0.601 | 0.921 | 0.229 |
| Iceland | 0.450 | 1.364 | 0.646 | 1.789 |
| India | -0.411 | -0.941 | -1.908 | -0.215 |
| Indonesia | -1.400 | -0.759 | -0.879 | -0.025 |
| Iran | 0.536 | -0.063 | 0.096 | -1.484 |
| Ireland | 0.278 | 1.556 | 0.771 | 1.231 |
| Israel | -0.153 | 0.962 | 0.919 | 0.318 |
| Italy | -0.153 | 1.251 | 0.764 | 0.736 |
| Jamaica | -1.185 | -0.559 | 0.195 | 0.533 |
| Japan | -0.454 | 1.269 | 0.759 | 0.698 |
| Jordan | -0.110 | -0.503 | 0.837 | -1.281 |
| Kazakhstan | 1.783 | -0.188 | -0.482 | -1.104 |



| <i>Countries</i> | <i>Climatic demands</i> | <i>Wealth resources</i> | <i>Agrarianism-Capitalism</i> | <i>Privileged culture</i> |
|------------------|-------------------------|-------------------------|-------------------------------|---------------------------|
| Kenya | -0.927 | -1.861 | 0.206 | -0.482 |
| Kyrgyzstan | 1.482 | -1.419 | -1.377 | -0.964 |
| Latvia | 1.525 | 0.243 | 0.570 | -0.253 |
| Lithuania | 1.525 | 0.352 | 0.535 | -0.291 |
| Macedonia | 0.751 | -0.095 | 0.334 | -0.939 |
| Madagascar | -0.583 | -2.168 | -2.458 | -0.647 |
| Malaysia | -1.271 | 0.233 | 0.467 | -0.165 |
| Malta | -1.013 | 0.864 | 1.009 | 0.470 |
| Mauritius | -1.228 | 0.396 | 0.726 | 0.191 |
| Mexico | -0.583 | 0.218 | 0.754 | 0.115 |
| Moldova | 1.052 | -1.512 | -0.787 | -0.736 |
| Mongolia | 2.858 | -1.367 | -0.745 | -0.596 |
| Morocco | 0.019 | -0.601 | -0.847 | -1.763 |
| Namibia | -0.282 | -0.134 | -0.458 | -0.165 |
| Netherlands | 0.622 | 1.343 | 0.650 | 2.386 |
| New Zealand | -0.411 | 1.064 | 0.596 | 2.132 |
| Nicaragua | -1.658 | -1.015 | -0.573 | -0.672 |
| Nigeria | -1.099 | -2.024 | 0.878 | -0.025 |
| Norway | 1.138 | 1.562 | 0.692 | 2.043 |
| Pakistan | -0.153 | -1.246 | -0.749 | -0.507 |
| Panama | -1.314 | -0.140 | 0.262 | 0.102 |
| Papua New Guinea | -1.400 | -1.096 | -2.278 | 0.495 |
| Paraguay | 0.321 | -0.419 | -0.394 | -1.408 |
| Peru | -1.185 | -0.339 | 1.013 | -0.241 |
| Philippines | -1.142 | -0.515 | -0.637 | -0.253 |
| Poland | 1.181 | 0.374 | 0.154 | -0.203 |
| Portugal | -0.497 | 0.898 | 0.439 | 0.647 |
| Qatar | -0.411 | 0.977 | 1.179 | -1.142 |
| Romania | 1.310 | -0.082 | -0.193 | -0.469 |
| Russia | 1.654 | 0.135 | 0.716 | -1.180 |
| Singapore | -1.443 | 1.160 | 1.129 | 0.153 |
| Slovakia | 1.439 | 0.561 | 0.847 | 0.013 |
| Slovenia | 0.880 | 0.912 | 0.700 | 0.495 |
| South Africa | 0.019 | 0.328 | 0.636 | 0.051 |
| South Korea | 0.708 | 0.826 | 0.480 | -0.368 |
| Spain | 0.278 | 1.052 | 0.705 | 0.927 |
| Sri Lanka | -1.400 | -0.663 | -0.471 | -0.253 |

| <i>Countries</i> | <i>Climatic demands</i> | <i>Wealth resources</i> | <i>Agrarianism-Capitalism</i> | <i>Privileged culture</i> |
|----------------------|-------------------------|-------------------------|-------------------------------|---------------------------|
| Sweden | 1.138 | 1.237 | 0.786 | 2.576 |
| Switzerland | 0.880 | 1.372 | 0.735 | 1.675 |
| Tanzania | -0.841 | -2.401 | -2.686 | -0.076 |
| Thailand | -0.755 | -0.018 | -0.806 | -0.088 |
| Trinidad and Tobago | -0.712 | 0.265 | 0.787 | 0.762 |
| Turkey | 0.966 | -0.107 | -1.422 | -0.241 |
| Uganda | -1.056 | -1.565 | -2.091 | -0.862 |
| Ukraine | 1.052 | -0.366 | 0.228 | -0.685 |
| United Arab Emirates | -0.411 | 1.093 | 0.846 | -0.583 |
| United Kingdom | 0.192 | 1.241 | 0.786 | 1.371 |
| United States | 0.708 | 1.540 | 0.802 | 1.536 |
| Uruguay | 0.106 | 0.088 | 0.816 | 0.292 |
| Venezuela | -0.884 | -0.271 | 0.516 | 0.013 |
| Vietnam | -0.626 | -1.084 | -1.473 | -0.977 |
| Zambia | -0.626 | -2.047 | -2.127 | -0.888 |

Table 2 ■ Intercorrelations of the study variables across 106 countries

| <i>Variable</i> | <i>1</i> | <i>2</i> | <i>3</i> |
|---------------------------|----------|----------|----------|
| 1. Climatic demands | | | |
| 2. Wealth resources | .32*** | | |
| 3. Agrarianism-capitalism | .22* | .77*** | |
| 4. Privileged culture | .15 | .69*** | .47*** |

* $p < .05$. ** $p < .01$. *** $p < .001$.

strongly correlated ($r = .77, p < .001$). This association made it necessary to include agrarianism-capitalism as a third predictor in order to check whether any effect of wealth resources is in fact an epiphenomenon of the relative sizes of a country's major economic sectors.

Confirmatory Tests

A hierarchical regression analysis was performed in four steps. The first step estimated the extent to which climatic demands can predict privileged culture. The second step estimated the extent to which



climatic demands and wealth resources have unique effects on privileged culture. The third step estimated the extent to which climatic demands and wealth resources influence each other's impact on privileged culture, and to what extent this interaction effect qualifies any primary effect in the preceding steps of the analysis. The fourth and final step estimated the extent to which the relative sizes of a country's major economic sectors can account for the effects of climatic demands and wealth resources on privileged culture.

When privileged culture was regressed on climatic demands, wealth resources, their mutual interaction, and agrarianism-capitalism, there was no multi-collinearity ($VIFs < 3.02$), and there were no outliers (Cook's $Ds < 1.13$). The first three regression models in Table 3 reveal that climatic demands ($\Delta R^2 = .02$, $B = .12$, ns), wealth resources ($\Delta R^2 = .45$, $B = .62$, $p < .001$), and their climato-economic interaction ($\Delta R^2 = .11$, $B = .30$, $p < .001$) accounted for 58 percent of the cross-national variation in privileged culture marked by mental health, personal freedom, and political democracy. As predicted, the last regression model shows that the main effect of agrarianism-capitalism cannot be held responsible for these results. Although the sample size of only 106 countries discourages the consideration of three-way interactions, I nonetheless ascertained that the inclusion of the interaction terms of agrarianism-capitalism with climatic demands and wealth resources did not change the pattern of findings.

Figure 2 portrays the particulars of the results, showing that climatic demands have an interaction effect rather than a main effect on privileged culture. Along the downward slope, privileged culture

Table 3 ■ Climatic demands, wealth resources, and agrarianism-capitalism predicting privileged culture

| Predictors | <i>B</i> | <i>B</i> | <i>B</i> | <i>B</i> |
|------------------------|----------|----------|----------|----------|
| Climatic demands (CD) | .12 | -.06 | -.10 | -.10 |
| Wealth resources (WR) | | .62*** | .48*** | .53*** |
| CD x WR | | | .30*** | .30*** |
| Agrarianism-capitalism | | | | -.06 |
| ΔR^2 | .02 | .45*** | .11*** | .00 |
| Total R^2 | .02 | .47*** | .58*** | .58*** |

Notes: $N = 106$ countries. There was no multicollinearity ($VIFs < 3.02$), and there were no outliers (Cook's $Ds < 1.13$).

* $p < .05$. ** $p < .01$. *** $p < .001$.

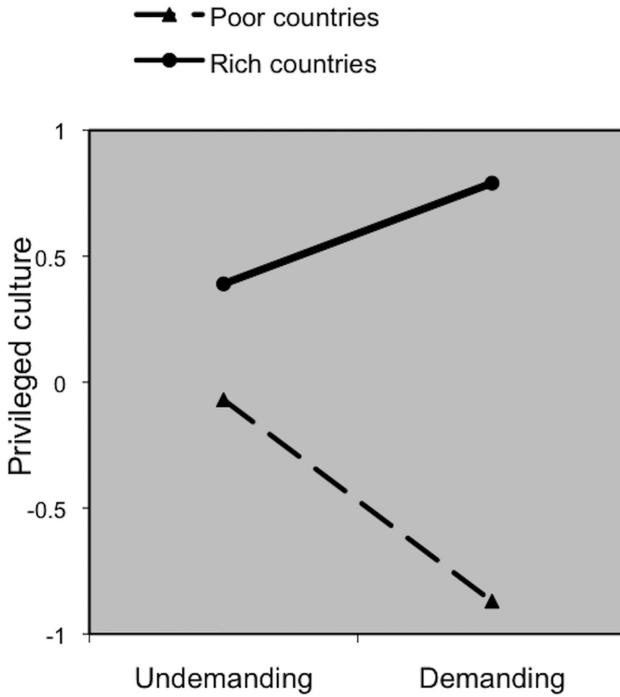


Figure 2 ■ Effect of climatic demands on privileged culture, broken down for poor and rich countries.

is weaker in poorer countries with more demanding climates ($B = -.40, p < .001$). However, along the upward slope, privileged culture is stronger in richer countries with more demanding climates ($B = .20, p < .01$). In addition, there is no difference between poorer and richer countries in undemanding climates at the left ($B = .23, ns$), but considerable difference between poorer and richer countries in demanding climates at the right ($B = .83, p < .001$). Without a single exception, the results of these more detailed simple slope tests are all in support of the climato-economic theory outlined in Figure 1.

Predictive Validity Test

Although data on climatic demands, wealth resources, and privileged culture were available for 127 countries, the sample had to be restricted to 106 countries because of missing data on agrarianism-capitalism. This sampling complication provided the opportunity to test whether the climato-economic conditions could correctly predict



the degree of privileged culture in the 21 non-sample countries. Predictions were based on the regression equation from Table 3: $PC = (-.10 \times CD) + (.48 \times WR) + (.30 \times CD \times WR)$, where PC is privileged culture, CD is climatic demands, and WR is wealth resources. The positive relationship between predicted privileged culture and measured privileged culture, visualized in Figure 3, supports the validity of climato-economic theorizing ($r = .60, n = 21, p < .004$).

Other Supplementary Analyses

It is informative to know that the results are quite robust in that they cannot be easily destroyed by rival explanations and competing predictors. For example, the climato-economic interaction effect survived controlling for ethnic diversity, religious diversity, income diversity, and all of their interactions. Reported in Table 4 are two analyses to exclude potential alternate explanations of the results in terms of a country's geographic latitude and longitude (Andersen et al. 1990; Diamond

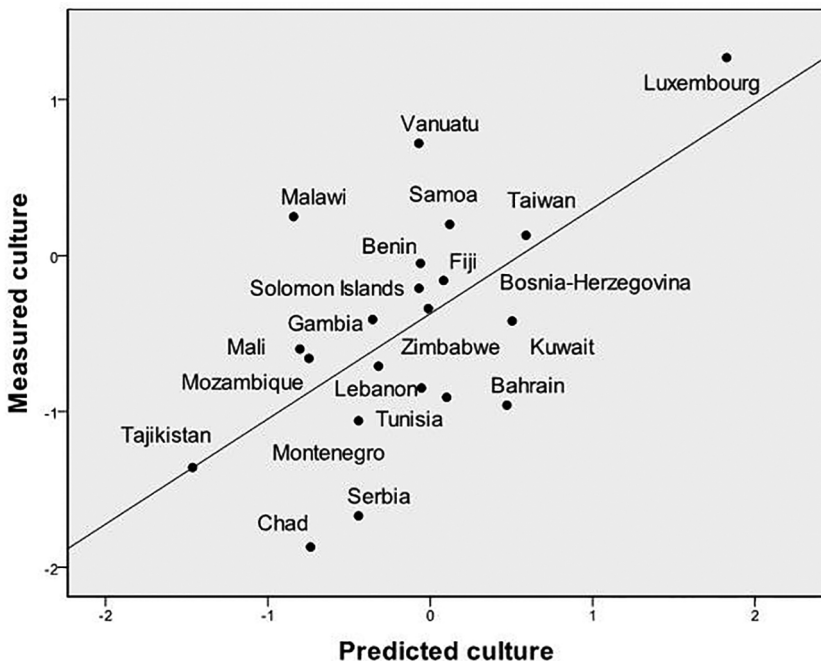


Figure 3 ■ Privileged culture predicted by the interaction of climatic demands and wealth resources corresponds with privileged culture measured in 21 non-sample countries.

Table 4 ■ Latitude, longitude, parasitic disease burden, climatic demands, wealth resources, and agrarianism-capitalism predicting privileged culture

| <i>Model</i> | <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> |
|---|----------|----------|----------|----------|
| <i>Predictors</i> | <i>B</i> | <i>B</i> | <i>B</i> | <i>B</i> |
| Absolute latitude (AL) ^a | .28*** | .03 | | |
| Longitude (LO) ^a | −12 | −.01 | | |
| AL x LO | −.17* | .01 | | |
| Non-zoonotic diseases (ND) ^b | | | −.37*** | .06 |
| Zoonotic diseases (ZD) ^b | | | .03 | −.08 |
| ND x ZD | | | .17* | .07 |
| Climatic demands (CD) | | −.12 | | −.05 |
| Wealth resources (WR) | | .53*** | | .55*** |
| CD x WR | | .30*** | | .30*** |
| Agrarianism-capitalism | | −.07 | | −.07 |
| ΔR^2 | .19*** | .39*** | .15*** | .44*** |
| Total R^2 | .19*** | .58*** | .15*** | .59*** |

Notes: $N = 106$ countries. There was no multicollinearity ($VIFs < 6.05$), and there were no outliers (Cook's $Ds < .77$).

^aSource: Parker (1997).

^bSource: Fincher and Thornhill (2012).

* $p < .05$. ** $p < .01$. *** $p < .001$.

1997; Turchin et al. 2006), and of its parasitic disease burden (Schaller and Murray 2011; Fincher and Thornhill 2012).

Distance to the equator is an omnibus representation of a variety of resources for human livability including the angle at which light strikes the earth, warmth, flora, fauna, and seasonal variation in necessities and opportunities. As a consequence, absolute geographic latitude is a better predictor of culture than geographic longitude (Turchin et al. 2006; Van de Vliert 2009). In line with this argument, model 1 in Table 4 implies that cultures are more privileged at higher latitudes, especially in the Americas. But this appears to be a spurious effect: geographic location does not account for any variation in privileged culture once the interactive impact of climatic demands and wealth resources has been accounted for in model 2. Likewise, as demonstrated in model 4, model 3 spuriously suggests that cultures



are minimally privileged in countries with a high non-zoonotic disease burden, and maximally privileged in countries with low prevalences of all kinds of parasites.

It is also informative to know that the confirmatory regression results are not restricted to mental health, personal freedom, and political democracy. Very similar effects can be demonstrated for other components of privileged culture such as freedom from press repression (Van de Vliert 2011b). Across 130 countries, climatic demands ($\Delta R^2 = .04$, *ns*), wealth resources ($\Delta R^2 = .34$, $p < .001$), their two-way interaction ($\Delta R^2 = .04$, $p < .01$), and agrarian capitalism ($\Delta R^2 = .00$, *ns*) account for 42 percent of the variation in the extent to which journalists and media assistants are killed, arrested, or physically attacked, and media outlets shut down or censored. In the terminology of Figure 1, press repression peaks in the most threatening environments, whereas press freedom peaks in the most challenging environments.

Discussion

National cultures are complex social systems requiring complex explanations. To describe cultural complexity I coined the term *privileged culture* marked by mental health, personal freedom, and political democracy. In search for explanatory complexity, I examined two- and three-way interactions as predictors of privileged culture. A crucially important task was to avoid explaining culture in terms of characteristics whose existence is ultimately based on observing the very same culture. To avoid such circular reasoning, no attempt was undertaken to trace privileged culture back to, for example, social capital (Locke and Flanagan 2013), or dynamic social construction processes (Harton and Bourgeois 2004; Yamagishi 2011). Instead, I scrutinized to what extent privileged culture can be successfully predicted by nonsocial, and thus less trivial, combinations of climatic demands and wealth resources while controlling for rival predictors including the relative size of major economic sectors, geographic latitude and longitude, and parasitic disease burden.

The observed interaction effects show that economic prosperity does not necessarily propel national culture in the direction of subjective wellbeing, personal freedom, and political democracy as the World Values Surveys group would have it (Inglehart and Baker 2000; Halman et al. 2005; Inglehart and Welzel 2005). Populations living in undemanding climates (e.g., Colombians and Singaporeans) appear

to be relatively insensitive to the level of national wealth when experiencing environments and making decisions about courses of action. Particularly poor populations residing in more demanding climates (e.g., Azerbaijanis and Belarusians) seem to propel away from survival goals and collectivist autocracy toward self-expression goals and individualist democracy when they get richer. This may be an especially important point for the Human Development Programme of the UN because cultural collectivism and autocratic policies often go hand in hand with unintended rerouting of money streams and redistribution of rights and duties.

It is difficult to avoid a causal interpretation of the stepwise increases in privileged culture in less threatening and more challenging environments. Granted, the longitudinal process of adaptation of privileged culture to climato-economic conditions has been examined here in a cross-sectional manner. But it would be a rare chance hit if more threatening environments covary negatively, and if more challenging environments covary positively, with mental health, personal freedom and political democracy for no reason other than pure coincidence. If the present findings are valid, and reflect causality rather than simultaneity, they help explain privileged culture, first and foremost because the composite of climatic demands and wealth resources cannot conversely adjust itself to the composite of mental health, personal freedom, and political democracy.

The results may also have implications for a better grasp of globalization. Although the findings do not speak to the history of economic globalization (e.g., Chase-Dunn et al. 2000; McMichael 2000), let alone the ecology of economic globalization (e.g., Jorgenson and Kick 2003), they seem to contribute to a better overall understanding of cultural globalization (e.g., Lechner and Boli 2005). The downward and upward slopes in Figure 2 tell us that globalization as the evolution of a nearly universal syndrome of culturally endorsed mental health, personal freedom, and political democracy “may have its limits because climate-based demands and wealth-based resources in concert shape unique local cultures ... Globaphobes and globaphiles may thus have too unrealistic nightmares and daydreams about the sameness of cultures around the globe in times to come” (Van de Vliert et al. 2009: 185).

A more refined understanding of the opposite slopes in Figure 2 may be sought in psychosocial compensation rather than economic compensation of climatic demands. Compensatory control theory (Kay et al. 2008; Kay and Sullivan 2013) posits that people have a funda-



mental need to maintain perceptions of control in the world, and that they can psychosocially switch from threatened personal control to unthreatened social and governmental control, or the other way round, from threatened social and governmental control to unthreatened personal control. Given that social and governmental control are higher in poorer countries whereas personal control is higher in richer countries, compensatory control theory suggests the following supplementary explanation of the opposite climato-economic slopes in Figure 2.

People tend to alternate between personal control and autocratic social and governmental control in poor countries, but between personal control and democratic social and governmental control in rich countries. Inhabitants of poorer countries with more demanding climates tend to switch to secure autocratic control with strong leaders because they cannot freely create personal control of the continuous threats to local livability. In contrast, inhabitants of richer countries with more demanding climates tend to switch to secure individual creativity because even democratic groups and organizations fall short of satisfactorily meeting their members' needs for idiosyncratic challenges and personal growth. For less demanding climates, this line of explanatory reasoning leads me to see less substitutability between personal and governmental control irrespective of the country's level of wealth resources. Anyway, compensatory control mechanisms are a promising topic for further ecological research.

The possible relevance of compensatory control theory also illustrates that climato-economic theorizing has been rightly criticized for its neglect of mediating factors (Kong 2013; Fischer 2013), which may differ between cold and hot climates (Murray 2013). Terracciano and Wayne (2013) find fault with the conceptual and empirical approach of collapsing cold demands and heat demands into climatic demands. Indeed, "money is more of a *sine qua non* for heating and eating in colder regions and months, but it is more for preventing and recovering from diseases produced by substances, germs, bacteria, and insects in hotter regions and months" (Van de Vliert 2013a: 467). In response to this criticism, refined indices for cold demands, heat demands, and total climatic demands in 232 independent countries and dependent territories have been made available for more accurate future research (Van de Vliert 2013b).

On closer consideration, the cold-heat issue is about whether societies use money to adapt culturally to additive or to interactive combinations of cold demands and heat demands. The additive combination

of cold and heat used here has three predictors (climatic demands, wealth resources, and their two-way interaction), and tips the inevitable trade-off between scientific parsimony and scientific accuracy (Weick 1979) in favor of parsimony. An interactive combination of cold and heat, by contrast, would have tipped the trade-off in favor of scientific accuracy by estimating cultural adaptations with seven predictors (cold demands, heat demands, wealth resources, three two-way interactions, and one three-way interaction). Most samples of countries are far too small to allow for estimating so many effects reliably. It may be more fruitful to create greater accuracy by zooming in on the climato-economic and cultural pictures of large countries, as has recently been done for states within the United States (Van de Vliert 2013a) and for Chinese provinces (Van de Vliert et al. 2013).

Although the current investigation was restricted to 106 countries, the impressive amount of co-occurrence of climato-economic conditions and privileged culture (58 percent) implies that degrees of mental health, personal freedom, and political democracy can be tentatively estimated for most of the world's independent countries and dependent territories. How this can be done is demonstrated and illustrated in the results paragraph on predictive validity. As to practical relevance, the day may not be far off when space- and satellite-based systems such as the Global Positioning System (United States) and the BeiDou Navigation System (China) provide integrated climatic, economic, and cultural information about every inhabited spot on earth. This indeed looks like an attractive practical application. The ultimate scientific goal is a paradigm shift from the fruits of culture to the roots of culture.

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