

Does the Physical Environment Influence Political Corruption?

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Abstract

Various physical and behavioral parameters of animals are related to ambient temperature. For example, cooperative breeding in birds is more common in low than in high latitudes. In warm-blooded animals, races from warm regions are smaller than races from cold regions (Bergmann's rule).

We predicted that ambient temperature is related to perceived corruption of countries, and that corruption is more prevalent in warm countries than cold ones. We used the Corruption Perceptions Index (CPI), an annual measure of countries' perceived corruption, and examined the relationship between CPI and mean annual temperature of the capital of each country.

We found that our prediction is held, and warm countries are significantly more corrupt than cold ones. We suggest ascribing this phenomenon to the fact that people living in warm countries often display greater fidelity to their family, tribe or larger social group than to society in general and its laws. Exceptions to this relationship (Singapore and Hong Kong in warm climates, Italy and Russia in colder ones) are discussed.

Key words: Corruption, ambient temperature, behaviour.

Introduction

Since 1995 Transparency International (TI) has published its annual **Corruption Perceptions Index (CPI), which ranks and scores more than 150 countries in terms of perceived levels of corruption**, as determined by expert assessments and opinion surveys. A description of the underlying methodology is available at www.transparency.org/surveys/index.html#cpi or at www.ICGG.org. TI noted that at first glance the CPI seems to confirm the stereotypical notion that corruption is predominantly a problem of the southern hemisphere (www.transparency.org/tools/measurement). However, while this impression seems generally to be true, it is not entirely so. For example, Russia occupies mid- to high-latitudes (mostly around 60°N)¹ across Europe and Asia and in 2007 ranked as a highly corrupt country (#143 out of 181), while Singapore and Hong Kong, which lie in low latitudes (1.4°N and 22.3°N, respectively) ranked low (#4 and 14, respectively). TI also noted that corruption level tends to be influenced by social issues such as low salaries, and to be higher in dictatorships. We provide evidence that suggests that it is the physical

environment that is to blame for corruption rather than social or cultural aspects.

It is well known that human behavior is related to the physical conditions under which people live, and that these conditions often determine the levels of wealth and poverty (Landes 1998). For example, the effect of ambient temperature on human activity is demonstrated by Noël Coward's song "Mad dogs and Englishmen go out in the midday sun." Indians know better.

Geographical variation in behavioral parameters and body size is a common phenomenon among animals. For example, cooperative breeding in birds (a phenomenon resulting from the delayed dispersal of young birds) is more common in low than in high latitudes as well as in the Australo-Papuan region (Arnold and Owens 1998, 1999; Geffen and Yom-Tov 2000). Another example of the influence of physical conditions on animals is the effect of ambient temperature on body size, summarized by Bergmann's rule, which is probably the best-known rule in zoogeography: "In warm blooded animals, races from warm regions are smaller than races from cold regions" (Mayr 1963). Body size in many vertebrates is related to ambient

temperature, as well as to other factors such as net primary productivity (Blackburn *et al.* 1999; Ashton *et al.* 2000; Ashton 2002a, 2002b). Using latitude as a proxy for ambient temperature for testing Bergmann's rule is very common in the literature (reviewed by Ashton 2004).

Since CPI is related to latitude, we wondered whether physical effects such as ambient temperature affect CPI in the same way that they do for other animal parameters. Hence, we examined whether ambient temperature or geographical position might affect the level of corruption of countries, and if so, we sought plausible explanations for the prevalence of corruption in low-latitude countries.

Material and methods

Data on country ranking and 2007 CPI scores of 181 countries were downloaded from the TI website. Countries are scored on a scale of 0 (most corrupt) to 10 (least corrupt) and ranked from #1 (least corrupt) to #181 (most corrupt). We reasoned that since most politicians reside in capital cities, and that it is they who are largely responsible for a country's corruption level, the CPI rank and score of each country should be related to the ambient conditions of that city. Hence, for each country we allocated the latitude, longitude, mean annual ambient temperature and height above sea level of its capital city, and related these factors and their 2-way interactions to its CPI rank and score. These data were downloaded from 2 websites: www.worldclimate.com and www.weatherbase.com/weather/country.php3?r=ASI&refer.

Statistical analysis was performed with JMP (ver. 5.1, SAS Inc.). We selected the best model (i.e., subset of predictors) using the Akaike's Information Criterion (AIC; Burnham & Anderson, 2001; Johnson & Omland, 2004) using Statistica (ver. 8, StatSoft). This approach weighs all the possible subsets (models) by the amount of the variance explained and model complexity.

Results

Model selection using the Akaike Criterion showed that the best models for both country ranking and CPI score included the main effects of latitude, longitude, and the 2-way interactions between latitude and temperature of the hottest month, and latitude and height above sea level (Table 1).

We used these results in multiple regressions and found that the above models explained 26.8% ($R^2 = 0.2683$, $F_{6, 174} = 10.6377$, $P < 0.0001$) and 36.7% ($R^2 = 0.3675$, $F_{6, 174} = 16.8501$, $P < 0.0001$) of the variation in country ranking and CPI score, respectively. All the examined factors (apart of the interaction height*latitude) had at least some effect on one or both dependent variables. Latitude and its interaction with temperature had the strongest effect, while temperature and its interactions came second (Table 2).

The effect of latitude on both the country's ranking ($F_{1,179} = 45.5116$, $R^2 = 0.2027$, $P < 0.0001$) and its CPI score ($F_{1,179} = 59.6470$, $R^2 = 0.2499$, $P < 0.0001$) is represented in Figures 1 and 2.

Table 1: The 4 best models in multiple regression of r^2 as the dependent and 6 independent environmental variables: latitude (Lat.), longitude, temperature of the hottest month (T) and height above sea level (H). K is the number of parameters in the model, AIC_c is AIC corrected for small sample size, ΔAIC_c is the difference in AIC_c values between each model to the best model (i.e., lowest AIC_c).

	Variables selected	K	AIC_c	ΔAIC_c
Country ranking				
1.	Latitude, Longitude, Lat.*T, Lat.*H	4	1883.971	0.000
2.	Latitude, Lat.*T, H*T	3	1884.147	0.176
3.	H, Latitude, Longitude, Lat.*T	4	1884.804	0.833
4.	T, Latitude, Lat.*H	3	1884.850	0.879
CPI score				
1.	Latitude, Longitude, Lat.*T, Lat.*H	4	701.976	0.000
2.	Temperature, Height, Latitude, Longitude	4	703.274	1.298
3.	Temperature, Latitude, Longitude, Lat.*T, Lat.*H	5	703.647	1.671
4.	Temperature, Latitude, Longitude, Lat.*H	4	703.803	1.827

Table 2: Effect of latitude (Lat.), longitude, temperature of the hottest month (T) and height above sea level (H) and their interactions on country ranking and CPI score. The full factorial model ($F_{6, 174} = 10.6377$, $P < 0.0001$) accounted for 26.8% and 36.7% ($F_{6, 174} = 16.8501$, $P < 0.0001$) of the variance, respectively. Significant results are underlined.

Term	Country ranking		CPI score	
	t ratio	P	t ratio	P
Intercept	1.18	0.2381	3.73	<u>0.0003</u>
Latitude	-3.12	<u>0.0021</u>	3.21	<u>0.0016</u>
Longitude	-1.27	0.2060	2.06	<u>0.0414</u>
Temperature of hottest month, C.	2.42	<u>0.0167</u>	-2.00	<u>0.0472</u>
Height, m.	2.43	<u>0.0159</u>	-2.29	<u>0.0230</u>
Temperature*Latitude	0.45	0.6567	-2.57	<u>0.0112</u>
Height*Latitude	0.79	0.4287	-1.82	0.0708

Discussion

Our main findings were that **physical phenomena, namely latitude and mean annual temperature, are significantly related to a country's corruption ranking and CPI score**, and that latitude explains about 6% more of the variation in ranking/score than does temperature. These results strongly suggest that geographical position as such, as well as temperature, somehow affect human behavior. However, latitude in itself cannot affect human behavior, and the fact that it explained more of the variations in both country rankings and CPI scores than did temperature suggests that it is only a proxy for additional factors.

We note that whatever physical attributes affect corruption, they have a residual behavioral effect that remains for some time even after people move from one location to another. We cite 2 cases for this observation: First, it is well known that people who migrate from equatorial latitudes to northern latitudes, such as Europe and the US, adjust to the standards of less corruption. Second, Israel is home to a large community that emigrated there in the last 60 years from northern latitudes, mostly Europe. Starting from a relatively high standard of government (placed #19 out of 85 countries in 1998), Israel has slowly descended the CPI scale (#30 out of 181 in 2007), suggesting that the physical effects causing

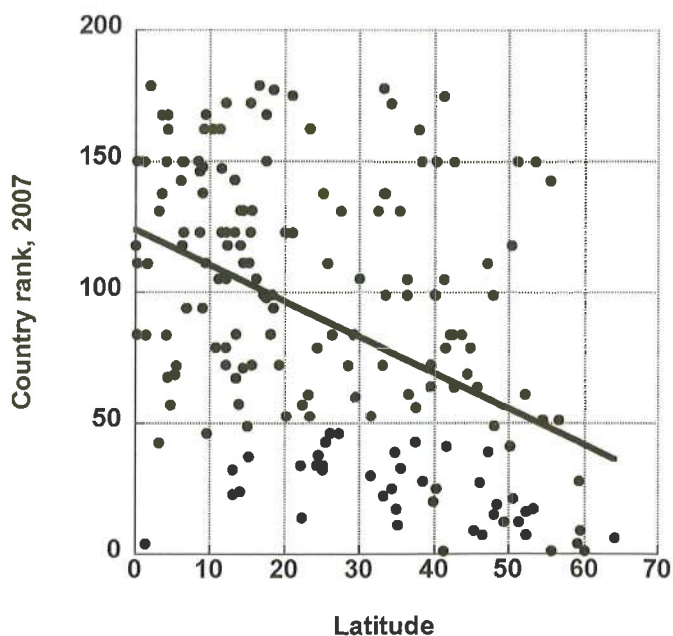


Figure 1: The relationship between latitude of the capital city of a country and its ranking.

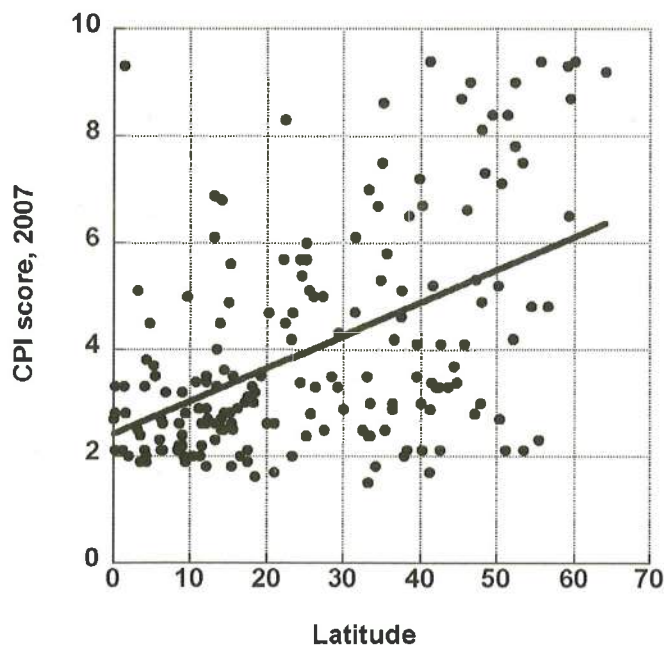


Figure 2: The relationship between latitude of the capital city and its 2007 CPI score.

people to become more corrupt are slowly affecting these communities. Therefore, the physical effects in question appear to have a lingering effect on behavior of at least several decades.

Ambient temperature is related to various animal characters, such as body size. Bergmann's rule explains the relationship between body size and ambient temperature in terms of physiological adaptation to the environment. A small animal has a relatively large surface area that is beneficial in hot climates for heat dissipation, while a large animal has a relatively small surface area that is advantageous for heat conservation in cold climates (Mayr 1968). However, although we found that mean annual temperature is significantly related to both country corruption ranking and CPI score, we do not suggest that temperature itself affects human behavior in a way that causes people to become corrupt².

It is well known that cooperative breeding in birds is more common in low latitudes, and this phenomenon has been related to habitat saturation and other ecological constraints such as shortage of resources like territory and food (Arnold and Owens 1998, 1999; Geffen and Yom-Tov 2000). Such shortages are partly due to greater biological diversity resulting in more potential competitors, as well as to a high population density of the same species that share the same demands for resources. Cooperative breeding derives from the fact that young birds are incapable of establishing their own territories and are thus forced to remain in their parents' territories for several years after they fledge. As long as they remain a part of a group of birds they participate in such communal activities as territorial defense and foraging for food, which is often shared with other members of the group, while being aggressive towards conspecifics that are not members of the same group.

We suggest that a similar mechanism may explain the high prevalence of corruption found among low latitude, warm countries. Many of these countries suffer from high population density, shortage of resources, and poor health facilities, and their governments hardly provide relief from these. In addition, productivity of labor in tropical countries is lower than in temperate ones (Landes 1998). To survive or to rise in the political system, people living in such countries often display greater fidelity to their family, tribe, or larger social group than to

society in general and its laws (Meredith 2005). Such fidelity entails providing benefits to people who may not be lawfully entitled to them, thus creating a corrupt society. Italy, which ranked #41 in 2007, the lowest of all old member states of the European Union, offers an example of a country that supports this hypothesis. Italy is famous for its strong family ties, especially in the south (where criminal and corrupt organizations such as the Sicilian Mafia, the Neapolitan Camorra, the Apulian Sacra Corona Unita, and the Calabrian 'Ndrangheta emphasize loyalty to themselves rather than to the State, were established). One aspect of this is the prevalence of the phenomenon of "children" remaining in their parental home well after the age of 30.

If the above hypothesis is correct, one would expect that as countries become richer, they will also become less corrupt. Although this may be true for some countries, it is not always so, and high resource availability does not always ensure that a country will be less corrupt. For example, wealthy Saudi Arabia ranked #79 in the CPI in 2007, apparently due to the fact that its riches are largely divided among members of the royal family and its cronies; and while the recent increase in raw material prices enriched Russia, its rank remained among the 20% most corrupt countries (#79 out of 91 countries in 2001 to #143 out of 181 in 2007; note that higher rank means more corruption), apparently due to the creation of a nouveau riche class that keeps these riches to itself and its cronies.

Using this hypothesis, it is easy to explain why the effect of latitude and temperature on increasing or reducing graft takes time to take root in migrant communities. The evolutionary advantages of such familial behavior are obvious when encountering a lack of resources. A new migrant community may thus take some years before learning and adopting the new mode of behavior of its adoptive society; but it eventually will adopt it in order to compete on even terms with other groups in that society.

Correlation does not imply causation. In our case, however, it is quite clear that correlation does indeed follow causation, as evidenced by the temporal residual effect noted above. We can therefore conclude that it is not design or folly that makes lower-latitude countries corrupt. Instead, one should blame a physical effect, which causes strong group bonding at the expense of society at large.

Notes

¹ However, as Napoleon noted, “Scratch a Russian and you find a tartar”, so perhaps one should simply adjust the true latitude of the Russians to somewhere closer to southern Mongolia.

² We do note, however, that there exist “islands” of relatively low corruption in the midst of areas of high corruption (e.g. Singapore, Hong Kong, Israel). This may be due to the utilization in these areas of local climate control apparatus such as fans and air conditioners. Citizens of these countries spend most of their time indoors in relatively low temperatures. Thus the corruption-inducing effect of warm temperatures may be mitigated by artificial climate.

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I didn’t follow the recent World Cup, but I did hear a lot of buzz about it. Mostly about some country I never heard of before. Vuvuzuela. Apparently that’s in the Horn of Africa. Their national anthem is “Be Flat”.

There was once a Physics Department whose motto could have been “Great Moments of Inertia”.

Over the last several decades, light meters have gotten lighter.

Is the multiplication of divisions a plus or a minus?

Sewage spills foul effluent neighborhoods.