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Local Warming, Local Economic Growth, and Local Change in Democratic Culture

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Abstract: In a 104-nation study we first demonstrate that cultural self-expression, individualism and democracy languish in poor countries with colder-than-temperate winters, but flourish in rich countries with such winters. Mild summers are kind to this syndrome of culturally embedded democracy in rich countries only. Using these climato-economic niches of culture, we then estimate how unarrested global warming in conjunction with unaltered economic growth would affect democratic culture in 138 countries and regions. Local warming in concert with local economic trends would weaken democratic culture, especially the strongly democratic cultures of Australia, New Zealand, Northern Europe, and North America, but would strengthen democratic culture in China and Russia.

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1 Introduction

Climate shapes culture, although this is much clearer for agriculture than for socioculture. Through the ages, Hippocrates, Ibn Khaldun, Montesquieu, Quetelet, and Huntington, to mention but a handful of classic scientists, have all tried in vain to relate thermal climate to psychosocial culture. We seek to open new perspectives to that old debate.

Recent investigations in this field concentrate on links between global cooling or warming and outbreaks of violent conflict (e.g., Burke et al. 2009; Lee 2009; Nordås and Gleditsch 2007; Raleigh and Urdal 2007; Tol and Wagner 2010; Zhang et al. 2006). Bitter winters or scorching summers are thought to reduce crop and livestock production, increase misery and malnutrition, weaken immunity to a variety of illnesses, and cause wars, raids, or riots in result. However, the scientific accuracy of these climate-conflict links may be challenged on three grounds.

First, common temperature scales for measuring climate offer only physical points of reference such as freezing and boiling. For humans as a warm-blooded species, however, a temperature scale with a livability optimum as a biological point of reference is more appropriate. A linear relationship between temperature and human activity is therefore implausible. Second, violent conflict is an ultimate outcome of processes with cultural goals and cultural means as preceding adaptations to average weather conditions of cold or heat. Cultural syndromes along the full range of people's goals, means, and outcomes are waiting to be discovered as chained adaptations to thermal climate (Tol and Wagner 2010). Third, precise links between climates and cultures of conflict are hidden from view by poverty and wealth, that is, by the monetary resources available to cope with climate. As a case in point, Van de Vliert et al. (2009) have shown that adults in colder-than-temperate or hotter-than-temperate climates value conflict-prone education of children more, and harmony-prone education less, to the extent that their society is poorer.

The present climato-economic study of changes in democratic culture was designed to overcome these shortcomings of previous research. We adopt 22^{o}C (about 72^{o}F) as a point of reference for optimal climatic livability, concentrate on local adaptations of broad cultural syndromes to unarrested global warming between 2000 and 2100, and take into account

current national trends of economic growth. These advances are facilitated by the climato-economic theory of culture (Van de Vliert 2009), which includes but is not restricted to issues of democratic culture. This theory posits that cold-based and heat-based demands in conjunction with money-based resources to cope with the demands determine the livability of the environment, and that a country's inhabitants in turn adapt their culture to the environmental livability. The next paragraphs introduce the climato-economic vantage point in greater detail and then apply it to culturally embedded democracy.

A country's climate is more demanding and thus less livable to the extent that winters are colder than 22°C, summers are hotter than 22°C, or both. This point of reference is chosen not only because 22°C is the approximate midpoint of the range of comfortable temperatures (Parsons 2003) and the temperature preferred by tourists (Bigano et al. 2006), but also because basic needs for nutrition and health are met easier in temperate climates varying around 22°C, owing to the abundant availability of plants and animals, and healthy living conditions (Parker 2000; Tavassoli 2009). In theory, precipitation and humidity can lower or raise the thermal livability optimum (cf. agricultural response functions; Mendelsohn and Schlesinger 1999; Cline 2007), but in practice inflection points of curvilinear climate-culture relations occur around 22°C, and somewhat lower or higher reference points than 22°C appear to have almost identical effects (Van de Vliert 2009; Van de Vliert et al. 2004). Colder-than-temperate winters and hotter-than-temperate summers entail a wider variety of thermoregulatory adjustments, less amenable vegetation, greater risks of food shortage and food spoilage, stricter diets, and more health problems, and thus call for more psychosocial adaptation in the longer run.

For multiple reasons, including institutional factors (Easterly and Levine 2003), climatic demands and geographical location, there are huge differences in national income. Once collective income is accumulated, it provides a country's inhabitants with personal and societal resources to meet the demands of colder-than-temperate winters or hotter-than-temperate summers. Liquid assets (cash) and illiquid assets (capital) can buy clothing, housing, heaters, refrigerators, air conditioners, household energy, meals, drinks, kitchenware, medicines, and medical treatment. In poor countries with cold climates (e.g., Kyrgyzstan and Mongolia) or hot climates (e.g., Chad and Sudan), families appear to spend up to 90 percent of their household income on such climate-related goods and services (Parker 2000; see also Maddison 2003). Even then, many survival needs can sometimes not be met at all by large parts of the population. By contrast, inhabitants of rich countries in cold or hot regions (e.g., Canada and Qatar) have both the climate-driven needs for thermal comfort, nutrition, and

health, and the financial resources to turn climatic threats into climatic challenges, thus creating different cultures.

Borrowing from leading cross-cultural psychologists (Hofstede 2001; Schwartz 2004; Triandis 1995), we define culture as a rich complex or syndrome of values, beliefs, and practices passed on and changed from generation to generation in nongenetic ways. In addition, we postulate that core values are pre-eminently reflected in desired goals, core beliefs in feasible means to achieve the goals, and core practices in likely outcomes of the values and beliefs. As visualized in Fig. 1, and confirmed in cross-sectional and longitudinal studies (Van de Vliert 2007, 2009, 2011, in press a, in press b), the following cultural adaptations of value-reflecting *goals*, belief-reflecting *means*, and practice-reflecting *outcomes* are thought to evolve from the livability of the climato-economic environment.

Insert Fig. 1 about here

Poor societies in cold or hot climates tend to set survival goals to stay in control, embrace collectivism by falling back on their ingroups as means to achieve their goals, and often end up with outcomes of oppression and autocratic leaders who misuse the threatening situation to stay in power. By contrast, rich people in similarly demanding climates have leeway to be creative and set self-expression goals for personal growth, embrace individualism by relying on themselves as means to achieve their goals, and often end up with outcomes of freedom and democratic leaders who empower them by reinforcing the challenging situation. For societies in temperate climates, life is relatively easy irrespective of their level of income. Neither poor nor rich people in temperate climates develop an obsession with control and survival or with creation and self-expression; they develop moderately self-expressive, individualistic, and democratic cultures instead.

To date, this climato-economic theory of culture, represented in Fig. 1, has only been tested separately for the subsyndromes of survival versus self-expression cultures (Van de Vliert 2007, 2009, in press b), collectivism versus individualism (Van de Vliert 2011), and autocratic versus democratic leadership in organizations (Van de Vliert 2006, 2009). The current 104-nation study is the first to test the theory's prediction of the overall syndrome of cultural goals, means, and outcomes in order to then use its predictive power for estimating local changes in culture due to global warming during the remainder of this century.

Section 2 presents our measures of climatic demands, national income, and cultural subsyndromes, followed by hierarchical regression tests of the theory in Section 3. The

theory-based predictions of the impact of unarrested global warming and unaltered economic growth on culturally embedded democracy by late in this century, reported in Section 4, are building stepping stones for the overall discussion in the concluding Section 5.

2 Measurement of the variables

2.1 Climatic demands

The average annual level of climatic temperature is an inaccurate predictor of human culture because (i) it neglects the existence of a livability optimum (4^oC and 40^oC are both problematic), (ii) it overlooks the impact of seasonal variations in cold and heat (the maritime climate of the Falklands and the continental climate of Kazakhstan share an average level of about 4^oC), and (iii) the annual average temperature and its variation are negatively correlated (e.g., higher latitudes have lower temperatures and larger variations). For those reasons, we employed two climatic predictors. Winter demands were measured as the absolute deviation from 22^oC for the average temperature in the coldest month, summer demands as the absolute deviation from 22^oC for the average temperature in the hottest month. Turkmenistan, for example, has cold winters (demands: $|-7^oC - 22^oC| = 29$) and mild summers ($|21^oC - 22^oC| = 1$), whereas Mali has mild winters ($|21^oC - 22^oC| = 1$) and hot summers ($|33^oC - 22^oC| = 11$).

Raw scores of winter and summer demands in degrees Celsius for the 1961-1990 period were retrieved from Cline (2007). Cline reported average temperature projections across six General Ciculation Models (GCMs) available for the 1961-1990 and 2070-2099 periods within the program of standardized analysis compiled by the Intergovernmental Panel on Climate Change. Specifically, individual GCM results were converted to estimates at a standardized global grid resolution (90 latitude cells of 2^o height by 120 longitude cells of 3^o width), and then mapped into corresponding territories. This resulted in fine-grained estimates of temperature at the level of 38 regions for the largest countries, 68 individual countries, and 39 countries nested in multicountry regions. We had to restrict the current study to the 100 countries listed in Table 3 plus Afghanistan, Cuba, Somalia, and Turkmenistan, for which both climato-economic data and culture data were available for analysis (i.e., Iraq, North Korea, Serbia-Montenegro, and the 38 regions of Australia, Brazil, Canada, China, India, Russia, and the United States had to be left out of the empirical analysis).

2.2 National income

To reduce the skew of its distribution, national income was operationalized as the natural logarithm of gross domestic product per capita (in purchasing power parity Geary-Khamis dollars). In order to be able to cover all 104 nations, 2002 was chosen as reference year (United Nations Development Programme 2004).

2.3 Democratic culture

For cultural goals, means, and outcomes, schematized in Fig. 1, we used three respective data sets that are freely available for secondary analysis. As for cultural *goals,* cross-national measures of survival versus self-expression goals are periodically produced by the World Values Surveys (Inglehart and Baker 2000; Inglehart et al. 2004). Specifically, we build on a 4-item subindex tapping whether the respondent gives priority to self-expression and quality of life over physical and economic security, supplemented with 4 singular items tapping whether the respondent wants to sign petitions, thinks that homosexuality is justifiable, would say that most people can be trusted, and is happy (for details, see Van de Vliert, in press b). As reported in detail elsewhere (Van de Vliert 2007), test-retest reliability (0.98 after 1 to 2 years, 0.83 after 2 to 3 years), measurement equivalence across a representative sample of climato-economic niches (0.62 for Nigeria, 0.82 for Tanzania, 0.81 for Belarus, 0.85 for Russia, 0.86 for New Zealand, 0.87 for Taiwan, 0.96 for Canada, and 0.91 for Finland), and intergenerational construct validity (-0.63 for egoistic enculturation, 0.59 for altruistic enculturation), are all good.

As for *means,* we use Van de Vliert's (2011) 178-nation index of collectivist versus individualist cultures to represent groups versus individuals as agencies to achieve cultural goals. Its subindices refer to the advantageous treatment of (i) fellow nationals over immigrants (compatriotism), (ii) relatives at large over other competitors for scarce jobs (nepotism), and (iii) parents and children over others outside the nuclear family (familism). Reflecting consistency and convergent validity, compatriotism, nepotism, and familism are indeed manifestations of a single latent factor of collectivism versus individualism (accounting for 82.37% of the variance; Cronbach's $\alpha = 0.89$). Additionally, the overall index is climato-economically valid in that winter demands, summer demands, national income, and their interactions can successfully predict 50 percent of its cross-national variation in collectivism versus individualism (Van de Vliert 2011).

In the terms of Fig. 1, Van de Vliert (in press b) tests the relationship between climatic demands, income resources, and cultural *goals*. Van de Vliert (2011) does the same for

climatic demands, income resources, and cultural *means*. Here, we add cultural *outcomes* by testing the relationship between climatic demands, income resources, and political autocracy versus democracy. Scholars from various disciplines have constructed a plethora of ratings of autocratic versus democratic practices across polities in terms of civil freedoms, elections, party competition, citizen participation, and the like. As each of these outcome measures of culture brings different strengths and weaknesses to the table, Pemstein et al. (2010) used a Bayesian latent variable approach to synthesize the Unified Democracy Scores (UDS). We chose the UDS over other indices because of the breadth of its domain, its reduction of measurement error, and its internal consistency (intercorrelations of the ten subscales range from 0.60 to 0.95; $M = 0.79$; $S.D. = 0.09$). In additive combination with the above measures of cultural goals and means, the UDS measure of democratic outcomes served as an appropriate operationalization of culturally embedded democracy (accounting for 81.94% of the variance; Cronbach's $\alpha = 0.88$).

Insert Table 1, Table 2, and Fig. 2 about here

3 Tests of the climato-economic theory

3.1 Confirmative test

The descriptive statistics in Table 1 show that present winter demands and summer demands are clearly distinct variables ($r = -0.19$, n.s.), and that winters are more demanding than summers ($t = 6.21$, df = 103, $p < 0.001$), with the potential consequence that winters have a stronger cultural impact than summers. Hierarchical regression analysis with standardized predictors revealed that climatic demands, national income, and their interactions accounted for 64 percent of the variation in democratic culture (Table 2). In agreement with the climato-economic theory of culture, winter demands and summer demands had no impact other than impacts in conjunction with national income. The main effect for national income in the first step ($\Delta R^2 = 0.39$; $B = 0.52$, $p < 0.001$) appeared to be strongly qualified by a winters-by-income interaction in the second step ($\Delta R^2 = 0.20$ $B = 0.40$, $p < 0.001$), and a further winters-by-summers-by-income interaction in the third and final step ($\Delta R^2 = 0.05$ $B = 0.24$, $p < 0.001$).

The significant three-way interaction effect, plotted in Fig. 2, shows that more demanding winters decrease democratic culture in poorer countries, where these threatening winters undermine the inhabitants' livability (simple slope tests: $B = -0.38$, $p < 0.001$ for mild summers; $B = -0.56$, $p < 0.001$ for hot summers). By contrast, inhabitants of richer countries with more challenging continental climates of colder winters in conjunction with hot summers

enjoy greater self-expression, individualism, and democracy ($B = 0.71$, $p < 0.001$). Both findings are in elegant agreement with the climato-economic theory of culture, also because they imply that temperate climates are associated with intermediate degrees of culturally embedded democracy. In contradiction to the theory, colder winters in conjunction with mild summers have no impact whatsoever on democratic culture in richer countries ($B = -0.08$, n.s.).

3.2 Disconfirmative tests

Turning from verification to falsification, we checked whether precipitation (1961-1990; Cline 2007) can destroy the predominantly confirmative results. The extended regression equation showed that standardized precipitation ($B = 0.25$, $p < 0.10$), precipitation-by-winters ($B = 0.25$, $p < 0.10$), precipitation-by-summers ($B = 0.22$, $p < 0.10$), precipitation-by-income ($B = 0.08$, n.s.), precipitation-by-winters-by-summers ($B = 0.05$, n.s.), precipitation-by-winters-by-income ($B = 0.07$, n.s.), and precipitation-by-summers-by-income ($B = 0.06$, n.s.) increased the predicted variation in democratic culture from 64 to 68 percent. However, these results in no way affect support for the theory reported in Table 2 and Fig. 2.

Another matter of possible concern is the identical climatic demands within each of the ten multicountry regions covering 38 out of the 104 countries. The problem is one of excluding the existence of spatial autocorrelation between countries that are not statistically independent units of analysis. The extended regression equation that addressed this concern demonstrated that mid-range latitude ($B = 0.06$, n.s.), mid-range longitude ($B = 0.08$, n.s.), and their interaction ($B = 0.06$, n.s.), also had a negligible impact on the results. Indeed, geographic location as such seems to play no confounding role. Moreover, removal of the 38 countries from the analysis, did not weaken support for the theory but actually strengthened the conclusion that political regimes, too, are cultural adaptations to winter and summer demands in concert with national income resources.

3.3 Validation of the regression equation

To build further confidence in the climato-economic model, we did a validation check using press freedom as a criterion. We reasoned that cultural self-expression, individualism and democracy are incompatible with press repression, and consequently predicted that the reported regression equation is generalizable from democratic culture to press freedom (for details on that prediction, see Van de Vliert in press a). This validation hypothesis was then tested making use of the following indices of press freedom.

Reporters Without Borders (http://www.rsf.org; retrieved January 15, 2008) annually measures press freedom violations in nations. In 2005, 2006, and 2007, partner organizations in all continents and a network of more than 130 journalists and correspondents answered 50 questions, including the following: How many journalists and media assistants were … murdered (5-15 points); murdered with the state involved (5 points per case); arrested or sent to prison (3-15 points); currently in jail and serving over a year of sentence for a media-related offence (3-20 points); physically attacked or injured (2-6 points); personally threatened (1-4 points)? How many media outlets were censored, seized, or ransacked (3-12 points)? How many cyber-dissidents or bloggers were … imprisoned (3-9 points); harassed or physically attacked (1-4 points)? After the square roots of the annual country scores were taken, and after these scores were reversed, the resulting press freedom indices approximated normal distributions. Their test-retest reliabilities across the 104 nations in our sample were good (≥ 0.95 for the 2005-2006, 2006-2007, and 2005-2007 periods).

Significant three-way interactions of winter demands, summer demands, and national income appeared to account for 53, 47 and 54 percent of the variation in press freedom in 2005, 2006 and 2007, respectively. The Spearman rank correlations between the 8 regression coefficients for democratic culture (Table 2, last column) and the corresponding 8 coefficients for press freedom were 0.98, $p < 0.001$ for 2005, 0.98, $p < 0.001$ for 2006, and 0.95, $p < 0.001$ for 2007. These results clearly attest to the validity of our regression equation.

4 Theory-based predictions of culture

The co-occurrence of climato-economic niches and cultural syndromes implies that, in and of themselves, harsher-than-temperate climate and national income each paints an incomplete and, in fact, misleading picture of culture. By further implication, neither local warming nor local economic growth can accurately predict future changes in culture. Providing a tentative illustration of how the climato-economic theory of culture (Van de Vliert 2009) can be used to forecast culture, we used unarrested global warming in conjunction with unaltered economic growth to estimate local changes in democratic culture by late in this century.

Insert Table 3 about here

Regional climatic demands for the 2077-2099 period were derived from Cline (2007). Again, as elaborated above, we operationalized winter demands as absolute deviations from 22°C in the coldest month, and summer demands as absolute deviations from 22°C in the hottest month (for local decreases and increases in climatic demands, see Table 3). National

income prospects under the inevitably speculative condition of unaltered economic growth were represented by FI = [ln(NI+g)], where FI is future income, ln is natural logarithm, NI is the above-described national income in 2002, and g is 18 times the annual percentual growth rate of NI from 1990 to 2007 (United Nations Development Programme 2009). To regions within Australia, Brazil, Canada, China, India, Russia, and the United States, we assigned the country values of NI and g (with the exception of Hong Kong for which NI and g were available; data for Afghanistan, Cuba, Somalia, and Turkmenistan were missing).

The climato-economically shaped decreases and increases in local democratic culture, listed in the last column of Table 3, were determined and interpreted in three steps. First, we standardized winter demands in 2100, summer demands in 2100, and future income. Second, we applied the regression equation obtained (Table 2, last column) to predict future democratic culture. Third, we estimated changes in culture by detracting present democratic culture from future democratic culture. Table 3 presents results as if they are for 2100. In fact, only the climate scenario is for the end of the 21st century; the economic growth scenario is synthetic and thus timeless. More importantly, the empirical analysis is cross-sectional. While there is strong evidence that democratic culture in countries and regions varies with seasonal temperatures and local income, there is no information on the speed of adjustment. The results in Table 3 give the equilibrium value of culturally embedded democracy. The actual value may lag behind, perhaps considerably so.

Insert Table 4 about here

Table 4 summarizes present degrees of democratic culture and future changes in democratic culture for subcontinents including large countries. Local warming in concert with local economic trends will weaken rather than strengthen democratic culture in most parts of the world, especially in climato-economic niches with strongly democratic cultures, notably including Australia, New Zealand, Northern Europe, and North America. On the African continent, especially the peoples of Ghana and Sierra Leone (Table 3, nos. 15, 17) share this dismal prospect. By contrast, the lesser democratic cultures in the former communist bulwarks of China and Russia will gain in self-expression, individualism, and democracy (Table 4). Striking progress in democratic culture will also be booked in Burma (Myanmar, Table 3, no. 138), in Equatorial Guinea (no. 137), and in Sudan (no. 135).

5 Discussion and conclusion

Like all warm-blooded species, humans can easily be frozen or boiled to death. This solid axiom raises fundamental questions about the covert and overt impacts of global cooling and

warming on societal functioning. No wonder, then, that overt cultural outcomes of climate change in the form of, for example, migration (Lee 2009; Warner et al. 2009), agriculture (e.g., Challinor et al. 2007; Cline 2007; Liu et al. 2004; Parry et al. 2005), and large-scale conflict (e.g., Burke et al. 2009; Lee 2009; Nordås and Gleditsch 2007; Raleigh and Urdal 2007; Tol and Wagner 2010; Zhang et al. 2006), have received much fruitful scholarly attention. One additional point we make here is that, for a profound understanding of how climatic changes shape cultural outcomes, the heretofore hidden impact of colder-than-temperate winters and hotter-than-temperate summers on people's underlying goals (survival vs. self-expression) and underlying means (collectivism vs. individualism) cannot be ignored.

Another point is that climatic changes in and of themselves provide suboptimal explanations of cultural changes at best. Our retest of the climato-economic theory of culture (Van de Vliert 2009) clearly shows that winter and summer demands have no demonstrable impact on culturally embedded democracy if national income is left out of the equation (Table 2). Poverty and riches shape a climate's livability, at least in harsher-than-temperate climates, and, through it, motivate inhabitants of climato-economic habitats to adapt their cultural goals and means to threatening cold or heat in case of poverty, and to challenging cold or heat in case of riches. Whereas both thermal climate and precipitational climate shape agriculture (Mendelsohn and Schlesinger 1999; Cline 2007), colder-than-temperate winters and hotter-than-temperate summers rather than drier or wetter winters or summers turn out to be important players in the process of shaping socioculture.

Owing to global warming, winter and summer demands will both decrease towards higher latitudes. This softening climate produces pushes and pulls away from challenges, self-expression goals, individualism, and democracy in rich regions (e.g., Table 3, Sweden, no. 4; New Zealand, no. 7; Canada, nos. 6, 12), but away from threats, survival stress, collectivism, and autocracy in poor regions (e.g., Russia, nos. 118, 114, 100, 85). As winters hit harder than summers, combinations of less demanding winters and more demanding summers will strengthen rather than weaken democratic culture (e.g., Northwest China, no. 129; Kazakhstan, no. 116; Zambia, no. 108; Iran, no. 105), unless this tendency is counteracted by economic decline (e.g., Tajikistan, no. 26; Kyrgyzstan, no. 27). Global warming hits environmental livability hardest in poor tropical areas where both winter and summer demands increase. As a result, in Brazil Amazon (no. 38), Mali (no. 76), Burkina Faso (no. 79), Congo-Kinshassa (no. 90), and the like, local warming will strengthen rather than weaken threats, survival stress, collectivism, and autocracy. Only stronger economic growth, as evidenced by the case of Sudan (no. 135), can prevent this misery from being perpetuated.

Democracy-enhancing interventions via economic growth are welcome because democratic governance has a better worldwide reputation than does autocratic governance (Acemoglu and Robinson 2006; Inglehart and Welzel 2005). The UN, for example, once placed the following assessment of democracy on the cover of its annual *Human Development Report*: "Democracy has proven to be the system of governance most capable of mediating and preventing conflict and of securing and sustaining well-being. By expanding people's choices about how and by whom they are governed, democracy brings principles of participation and accountability to the process of human development" (United Nations Development Programme 2002). Against this glossy background, the results reported in Tables 3 and 4 make clear that the effectiveness of human development programs is dependent on the severity of local climatic conditions. Thus, global warming creates an ethical dilemma of choosing between democracy-enhancing interventions in some poor countries but not in others.

Gallup et al. (1999) and Masters and McMillan (2001) argue that an adverse climate is a cause for poverty. Acemoglu et al. (2001, 2002) and Easterly and Levine (2003), on the other hand, argue that human "institutions" (e.g., rule of law, education) dominate any climate- or geography-based explanation of income differences between countries. Here we add another twist: climatic demands and income resources shape culture (and hence institutions). In the same vein, Van de Vliert (2008, 2009) shows that bureaucratic organizational structures and strategies are most prevalent in poor countries with demanding climates, moderately prevalent in poor and rich countries with temperate climates, and least prevalent in rich countries with demanding climates. The implications of these climatic covariates of institutions for economic growth theory are deferred to future research.

Our explanatory and predictive study of climate-culture links is no exception to the rule that every investigation has inherent strengths and weaknesses as a result of the methods employed. The strength of sampling data from no less than 111 populous countries on all inhabited continents came with the weakness that precise indicators of local income and local culture were not available for 37 regions within the seven largest countries. Isomorphic confirmation of the climato-economic theory of culture for climatic subzones within large countries is needed, and has begun (Van de Vliert et al. 2010). The strength of investigating broad syndromes of cultural goals, means, and outcomes came with the weakness of insufficiently fine-grained theory building on the climatic origins of cultural subsyndromes of survival versus self-expression, collectivism versus individualism, and autocracy versus democracy. Finally, the strength that winter demands, summer demands, and national income

accounted for 64 percent of the variation in cultural self-expression, individualism, and democracy came with the weakness of correlational analyses that offered no conclusive evidence for causality.

Unless the weaknesses of this research overrule its strengths, the take-home message is that unarrested global warming would affect culturally embedded democracy, and negatively so in many countries. Even though that impact can be attenuated through economic development, this is a worrying prospect.

References

Acemoglu D, Johnson S, Robinson, JA (2001) The colonial origins of comparative development: An empirical investigation. Am Econ Rev 91:1369-1401

Acemoglu D, Johnson S., Robinson, JA (2002) Reversal of fortune: Geography and institutions in the making of the modern world income distribution. Q J Econ 117: 1231-1294

Acemoglu D, Robinson JA (2006) Economic origins of dictatorship and democracy. Cambridge University Press, New York

Bigano A, Hamilton JM, Tol RSJ (2006) The impact of climate on holiday destination choice. Clim Change 76:389-406

Burke MB, Miguel E, Satyanath S, Dykema JA, Lobell DB (2009) Warming increases the risk of civil war in Africa. Proc Natl Acad Sci USA 106:20670-20674

Challinor A, Wheeler T, Garforth C, Craufurd P, Kassam A (2007) Assessing the vulnerability of food crop systems in Africa to climate change. Clim Change 83:381-399

Cline WR (2007) Global warming and agriculture: impact estimates by country. Center for Global Development, Peterson Institute for International Economics, Washington, DC

Easterly W, Levine R (2003) Tropics, germs and crops: How endowments influence economic development. J Mon Econ 50:3-39

Gallup JL, Sachs JD, Mellinger AD (1999) Geography and economic development. Int Reg Sci Rev 22:179-232

Hofstede G (2001) Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations. Sage, London

Inglehart R, Baker WE (2000) Modernization, cultural change, and the persistence of traditional values. Amer Sociol Rev 65:19-51

Inglehart R, Basáñez M, Díez-Medrano J, Halman L, Luijkx R (2004) Human beliefs and values: a cross-cultural sourcebook based on the 1999-2002 values surveys. Siglo XXI Editores, Mexico

Inglehart R, Welzel C (2005) Modernization, cultural change and democracy: the human development sequence. Cambridge University Press, New York

Lee JR (2009) Climate change and armed conflict: hot and cold wars. Routledge, New York.

Liu H, Li XB, Fischer G, Sun LX (2004) Study on the impacts of climate change on China's agriculture. Clim Change 65:125-148

Maddison DJ (2003) The amenity value of the climate: The household production function approach. Res Ener Econ 25:155-175

Masters WA, McMillan MS (2001) Climate and scale in economic growth. J Econ Growth 6:167-186

Mendelsohn R, Schlesinger ME (1999) Climate response functions. Ambio 28:362-366

Nordås R, Gleditsch NP (2007) Climate change and conflict. Polit Geogr 26:627-638

Parker PM (2000) Physioeconomics: the basis for long-run economic growth. MIT, Cambridge.

Parsons KC (2003) Human thermal environments: the effects of hot, moderate and cold environments on human health, comfort and performance. Taylor and Francis, London

Parry M, Rosenzweig C, Livermore M (2005) Climate change, global food supply and risk of hunger. Philos Trans R Soc B 360:2125-2138

Pemstein D, Meserve SA, Melton J (2010). Democratic compromise: a latent variable analysis of ten measures of regime type. Retrievable from http://www.unified-democracy-scores.org

Raleigh C, Urdal H (2007) Climate change, environmental degradation and armed conflict. Polit Geogr 26:674-694

Schwartz SH (2004) Mapping and interpreting cultural differences around the world. In: Vinken H, Soeters J, Ester P (eds) Comparing cultures: Dimensions of culture in a comparative perspective. Brill, Leiden, Netherlands, pp. 43-73

Tavassoli NT (2009) Climate, psychological homeostasis, and individual behavior across cultures. In: Wyer RS, Chiu CY, Hong YY (eds) Understanding culture: Theory, research, and application. Psychology Press, New York, pp. 211-221

Tol RSJ, Wagner S (2010) Climate change and violent conflict in Europe over the last millennium. Clim Change 99:65-79

Triandis HC (1995) Individualism and collectivism. Westview, Boulder, CO

United Nations Development Programme (2002) Human development report 2002. Oxford University Press, New York

United Nations Development Programme (2004) Human development report 2004. Oxford University Press, New York

United Nations Development Programme (2009) Human development report 2009. Palgrave Macmillan, New York

Van de Vliert E, Huang X, Parker PM (2004) Do colder and hotter climates make richer societies more, but poorer societies less, happy and altruistic? J Econ Psych 24:17-30

Van de Vliert E (2006) Autocratic leadership around the globe: Do climate and wealth drive leadership culture? J Cross-Cult Psych 37:42-59

Van de Vliert E (2007) Climato-economic roots of survival versus self-expression cultures. J Cross-Cult Psych 38:156-172

Van de Vliert E (2008) Climate, wealth, and organization. In: Smith PB, Peterson MF, Thomas DC (eds) Handbook of cross-cultural management research. Sage, Thousand Oaks, CA

Van de Vliert E (2009) Climate, affluence, and culture. Cambridge University Press, New York

Van de Vliert E (2011) Climato-economic origins of variation in ingroup favoritism. J Cross-Cult Psych 42:xx-xx

Van de Vliert E. (in press a) Bullying the media: cultural and climato-economic readings of press repression versus press freedom. Appl Psych Internat Rev

Van de Vliert E. (in press b) Climate, cash, and culturally embedded happiness. In: Selin H (ed) Happiness across cultures. Springer, Dordrecht, Netherlands, pp. xx-xx.

Van de Vliert E, Matthiesen SB, Gangsøy R, Landro AB, Einarsen S (2010) Winters, summers, and destructive leadership cultures in rich regions. Cross-Cult Res 44:315-340

Van de Vliert E, Van der Vegt GS, Janssen O (2009) Prosocial to egoistic enculturation of our children: a climato-economic contextualization. Negot Confl Manag Res 2:123-137

Warner K, Ehrhart C, de Sherbinin A, Adamo SB, Onn TC (2009) In search of shelter: mapping the effects of climate change on human migration and displacement. A policy paper prepared for the 2009 Climate Negotiations, Bonn, Germany: United Nations University, CARE, and CIESIN-Columbia University

Zhang DD, Jim CY, Lin GC-S, He Y-Q, Wang JJ, Lee, HF (2006). Climate change, wars and dynastic cycles in China over the last millennium. Clim Change 76:459-477

Table 1 Means, standard deviations, and intercorrelations of main variables

Variable	*M*	*S.D.*	1	2	3
1. Winter demands[a]	11.09	10.28			
2. Summer demands[a]	4.33	2.64	-0.19		
3. National income[b]	8.40	1.20	-0.58***	-0.09	
4. Democratic culture[c]	-0.16	0.89	-0.35***	0.04	0.61***

N = 104 countries

[a] Climatic demands are the absolute average deviations from 22°C for the coldest winter month and the hottest summer month during the 1961-1990 period

[b] National income is the natural logarithm of gross domestic product per capita in 2002 (purchasing power parity in US dollars)

[c] Democratic culture is the average of standardized indices of self-expression culture, individualistic culture, and political democracy

* coefficient significant at the 0.05 level

** coefficient significant at the 0.01 level

*** coefficient significant at the 0.001 level

Table 2 Hiearchical regression predicting democratic culture

Predictor	*B*	*B*	*B*
Constant	-0.08	-0.31***	-0.36***
Winter demands (WD)	0.01	0.03	-0.08
Summer demands (SD)	-0.09	-0.03	-0.21**
National income (NI)	0.52***	0.46***	0.51***
WD*SD		0.16	0.15
WD*NI		0.40***	0.39***
SD*NI		-0.05	-0.04
WD*SD*NI			0.24***
ΔR^2	0.39***	0.20***	0.05***
Total R^2	0.39***	0.59***	0.64***

N = 104 countries

Regression coefficients shown are unstandardized beta weights from the equations for the regression models in the three columns. There was no multicollinearity (*VIFs* < 2.69), and there were no outliers (Cook's *Ds* < .35).

* coefficient significant at the 0.05 level

** coefficient significant at the 0.01 level

*** coefficient significant at the 0.001 level

Table 3 Trends in local warming, local economic growth, and local decreases (–) or increases (+) in cultural self-expression, individualism, and democracy

	Country or *region*[a]	Local warming[b]		Local economic growth[c]	Local change in democratic culture[d]
		Winter demands	Summer demands		
1	*Australia–Central West*	–3.57	+4.16	+43.2	–2.92
2	*Australia–North*	+1.03	+3.82	+43.2	–2.92
3	*Australia–Central East*	–3.65	+4.22	+43.2	–2.47
4	Sweden	–5.85	–3.67	+41.4	–1.83
5	*Australia–Southwest*	–2.93	+3.54	+43.2	–1.76
6	*Canada–Central*	–7.07	–4.91	+39.6	–1.73
7	New Zealand	–2.57	–2.68	+37.8	–1.62
8	*Australia–Southeast*	–2.96	+3.81	+43.2	–1.56
9	Denmark	–5.85	–3.67	+34.2	–1.49
10	Netherlands	–4.23	–4.87	+37.8	–1.46
11	*USA–Southeast*	–4.27	+4.66	+36.0	–1.41
12	*Canada–Southeast*	–9.31	–5.54	+39.6	–1.40
13	*USA–Southwest Plains*	–4.55	+5.36	+36.0	–1.32
14	Norway	–5.85	–3.67	+46.8	–1.13
15	Ghana	+3.26	+3.76	+37.8	–1.10
16	*USA–South Pacific Coast*	–4.29	+5.12	+36.0	–1.09
17	Sierra Leone	+3.73	+3.41	–5.4	–1.07
18	*Canada–Pacific Coast*	–4.7	–4.67	+39.6	–1.01
19	*USA–Pacific Northwest*	–4.22	–1.56	+36.0	–1.01
20	Finland	–5.85	–3.67	+50.4	–0.97
21	Switzerland	–5.27	–4.27	+14.4	–0.96

22	United Kingdom	–3.33	–3.46	+43.2	–0.95
23	Austria	–5.27	–4.27	+32.4	–0.92
24	*USA–Rockies Plains*	–5.62	+4.22	+36.0	–0.87
25	*USA–Lakes Northeast*	–6.38	+5.91	+36.0	–0.86
26	Tajikistan	–5.30	+4.85	–39.6	–0.85
27	Kyrgyzstan	–5.3	+4.85	–7.2	–0.83
28	Botswana	–4.51	+4.08	+77.4	–0.81
29	Namibia	–4.51	+4.08	+32.4	–0.78
30	Malawi	–3.56	+4.74	+7.2	–0.78
31	Costa Rica	+3.15	+3.78	+46.8	–0.77
32	Nigeria	+4.33	+3.73	+19.8	–0.73
33	Guinea-Bissau	+3.73	+3.41	–46.8	–0.73
34	*India–Southeast*	+3.36	+3.12	+81.0	–0.73
35	Senegal	+4.02	+3.68	+19.8	–0.69
36	*India–Northwest*	–4.66	+3.67	+81.0	–0.68
37	Belgium	–4.17	–4.04	+32.4	–0.66
38	*Brazil–Amazon*	+4.91	+4.84	+21.6	–0.64
39	*India–Southwest*	+3.53	+3.00	+81.0	–0.63
40	Japan	–4.12	+4.08	+18.0	–0.62
41	Nepal	–4.78	–1.90	+34.2	–0.61
42	Thailand	+3.74	+3.32	+52.2	–0.60
43	El Salvador	+3.15	+3.78	+32.4	–0.59
44	Tanzania	+0.58	+3.95	+32.4	–0.58
45	*Brazil–Northeast*	+4.03	+4.13	+21.6	–0.56
46	Bosnia and Herzegovina	–4.06	+3.79	+201.6	–0.55
47	Central African Republic	+3.53	+3.36	–14.4	–0.55

48	France	–3.93	–0.96	+28.8	–0.54
49	Pakistan	–5.09	+4.96	+28.8	–0.53
50	Spain	–3.58	+6.19	+43.2	–0.52
51	Algeria	–4.28	+5.50	+25.2	–0.51
52	Germany	–4.89	–4.82	+25.2	–0.51
53	Venezuela	+4.12	+3.27	–3.6	–0.51
54	Panama	+3.15	+3.78	+46.8	–0.48
55	South Africa	–4.11	+3.92	+18.0	–0.47
56	Sri Lanka	+2.76	+2.81	+70.2	–0.45
57	Kenya	+4.36	+3.03	0.0	–0.42
58	Mexico	–3.59	+4.21	+28.8	–0.41
59	Italy	–3.96	+3.11	+21.6	–0.41
60	*India–Northeast*	–4.85	+3.20	+81.0	–0.40
61	*Canada–NW Territories*	–8.77	–4.58	+39.6	–0.37
62	Czech Republic	–5.27	–4.27	+43.2	–0.37
63	Greece	–3.51	+5.19	+48.6	–0.36
64	Portugal	–3.27	+4.68	+34.2	–0.36
65	Chile	–2.84	–2.90	+66.6	–0.35
66	*USA–Alaska*	–8.54	–3.69	+36.0	–0.33
67	*Brazil–South*	–3.06	+3.32	+21.6	–0.31
68	Colombia	+3.83	+3.15	+21.6	–0.30
69	Philippines	+2.62	+2.92	+30.6	–0.26
70	Argentina	–2.78	+1.64	+27.0	–0.25
71	Malaysia	+2.89	+3.04	+61.2	–0.20
72	Ukraine	–6.51	+2.05	–12.6	–0.17
73	Ivory Coast	+3.20	+3.58	–12.6	–0.16

74	*Russia–Southeast Siberia*	–7.95	–5.42	+21.6	–0.16
75	Liberia	+3.73	+3.41	+34.2	–0.16
76	Mali	+3.26	+4.89	+39.6	–0.16
77	Indonesia	+2.81	+2.86	+41.4	–0.15
78	Turkey	–3.70	+6.25	+39.6	–0.13
79	Burkina Faso	+4.66	+4.48	+45.0	–0.12
80	Egypt	–4.07	+5.55	+45.0	–0.11
81	Slovenia	–4.06	+3.79	+63.0	–0.09
82	Djibouti	+3.58	+4.23	–37.8	–0.07
83	Madagascar	–2.35	+3.20	–7.2	–0.06
84	Croatia	–4.06	+3.79	+54.0	–0.02
85	*Russia–Northeast Siberia*	–7.95	–5.42	+21.6	0.00
86	Nicaragua	+3.15	+3.78	+34.2	+0.01
87	Cameroon	+3.57	+3.35	+10.8	+0.04
88	Slovakia	–5.27	–4.27	+61.2	+0.04
89	Niger	–1.56	+4.55	–10.8	+0.06
90	Congo–Kinshassa	+4.56	+3.52	–77.4	+0.08
91	Guatemala	+3.15	+3.78	+25.2	+0.08
92	Gabon	+3.53	+3.36	–12.6	+0.08
93	Romania	–5.28	+1.19	+41.4	+0.08
94	Bolivia	–3.57	+3.89	+23.4	+0.09
95	Mozambique	–1.05	+3.35	+75.6	+0.10
96	Uzbekistan	–5.16	+6.67	+21.6	+0.12
97	Congo–Brazzaville	+3.53	+3.36	–3.6	+0.12
98	Ecuador	+1.75	+3.02	+21.6	+0.13
99	Zimbabwe	–4.65	+5.37	–37.8	+0.15

100	*Russia–N Urals Siberia*	–9.99	–5.13	+21.6	+0.17
101	*Russia–S Urals Siberia*	–7.71	–1.72	+21.6	+0.19
102	Cambodia	+3.92	+3.46	+111.6	+0.19
103	Guinea	+3.73	+3.41	+23.4	+0.19
104	Uganda	+3.17	+3.42	+63.0	+0.19
105	Iran	–4.50	+6.34	+45.0	+0.19
106	Honduras	+3.15	+3.78	+27.0	+0.22
107	Ethiopia	+2.13	+3.86	+34.2	+0.24
108	Zambia	–4.78	+5.36	+1.8	+0.24
109	Vietnam	–0.88	+3.10	+108.0	+0.25
110	Hungary	–5.27	–4.27	+59.4	+0.27
111	Yemen	–2.03	+4.44	+28.8	+0.29
112	Macedonia	–4.06	+3.79	+7.2	+0.29
113	Bangladesh	–4.18	+2.51	+55.8	+0.31
114	*Russia–North European*	–9.24	–4.56	+21.6	+0.36
115	Poland	–6.25	–4.46	+79.2	+0.38
116	Kazakhstan	–6.41	+6.88	+57.6	+0.38
117	Peru	–3.42	–0.34	+48.6	+0.39
118	*Russia–Far Eastern*	–10.99	–4.92	+21.6	+0.40
119	*Russia–Caspian BlackSea*	–6.35	+6.42	+21.6	+0.41
120	Albania	–4.06	+3.79	+93.6	+0.43
121	*China–Hong Kong*	–4.92	+3.17	+43.2	+0.48
122	South Korea	–4.50	+4.05	+81.0	+0.50
123	Morocco	–3.76	+4.62	+36.0	+0.54
124	Bulgaria	–4.06	+3.79	+41.4	+0.57
125	*China–Beijing Northeast*	–6.63	+2.64	+160.2	+0.62

126	*China–Yellow Sea*	–5.43	+3.76	+160.2	+0.65
127	Paraguay	–3.57	+3.89	–5.4	+0.69
128	Angola	–3.62	+4.46	+52.2	+0.70
129	*China–Northwest*	–5.85	+4.27	+160.2	+0.72
130	*China–Tibetan Plateau*	–5.87	–5.26	+160.2	+0.79
131	Saudi Arabia	–4.24	+4.50	+5.4	+0.81
132	Syria	–3.63	+5.65	+27.0	+0.81
133	*China–South Central*	–4.64	+3.16	+160.2	+0.83
134	*China–Central*	–5.81	+0.43	+160.2	+0.86
135	Sudan	+3.84	+4.43	+64.8	+0.88
136	*Canada–Arctic*	–9.45	–4.34	+39.6	+1.30
137	Equatorial Guinea	+3.53	+3.36	+379.8	+1.31
138	Burma (Myanmar)	–4.05	+3.02	+122.4	+1.60

[a] Countries (non-italicized) and *regions* (italicized) listed in the order of estimated change in democratic culture (last column).

[b] Future decreases (–) or increases (+) in winter demands and summer demands, expressed in absolute deviations from 22°C.

[c] Unaltered negative (–) or positive (+) growth of national income, represented by 18 times the annual percentual growth rate from 1990 to 2007.

[d] Future decreases (–) or increases (+) in culturally embedded democracy expressed in z scores. The score for present democratic culture has been described under 2.3. The score for future democratic culture was estimated (S_{est} = .554) as DC = (–0.363) + (–0.078*WD) + (–0.207*SD) + (0.510*FI) + (0.153*WD*SD) + (0.392*WD*FI) + (–0.038*SD*FI) + (0.242*WD*SD*FI), where DC = democratic culture, –0.363 is the constant, WD is winter demands in 2100, SD is summer demands in 2100, and FI is future income (for computation of FI, see under 4).

Table 4 Trends of decreases (at the top) and increases (at the bottom) in cultural self-expression, individualism, and democracy within continents and large countries

Subcontinents	Number of countries or regions	Degree of democratic culture (z)			
		Present	Future	Change	
		M	*M*	*M*	*S.D.*
Australia and New Zealand	6	+1.86	–0.35	–2.21	0.64
Northern Europe	6	+1.82	+0.51	–1.31	0.35
United States	7	+1.54	+0.56	–0.98	0.36
Canada	5	+1.57	+0.93	–0.64	1.20
India	4	–0.07	–0.68	–0.61	0.15
Brazil	3	+0.13	–0.38	–0.51	0.17
Europe (minus Northern Europe)	20	+0.36	+0.15	–0.21	0.45
Central America	7	–0.09	–0.37	–0.28	0.38
Africa	35	–0.43	–0.58	–0.15	0.54
South America	8	–0.13	–0.14	–0.01	0.41
Asia (minus Russia, China, India)	23	–0.61	–0.61	0.00	0.60
Russia	7	–0.70	–0.50	+0.20	0.22
China	7	–0.89	–0.18	+0.71	0.14

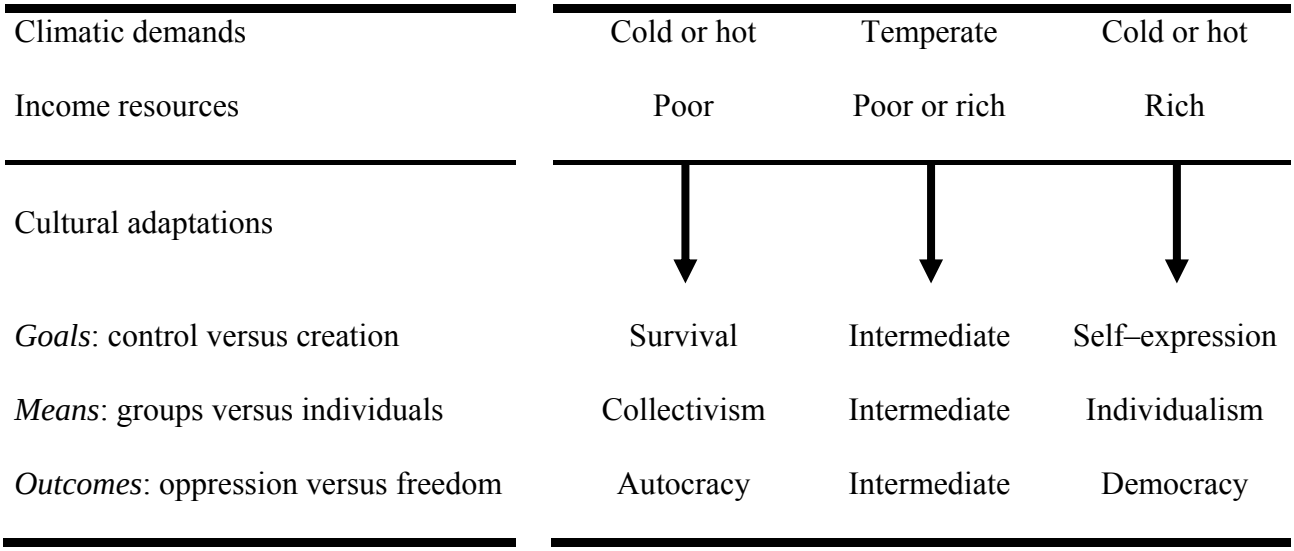

Fig. 1 Visualization of the climato–economic theory of culture

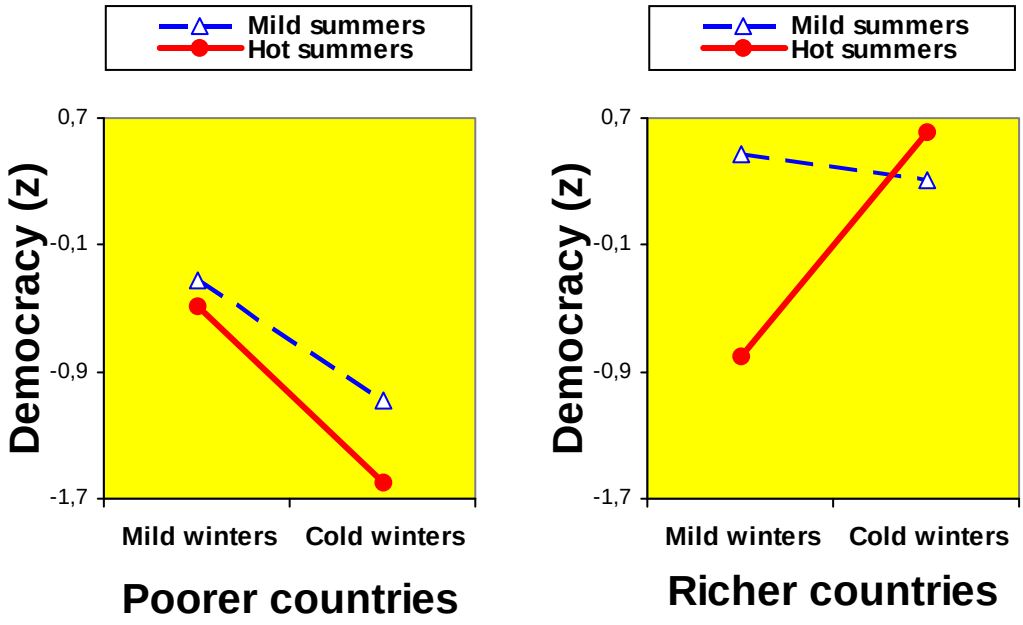

Fig. 2 Joint effects of winter demands and summer demands on democratic culture, broken down for poorer and richer countries

Year	Number	Title / Author(s) ESRI Authors / Co-authors *Italicised*
2011		
	377	The Social Cost of Carbon *Richard S.J. Tol*
	376	The Economic Impact of Climate Change in the 20th Century *Richard S.J. Tol*
	375	Regional and Sectoral Estimates of the Social Cost of Carbon: An Application of FUND David Anthoff, Steven Rose, *Richard S.J. Tol* and Stephanie Waldhoff
	374	The Effect of REFIT on Irish Electricity Prices *Conor Devitt* and *Laura Malaguzzi Valeri*
	373	Economic Regulation: Recentralisation of Power or Improved Quality of Regulation? *Paul K. Gorecki*
	372	Goldilocks and the Three Electricity Prices: Are Irish Prices "Just Right"? *Conor Devitt, Seán Diffney, John Fitz Gerald, Laura Malaguzzi Valeri* and Aidan Tuohy
	371	The Climate Change Response Bill 2010: An Assessment *Paul K. Gorecki* and *Richard S.J. Tol*
	370	Shapley Values for Assessing Research Production and Impact of Schools and Scholars *Richard S.J. Tol*
	369	Determinants of Vegetarianism and Partial Vegetarianism in Ireland *Eimear Leahy, Seán Lyons, Richard S.J. Tol*
	368	Modified Ramsey Discounting for Climate Change *Richard S.J. Tol*
	367	A Cost-Benefit Analysis of the EU 20/20/2020 Package *Richard S.J. Tol*
	366	The Distributional Effects of Value Added Tax in Ireland *Eimear Leahy, Seán Lyons, Richard S.J. Tol*

2010

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An Application of FUND
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Stefanie A. Haller and *Liam Murphy*

346 Female Labour Supply and Divorce: New Evidence from Ireland
Olivier Bargain, Libertad González, *Claire Keane* and Berkay Özcan

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Migrants

Alan Barrett and Jean Goggin