INSTITUTIONS, PARASITES AND THE PERSISTENCE OF IN-GROUP PREFERENCES

5

Daniel J. Hruschka
School of Human Evolution and Social Change
Arizona State University
dhruschk@asu.edu

10

Joseph Henrich
Department of Psychology
Department of Economics
University of British Columbia
joseph.henrich@gmail.com

15

ABSTRACT

Much research has established reliable cross-population differences in motivations to invest in one's in-group. We compare two current historical-evolutionary hypotheses for this variation based on (1) effective large-scale institutions and (2) pathogen threats by analyzing cross-national differences (N= 122) in in-group preferences measured in three ways. We find that the effectiveness of government institutions correlates with favoring in-group members, even when controlling for pathogen stess and world region, assessing reverse causality, and providing a check on endogeneity with an instrumental variable analysis. Conversely, pathogen stress shows inconsistent associations with in-group favoritism when controlling for government effectiveness. Moreover, pathogen stress shows little to no association with in-group favoritism within major world regions whereas government effectiveness does. These results suggest that variation in in-group preferences across contemporary nation-states is more consistent with a generalized response to institutions that meet basic needs rather than an evolved response dedicated to pathogens.

Word count: Body 4319, Refs 1363, Abstract 151, 1 table, 2 figures.

Key words: Material security, pathogen, collectivism, nepotism, favoritism, religion, culture, Institutions

40   The degree to which people prefer interacting with and investing in family, friends, and in-group members—which we label "in-group preferences"—varies substantially across human societies, and has been associated with a variety of population-level cognitive differences [1-5]. For example, in one multi-country study of hypothetical decision-making, the probability of lying to help a friend over

45   telling the truth in court varied between 5% and 70% [6]. Nevertheless, despite a large and expanding body of findings showing reliable differences across populations, only recently has research begun to develop and test historical-evolutionary causal explanations for such differences.

Here we assess two current historical-evolutionary accounts for this cross-cultural

50   variation in in-group preferences, focused on the effects of (1) large-scale uncertainty-reducing institutions, and (2) pathogen threats.

The first *material or existential security* hypothesis proposes that these population-level differences are responses to the existence of social institutions that can buffer risk, ensure basic needs are met, and mitigate threats to survival [7]. Like other

55   animals who engage in social niche construction, humans actively modify their social environments as a means of adapting to material threats , including pathogen stress [8,9], environmental extremes [10], food insecurity [11], and inter-group conflict [12]. However, humans are unique in their ability to construct their social environments cumulatively over generations, with the cultural transmission of

60   social norms (e.g., food sharing), knowledge (e.g., germ theory of disease), practices (e.g. food storage, charity), complex technologies (e.g., boiling water, burying the

dead) and formal institutions (e.g., courts, police, hospitals, health care, insurance and social safety nets). In these culturally-constructed niches, humans face frequent decisions about investing in one's family or in-group vs. pursuing other social

65   investments, including cultivating new relationships in a broader social network. Under different social and ecological conditions, the same investments can have very different consequences. For example, public services, global markets, and social safety nets that mitigate material threats may render investments in an expansive network of kith and kin less necessary as alternative forms of social insurance.

70   Moreover, limiting one's social interactions to local in-group members can prevent one from accessing the benefits of trade and comparative advantage, of expanded mating opportunities, and of new ideas and cultural innovations. By contrast, in societies lacking such institutions, where plagues, injuries, and economic shocks represent serious and persistent threats, in-group members may be the only reliable

75   source of social insurance and support, and intensive investments in enduring social relationships may serve as a crucial buffer against threats to survival and reproduction [13-15]. The cultural evolution of norms, know-how, technologies and institutions that increasingly mitigate threats to material insecurity may create new contexts which permit reallocations of investment away from in-group relationships

80   via several mechanisms [15-17]. These can include facultative calculations of costs and benefits, learning over the lifespan, genetic changes, and culturally acquired beliefs, values, habits and motivations [10,18,19]. For example, a vast body of experimental work indicates that cuing uncertainty in a number of domains, including mortality, disease, and social exchange, makes people more likely to invest

85   in cultivating cooperative social ties and to favor in-group members [20-25].

Conversely, priming individuals with terms related to safety and security make

them less likely to favor in-group members [26]. This suggests that decisions about

in-group and out-group investment involve at least some facultative responses to

the current level of certainty and safety. These facultative responses and the other

90   mechanisms outlined above may contribute to the extant patterns of variation in in-

group investment. Some researchers have also proposed an opposite causal

pathway linking in-group preferences and institutions. Specifically, lower levels of

in-group favoritism may foster economic growth and the development of

institutions that mitigate material threats [27]. In both cases, we would expect a

95   correlation between institutional quality and in-group favoritism.

The second account proposes that in-group preferences are a form of

behavioral immune system reflecting a cognitive adaptation evolved specifically to

protect against the spread of pathogens. According to this hypothesis, in regions

with high risk of infection by dangerous pathogens, individuals will preferentially

100   affiliate with in-group members in a way that insulates them from infection by out-

group members [8,28-30]. Though originally predicting xenophobia (negative out-

group attitudes and behaviors), the theory has been extended to account for in-

group favoritism (positive in-group attitudes and behaviors) as well [30].

Depending on the specific treatment of this hypothesis, the adaptive mechanisms

105   may range from short-term cost-benefit calculations to longer term changes due to

cultural learning, epigenetics, or even genetic adaptation [28]. Emerging

experimental evidence suggests that people do indeed adjust social motivations and

behaviors (i.e. conformism) to specific cues of pathogen threats over and above generalized threats [31]. Broadly, this hypothesis is subsumed by the material

110   insecurity hypothesis, which views pathogen threat as but one type of material insecurity. However, this hypothesis differs crucially from the material security hypothesis by positing that the adaptive mechanisms responsible for this effect are specific to pathogen risk and were designed to impede the spread of pathogens. In addition to critiques of the theory's key assumptions [32], scholars have recently

115   criticized cross-population tests of the pathogen stress hypothesis for not considering alternative hypotheses [31,33] and for not accounting for the non-independence of country-level data [34].

　　　　Here we assess these two hypotheses using available cross-national measures of in-group preferences. We focus our analyses on three independent

120   measures of in-group preferences used in the literature. First, we use Hofstede's measure of collectivism as one of the first and most commonly deployed assessments of loyalty to one's in-group in cross-national analyses. Second, Van der Vliert's measure of in-group favoritism is a reliable between-country measure of in-group favoritism which incorporates in-group preferences at several social scales—

125   including immediate family, extended relatives, and country. Third, Fincher and Thornhill's measure of familism is a key variable in current studies of pathogen stress. We also further validate these findings against five additional measures of in-group favoritism—particularism, compatriotism, nepotism, familism, and embeddedness—in on-line Supporting Information. These measures include

130   preferences for in-groups of varying kinds and at differing social scales, from close

friends and family to members of the same country.

To analyze these measures we used a three-pronged approach that goes

beyond previous tests of the pathogen stress hypothesis. First, using ordinary least

squares regression, we assess the effect of quality of basic government services

135   (government effectiveness, GE) and parasite stress on all three assessments of in-

group preferences, controlling for world region and dominant religious tradition. As

a confirmatory check, we also look for evidence of reverse causality by which

greater in-group favoritism might weaken large-scale institutions [27,35,36].

Specifically, we assess how our measures of in-group favoritism predict change in

140   government effectiveness from 1996 to 2009. This approach further confirms that

reverse causality is unlikely at least at relatively short 13-year time scales, though

such reverse causality remains possible on larger time scales. Finally, we develop

an instrumental variable regression as an additional check on selection and omitted

variables in any observed relationship between government effectiveness and in-

145   group preferences [37,38].

Overall, these analyses suggest that general material insecurity in the face of

weak institutions, not just a dedicated response to pathogens, is an important

determinant of in-group preferences. Moreover, the instrumental variable analysis

suggests a historical explanation for the raw, unadjusted correlations observed

150   between pathogen stress and in-group favoritism.

DATA AND METHODS

In this section we first discuss our sample and then how we measured preferences for in-group investment, institutional quality, pathogen risk, and religion. Then, we lay out the analysis and results.

SAMPLE

The units of analysis are geopolitical regions, which are usually formal countries (e.g. Italy), but also include regions defined by political, economic and cultural history (e.g. Hong Kong). Henceforth, we will refer to these units as "countries." Countries can contain substantial within-population heterogeneity in cultural, religious and economic factors, but they also exhibit sufficient between-population variation to support informative ecological analyses [39]. The samples used in this paper differ depending on the availability of outcome measures, with sample sizes listed below.

MEASURING IN-GROUP PREFERENCES

For each variable, higher values indicate stronger in-group preferences. The derivation and description of these three in-group preference measures, five additional in-group preference measures, as well as predictor and control variables are described in on-line Supporting Information (Supplementary Tables 1-3).

170 ***Hofstede's Collectivism*** (N = 72)*.* Collectivism is the tendency to care about the

consequences of one's behavior for in-group members and to sacrifice personal

interests for collective gains [2,40]. The extreme individualism that distinguishes

many western societies, by contrast, measures people's lack of willingness to

differentiate an in-group and sacrifice for the collective good of that in-group. We

175 use Hofstede's national measure of collectivism assessed from the work attitudes of

over 100,000 IBM employees.

Van der Vliert's In-Group Favoritism (N= 121)*.* Van der Vliert [10] developed a

scale of in-group favoritism from three highly correlated international assessments

of: (1) familism, (2) nepotism, and (3) compatriotism (Cronbach's α = 0.89).

180 Familism is preferential concern for and investment in one's closest relatives

(parents, children and siblings) assessed from middle managers about how parents

and children respect each other and live together [41], and this specific measure has

also been used in other work as "in-group collectivism" [8]. Nepotism is favoring

relatives over non-relatives in the allocation of resources, and was measured from a

185 multi-country survey of business executives from nationally representative samples

of firms about the degree to which senior management positions are chosen based

either on superior qualifications or on one's kin relationship [42]. Compatriotism is

favoring members of one's own nationality over others, and was derived from

questions in the World Values Survey (1999-2002 wave) about whether employers

190 should give priority to compatriots [43]. Additional analyses in the on-line

Supporting Information, confirm that the general results for this composite variable

also hold for each of the three components.

Fincher and Thornhill's Strength of Family Ties *(N = 71).* In order to compare our

195 results with recent findings by Fincher and Thornhill about the pathogen stress

hypothesis, we use the measure of in-group preference—strength of family ties—

they use in a recent publication. Family investment is preferential concern for and

investment in one's closest relatives (parents, children and siblings). Fincher and

Thornhill (2012) derived this measure as the sum of five items in the 1981-2007

200 pooled dataset of the World Values Survey about the value placed on immediate

family. Despite capturing different dimensions of in-group preferences the three

measures of in-group preference show moderate to high correlations among

themselves (collectivism-favoritism $\rho = 0.70$, collectivism-family ties $\rho = 0.65$,

favoritism-family ties $\rho = 0.56$, $p < 0.001$).

205

Pathogen Stress: Estimates of contemporary pathogen prevalence were used from Fincher and Thornhill (2012). To assess F&T's hypothesis about a dedicated

210 psychological response to human-to-human pathogens, we focus on their preferred measure of non-zoonotic pathogens. In the on-line Supplemental Materials (Supplementary Table 4), we also assess the hypothesis with a historical measure of pathogen stress [9].

Quality of Government Services: To assess quality of government services, we used

215 the World Bank's 1996 measure of government effectiveness which indexes the quality of public and civil services in a country, including roads, schools, hospitals, and courts [44]. The on-line Supporting Information consider three other measures of institutions and material security: GDP per capita, the Human Development Index, and Food Stress (Supplementary Table 5).

220 ***Religion:*** To adjust for potential confounding effects of shared religious background [45,46] [47], we use world religious tradition with a plurality of adherents in a country as determined by Inglehart and Norris (2004). The categories include Muslim, Jewish, Catholic, Orthodox, and Protestant, and Eastern (which includes Hindu, Buddhist, Shinto and Confucian traditions). We use Catholic

225 as the reference category in regressions.

World Region: To assess and adjust for potential confounding effects of shared social, political, and cultural history as well as shared genetic background, we use world regions defined by the World Bank, including sub-Saharan Africa, Middle East

and North Africa, East Asia, South Asia, Latin America and the Caribbean, and

230   Europe and Central Asia. We use Europe and Central Asia as the reference category

in regressions. Such controls importantly assess whether observed associations

could be due to unmeasured similarities among nation-states based on shared

ecological, cultural, social or religious factors which are not causally related to key

predictors. If observed associations don't hold up under such controls, it is not

235   possible to disentangle whether the effect of pathogens or institutions is due

directly to these specific variables or rather to some underlying cultural or regional

similarity which effects both pathogens or institutions and in-group favoritism. In

short, including regional controls helps address the problem of the non-

independence of countries as data points created by shared history, geography and

240   proximity. Without such controls, Germany and Austria are considered as

independent as Germany and Niger.

Additional Control Variables: We also assessed whether bivariate associations and

model estimates changed when including a measure of income inequality in the

models—the Gini coefficient measure closest to 1996 [48]. There were no

245   substantive changes in effect sizes or inferences when including the Gini coefficient,

and to maintain the largest sample size, we report results without Gini controls. We

also assessed an interaction between government services and temperature

variability based on prior analyses suggesting that this interaction may predict in-

group favoritism [10].

250   ***Instrumental Variable:*** Widely used in economics, an instrumental variable

regression helps identify what part of the association between a predictor variable

(X, government effectiveness in this case) and an outcome (Y, in-group favoritism in

this case) is due to the direct effect of X on Y, rather than due to reverse causality of

Y on X or from other omitted variables. An instrumental variable Z is a variable

255   which is expected to cause the predictor variable (X), but whose effect on Y is

mediated via X.   An instrumental variable regression considers only the variation in

X predicted by Z, and examines how this variation predicts the outcome Y. If a

relationship between the variation in X predicted by the instrumental variable and

the outcome can be shown, this contributes to establishing a causal relationship

260   between X and Y more than a standard multiple regression. Following work in

economics on historical determinants of economic growth [49,50], we use the

mortality rates of early settlers in European colonies (1600-1875) as an

instrumental variable which is expected to affect contemporary government

effectiveness. Acemoglu et al. provide ample historical evidence that European

265   colonizers avoided settling in places with high mortality rates, such as in the Belgian

Congo. In lieu of settling, they set up extractive systems in these places. In situations

of low mortality, on the other hand, colonizers settled in larger numbers and

brought with them institutions, such as respect of private property, checks and

balances in government, and equality of opportunity, which in turn fostered greater

270   government effectiveness that persisted even after independence [49]. These

measures of settler mortality allow us to identify what portion of the variance in

government institutions is due to early (exogenously caused) settlement patterns.

Given this reasoning and the strong association between early settler mortality and contemporary government effectiveness (ρ = -0.54, N = 55), we use settler mortality

275 (1600-1875, [49,51]) as an instrumental variable for the relationship between effectiveness of government institutions and in-group preferences. More details on this approach are provided in the Supporting Information.

ANALYSIS AND RESULTS

Here we present analyses of three measures of in-group preferences using one

280   measure of public services and one measure of pathogen stress. Additional analyses

of other measures of in-group preferences, pathogen stress, and material security as

well as tests of potential interactions are presented in the on-line Supporting

Information.

In bivariate correlations with in-group preferences, both government effectiveness

285   (ρ = -0.52, -0.68, -0.74, p < 0.001) and pathogen stress (ρ = 0.58, 0.64, 0.37, p <

0.001) were significantly associated with all three measures of in-group

preferences—strength of family ties, collectivism, and in-group favoritism,

respectively (Figure 1). When including government effectiveness and non-zoonotic

pathogen stress together in a linear regression predicting in-group favoritism,

290   government effectiveness remained significantly associated with all three primary

measures (and all five alternative measures) of in-group favoritism. In the

regression, pathogen stress showed less consistent associations with in-group

favoritism measures. It was significantly associated with only two of the three

primary variables—Collectivism and Strength of Family ties—and only two of the

295   five alternative measures—Nepotism and Embeddedness.
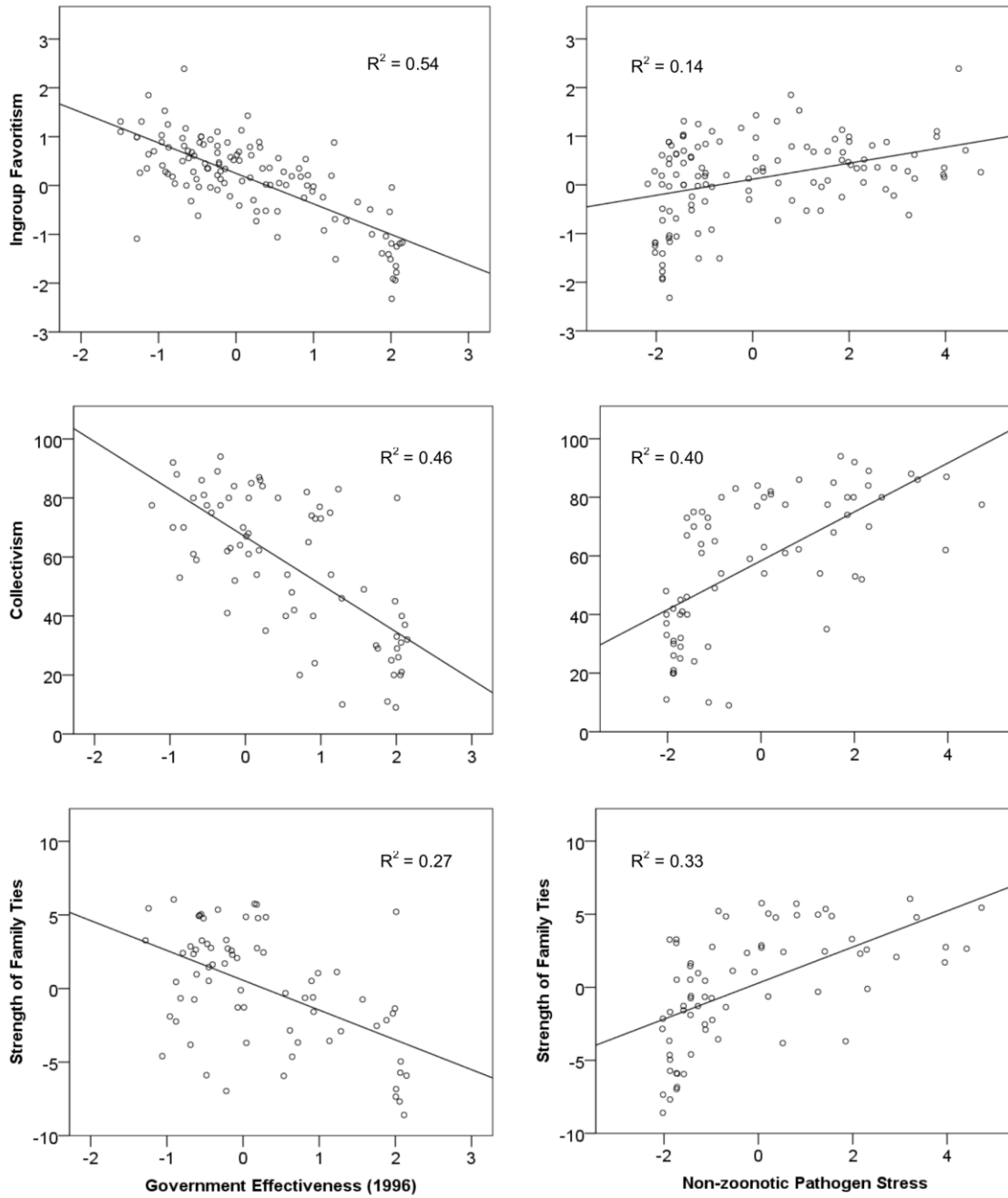
300   **Figure 1.** Three Measures of In-group Preferences by Government Effectiveness and Pathogen Stress.

We fit regression models of each of the three measures of in-group preferences on

Government Effectiveness (GE) and Pathogen Stress (PS) controlling for (1) world

305   region alone and (2) both world region and dominant religion. The standardized

regression coefficients in Table 1 show that after controlling for shared regional

background, GE is significantly related to Collectivism (standardized beta = -0.54,

ΔR^2 when adding Collectivism to regional model= 0.17), Ingroup Favoritism

(standardize beta = -0.75, ΔR^2 = 0.48), and Strength of Family Ties (standardized

310   beta = -0.36, ΔR^2 = 0.13). This is consistent with the five other measures of in-group

measures in the supporting information online. No associations between in-group

preference measures and non-zoonotic pathogen prevalence remained significant

after controlling for world region. In the Supporting Information, we show that

historical pathogen stress remains associated with one of the three primary

315   outcomes—Strength of Family Ties, p = 0.015—but not with any of the other five

variables included in the on-line Supporting Information. Figure 2 graphically shows

the relationship of the in-group preference measures with GE and PS, when the

impact of world region has been removed.   Within-region analyses of the

association of government effectiveness and pathogen stress with in-group

320   favoritism measures are consistent with these findings (see Supporting
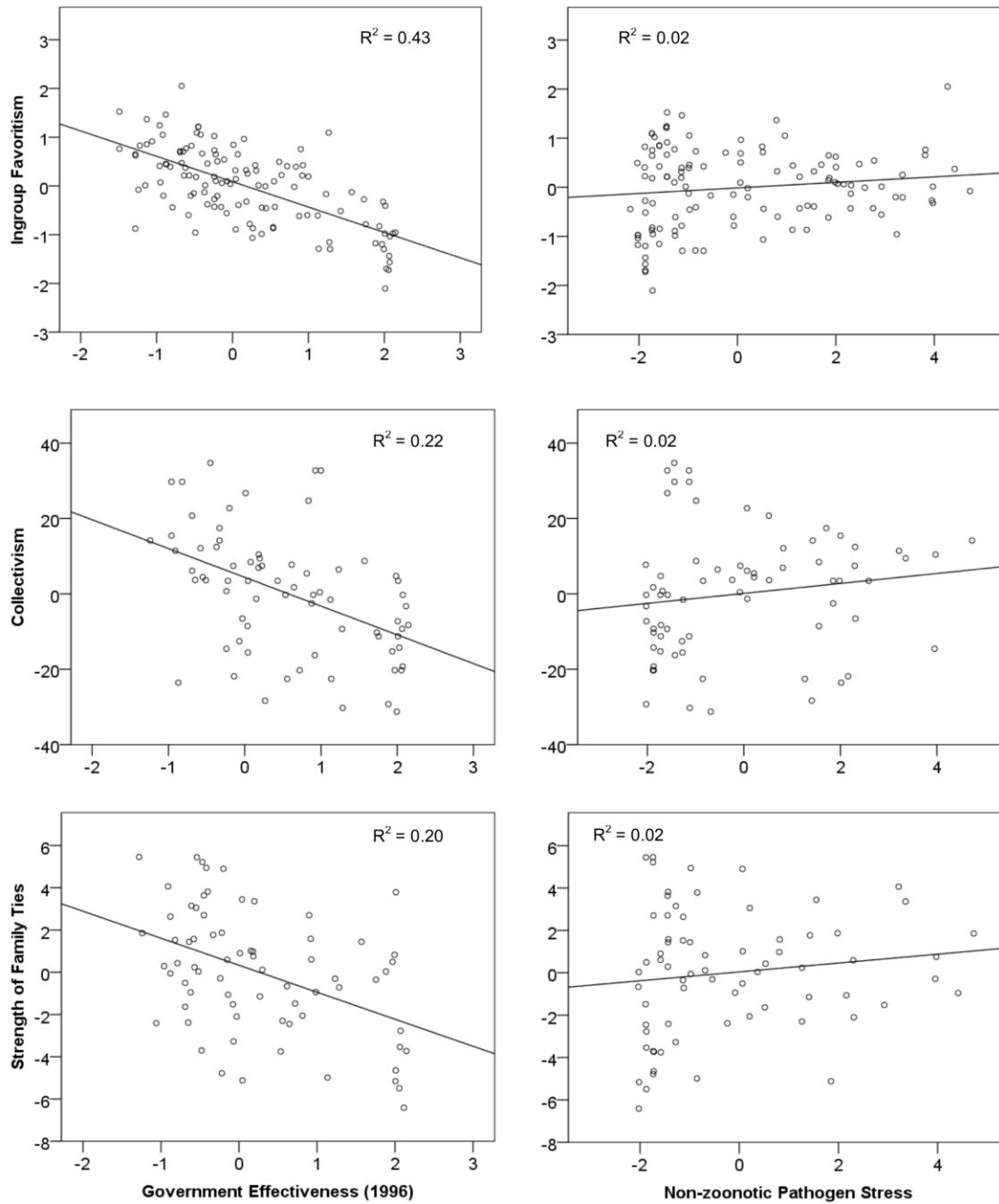
Information).

Figure 2. Three Measures of In-group Preferences (residualized by world region) by Government Effectiveness and Pathogen Stress

325

Table 1. Regression models predicting 3 measures of in-group preference by government effectiveness, pathogen stress, and dominant religion (Coefficients are standardized betas). Models 2 and 3 include regional controls. ΔR^2 is the increase in adjusted R^2 when adding Government Effectiveness and Pathogen Stress Base Model

	Collectivism N =72			Ingroup Favoritism N =121			Strength of Family Ties N =71		
	1	2	3	1	2	3	1	2	3
Government Effectiveness (GE)	-0.47***	-0.52***	-.031*	-0.72***	-0.75***	-0.63***	-0.35*	-0.36***	-.08
Pathogen Stress (PS)	0.34*	-0.01	-0.06	0.03	0.05	-0.01	0.45***	0.14	0.13
Religion									
Catholic			--			--			--
Protestant			-0.27**			-0.33***			-0.33*
Orthodox			0.14			0.05			0.08
Islam			0.09			-0.08			0.30*
Eastern			-0.03			-0.08			-0.08
Jewish			0.02			-0.09			--
Adjusted R^2	0.52	0.66	0.72	0.53	0.57	0.64	0.43	0.53	0.63
ΔR^2 from adding GE & PS	--	0.17	0.03	--	0.48	0.22	--	0.13	0.00

* $p < 0.05$, ** $p < 0.005$, *** $p < 0.001$

After adding controls for dominant religion, GE remains significantly related to

Collectivism (ΔR^2 when adding GE to region+religion model = 0.03) and Ingroup

Favoritism (ΔR^2 = 0.22), which is consistent with four other measures of in-group

measures modeled in on-line Supporting Information, but not with Strength of

330

Family Ties. In all cases, adding dominant religion to the model significantly reduces the independent variation accounted for by GE. Importantly, collinearity statistics

335   indicated no substantial problems with collinearity in these models (all tolerances > 0.20 and VIF < 5).

In the full model including region, religion, government effectiveness and parasite stress, a country's predominant religion accounted for additional variation in in-group preferences across all measures of in-group preferences. Table 1 shows that,

340   adjusting for GE and PS variables, Protestant religion most consistently affected in-group preferences. Countries with a plurality of Protestants had lower average in-group preferences for all three measures. In the full model, regions show less consistent relationships with in-group favoritism, with East Asian and sub-Saharan African countries showing significantly higher levels of collectivism and strength of

345   family ties, Latin American countries show significantly higher levels of collectivism, and North African and Middle Eastern countries show higher levels of in-group favoritism (Supplementary Tables 8 & 9).

To assess whether the observed associations between the effectiveness of government institutions and in-group preferences are due to confounding or

350   omitted variables, we conducted two checks (full analyses available in online Supporting Information).

For the first check, we estimated how well in-group preferences predicted change*s* in GE from 1996 to 2009 as well as related measures of GDP per capita from 1996 to 2009 and the UN Human Development Index from 1995 to 2010, adjusting for

355   geographic region and dominant religion. The effects were either non-significant or

significant in the opposite direction expected by an argument for reverse causality

(Supplementary Table 6). Thus the cross-sectional association between in-group

preferences and these measures is unlikely a result of in-group preferences leading

to higher levels of material insecurity or depressed economic growth at least at a

360   13-year time scale. If anything, the opposite is true.

The second check involved an instrumental variables regression and followed

Acemoglu et al. [49] by using settler mortality during colonization as an exogenous

source of variation in later quality of government institutions. We find that the

estimates from the original OLS regression are consistent with the estimates from

365   the instrumental variable regression, indicating that omitted variables have not

introduced substantial bias (Supplementary Table 7 and Figures 1-3). In fact, for all

three of our measures of in-group favoritism, the IV coefficient estimates are larger

in magnitude than the OLS coefficients, and for Collectivism, they are significantly

larger in magnitude. This suggests that any endogeneity issues we have not

370   modeled—if anything—likely suppress the size of the observed relationship.

These findings are robust to a variety of checks and alternative hypotheses.

Supplementary tables on-line provide analyses parallel to those shown above for all

eight of the available measures of in-group preferences, including individual

analyses of the measures that compose Van der Vliert's In-Group Favoritism

375   (Supplementary Tables 8 & 9) and various measures of pathogen stress, including

both historical pathogen stress and zoonotic pathogen stress (Supplementary Table

4). Supplementary Tables 10 to 12 show that including an interaction term for GE and PS does not improve the model, that including a term for Temperature Range and the interaction of Temperature Range and GE does not improve the model, and

380 that historical pathogens do not confound the relationship between GE and In-group Favoritism.

DISCUSSION

Cross-national variation in in-group preferences or favoritism, measured in three distinct ways, reveal a consistent relationship between government effectiveness

385 and in-group preferences. Specifically, in societies where government services are less likely to meet people's basic needs, people invest preferentially in family and in-group members. This finding remains for all three of our in-group preferences measures when both pathogen stress and world region are included in the analysis. The effect is robust across alternative proxies for government effectiveness as well

390 as all five alternative measures of in-group favoritism considered in the Supporting Information. These effects also remain for two of three measures (and four of five supplementary measures) even after removing global level variation in religious denomination. Finally, these effects withstand checks on reverse causality and omitted confounding and selection.

395   Contrary to a recent finding that specific psychological responses to pathogens explain this cross-population variation [8], there is no significant effect of non-zoonotic pathogen stress on any of the three measures of in-group preferences

22

(or the five supplementary measures) after including controls for geography and shared cultural history. Even when simply controlling for government effectiveness,

400   parasite stress only remains significantly associated with four of the eight measures of in-group preferences. Moreover, when these associations are significant, the coefficients on pathogen stress predictor variables are no larger than other material security measures. These findings indicate that pathogens are inconsistently associated with measures of in-group favoritism when controlling for government

405   effectiveness, that significant associations may be due to confounding from other variables which covary across major world regions, and that the effects of pathogens are generally weaker than the effects of government institutions. Taken together, these findings suggest that a generalized response to social resources available to meet basic needs (which may include buffers against disease threats) appears the

410   more plausible adaptive account for variation in in-group preferences, than a response dedicated specifically to pathogens

We also identified an independent contribution of shared religious heritage to in-group preferences that accounted for a substantial portion of the effect of institutions on in-group preferences. A large part of this effect is carried by

415   Protestantism, and countries with a plurality of Protestant adherents have significantly lower levels of in-group favoritism even after controlling for government effectiveness and world region. This is consistent with Weber's view that a key effect of Protestantism was to "shatter the fetters" of extended family, and presumably other kinds of in-groups [52]. Recent authors have pinned this on

420   Protestant core values of self-reliance and individualism which potentially led to

23

less investment in family, friends and local in-groups [53,54]. The current data is not equipped to discriminate between hypotheses for the role that dominant religion plays in the relationship between institutions and in-group preferences, though these findings are consistent with work suggesting that modern religions have

425   evolved culturally to expand the sphere of social interaction, cooperation and exchange [55]. Taken together, these findings suggest that both general processes of adaptation to material insecurity, as well as particular historical contingencies or trajectories, may play a role in shaping people's in-group preferences.

We argue that variation in institutional resources creates the relevant social niche to

430   which a variety of in-group preferences may be a response. However humans also possess several different mechanisms that permit adaptation at different time scales, including immediate cost-benefit calculations, learning over the life course, and cross-generational transmission [56-61]. The current data is insufficient to discriminate between these different pathways [28]. Some researchers have

435   proposed that high endemic pathogen load accounts for the observed link between low institutional quality and in-group preferences by both: (1) inhibiting economic growth and the development of public services [62] and (2) spurring in-group favoritism. A related argument proposes that high pathogen load leads to in-group preferences, which in turn lead to weak institutions [63]. Two of our findings

440   suggest these proposals are unlikely. First, the effect of pathogen prevalence on in-group favoritism generally does not withstand simple controls for common regional and religious background. This suggests that the second pathway is not well-supported by existing cross-national data. Second, the effects of other measures of

24

material security on in-group preferences are usually stronger than are pathogen

445   stress, indicating that pathogen stress is not a relevant confounder. A more

plausible explanation based on our analysis would place the causal role of

pathogens (at least among former European colonies) at much deeper time scales

[50]. Specifically, places with low pathogen stress led European colonizers to settle

and to forge effective institutions. In places with high pathogen stress, colonizers

450   set up extractive regimes with little concern for fostering effective institutions. That

is, pathogen stress may have influenced the spread of effective, pluralistic,

government institutions, which in turn influences in-group favoritism (and GDP per

capita). Consistent with this hypothesis, government effectiveness significantly

mediates the effect of historical pathogens on seven of the eight measures of

455   contemporary in-group preferences (see on-line Supporting Information). However,

future studies that go beyond cross-sectional, cross-national datasets will be

necessary to disentangle such potential interactions.

There are a number of limitations to our cross-sectional, cross-national analyses.

We are analyzing aggregate decisions based on aggregate predictors, and it is

460   possible that the associations do not reflect between-individual differences in

decisions and adaptations—though other work suggests they do [58]. Second, since

most data was only available at single time points, it is difficult to sort out the causal

direction underlying observed associations. That said, when longitudinal data was

available, we have tried to assess the possibility of reverse causation. Checks on

465   reverse causation suggest that greater in-group preferences at the national level are

not associated with reductions in government effectiveness over a 13-year period.

Thus, there is little support for the claim that the cross-sectional association results from in-group preferences decreasing government effectiveness at least over the short run. Third, our controls for shared culture—World Bank region and dominant

470 world religion—are admittedly coarse-grained. However, they do help discriminate between the government effectiveness and parasite stress hypotheses. Future work, will hopefully apply more sophisticated checks on Galton's problem or at least determine that they are unnecessary. Fourth, the national level measures of in-group favoritism we use in this study tap into only some aspects of in-group

475 favoritism and are available for limited samples of countries. Future analyses with measures that cover a more representative sample of countries and examine in-group favoritism at differing social scales and in different social situations will provide important refinements of these analyses. Finally, with observational studies there is always the problem of unmeasured confounding. An instrumental

480 variable analysis indicates that the results are robust to omitted confounding or selection. We have also examined two omnibus sources of confounding, world region and dominant religious traditions, as well as economic inequality. The first two capture geography, shared cultural history and other effects, such as those associated with colonization and religious assimilation. If alternative theories are

485 proposed, it may be possible to identify variables for assessing such confounding.

Here we have focused on only one kind of cultural niche construction, how institutions, pathogens, economic growth and technologies have shaped a variety of cultural and behavioral responses toward in-group members. Humans also devote considerable time and effort to investing in religious activities, such as attending

490   religious services and praying, which can be framed as an investment in

relationships with supernatural entities. Interestingly, cross-national studies of

religious investment—e.g., praying and attending services—indicate similar

associations with material security [43]. Strong secular institutions may create

cultural evolutionary pressures for different forms of religiosity or spirituality.

495   Future work that examines the influence of material security on this and other kinds

of social niche construction will hopefully shed light on the nature and bounds of

this association.

510   # REFERENCES

1. Triandis HC (1995) Individualism and Collectivism. Boulder, CO: Westview.
2. Hofstede GH (2001) Culture's Consequences: Comparing Values, Behaviors, Institutions,
      and Organizations across Nations. Thousand Oaks, CA: Sage Publications.
515   3. Nisbett RE, Masuda T (2003) Culture and point of view. PNAS 100: 11163-11170.
4. Heine SJ (2008) Cultural Psychology. New York: W.W. Norton.
5. Markus HR, Kitayama S (1991) Culture and Self: Implications for cognition, emotion and
      motivation. Psychological Review 98: 224-253.
6. Trompenaars F (1998) Riding the Waves of Culture. New York: McGraw Hill.

520   7. Norris P, Inglehart R (2004) Sacred and Secular: Religion and Politics Worldwide. Cambridge: Cambridge University Press.

8. Fincher CL, Thornhill R, Murray DR, Schaller M (2008) Pathogen prevalence predicts human cross-cultural variability in individualism/collectivism. Proceedings of the Royal Society B 275: 1279-1285.

525   9. Murray DR, Schaller M (2010) Historical Prevalence of Infectious Diseases within 230 Geopolitical regions: a tool for investigating origins of culture. Journal of Cross-Cultural Psychology 41: 99-108.

10. Van de Vliert E (2011) Climato-economic origins of variation in ingroup favoritism. Cross-Cultural Psychology 42: 494-515.

530   11. Kaplan H, Gurven M, Hill K (2005) A natural history of food sharing and cooperation: a review and a new multi-individual approach to the negotiation of norms. In: Gintis H, Bowles S, Boyd R, Fehr E, editors. Moral Sentiments and Material Interests. Cambridge, MA: MIT Press. pp. 75-113.

12. Mathew S, Boyd R (2011) Punishment sustains large-scale cooperation in prestate
535   warfare. Proceedings of the National Academy of Sciences 108: 11375-11380.

13. Geertz C (1978) The bazaar economy: information and search in peasant marketing. The American Economic Review 68: 28-32.

14. Granovetter M (1985) Economic action and social structure: the problem of embeddedness. American Journal of Sociology 91: 481-510.

540   15. Kranton RE (1996) Reciprocal exchange: a self-sustaining system. The American Economic Review 86: 830-851.

16. Lomnitz LA (1977) Networks and Marginality: Life in a Mexican Shanty Town. New York: Academic Press.

17. Hruschka DJ (2010) Friendship: Development, Ecology and Evolution of a Relationship.
545   Berkeley, CA: University of California Press.

18. Sugiyama LS (2004) Illness, injury and disability among Shiwiar forager-horticulturalists: implications of health-risk buffering for the evolution of human life history. American Journal of Physical Anthropology 123: 371-389.

19. Navarrete CD, Fessler DMT (2005) Normative bias and adaptive challenges: a relational
550   approach to coalitional psychology and a critique of terror management theory. 3: 297-325.

20. Hohman ZP (2011) Fear and uncertainty in the face of death: the role of life after death in group identification. European Journal of Social Psychology 41: 751-760.

21. Kollack P (1994) The emergence of exchange structures: an experimental study of
555   uncertainty, commitment and trust. American Journal of Sociology 100: 313-345.

22. Navarrete CD, Kurzban R, Fessler DMT, Kirkpatrick LA (2004) Anxiety and intergroup bias: terror management or coalitional psychology? Group Processes and Intergroup Relations 7: 370-379.

23. Heine SJ, Proulx T, Vohs KD (2006) The meaning maintenance model: on the coherence
560   of social motivations. Personality and Social Psychology Review 10: 88-110.

24. Proulx T, Heine SJ (2010) The Frog in Kierkegaard's Beer: Finding Meaning in the Threat-Compensation Literature. Social and Personality Psychology Compass 4: 889-905.

25. Kaplan HS, Schniter E, Smith VL, Wilson BJ (2012) Risk and the evolution of human
565   exchange. Proceedings of the Royal Society B.

26. Mikulincer M, Shaver PR (2001) Attachment theory and intergroup bias: evidence that priming the secure base schema attenuates negative reactions to out-groups. Journal of Personality and Social Psychology 81: 97-115.

570

27. Fukuyama F (1995) Trust: The Social Virtues and the Creation of Prosperity. Chicago: Free Press.

28. Schaller M, Murray DR (2010) Infectious disease and the evolution of cross-cultural differences. In: Schaller M, editor. Evolution, Culture, and the Human Mind.

29. Schaller M (2011) The behavioural immune system and the psychology of human sociality. Philosophical Transactions of the Royal Society B 366: 3418-3426.

575

30. Fincher CL, Thornhill R (2012) Parasite-stress promotes in-group assortative sociality: the cases of strong family ties and heightened religiosity. Behavioral and Brain Sciences 35: 61-79.

31. Hackman J, Hruschka DJ (2013) Fast life histories, not pathogens, account for U.S. state-level variation in homicide, maltreatment, family ties, and religiosity. Evolution and Human Behavior.

580

32. de Barra M, Curtis V (2012) Are the pathogens of out-groups really more dangerous? Behavioral and Brain Sciences 35: 85-86.

33. Van de Vliert E, Postmes T (2012) Climato-economic livability predicts societal collectivism and political autocracy better than parasitic stress does. Behavioral and Brain Sciences 35: 94-95.

585

34. Currie T, Mace R (2012) Analyses do not support the parasite-stress theory of human sociality. Behavioral and Brain Sciences 35: 83-85.

35. Realo A, Allik J, Greenfield B (2008) Radius of trust: social capital in relation to familism and institutional collectivism. Journal of Cross-cultural Psychology 39: 447-462.

590

36. Alesina A, Glaeser EL (2004) Fighting Poverty in the U.S. and Europe: a World of Difference. Oxford: Oxford University Press.

37. Gelman A, Hill J (2007) Data Analysis Using Regression and Multilevel/Hierarchical Models. Cambridge: Cambridge University Press.

38. Antonakis J, Bendahan S, Jacquart P, Lalive R (2010) On making causal claims: a review and recommendations. The Leadership Quarterly 21: 1086-1120.

595

39. Gelfand MJ (2011) Differences between tight and loose cultures: a 33-nation study. Science 32: 1100-1104.

40. Triandis HC, Bontempo R, Villareal MJ, Masaaki A, Lucca N (1988) Individualism and collectivism: cross-cultural perspectives on self-ingroup relationships. Journal of Personality and Social Psychology 54: 323-338.

600

41. House RJ, Hanges PJ, Javidan M, Dorfman PW, Gupta V (2004) Culture, leadership, and organizations: the GLOBE study of 62 societies. Thousand Oaks, CA: Sage.

42. Blanke J, Loades E (2005) The executive opinion survey: an essential tool for measuring country competitiveness. In: Lopez-Claros A, Porter ME, Schwab K, editors. The Global Competitiveness Report 2005-2006. New York: Palgrave MacMillan.

605

43. Inglehart R, Basanez M, Diez-Medrano J, Halman L, Luijkz R (2004) Human Beliefs and Values: A Cross-Cultural Sourcebook Based on the 1999-2002 Values Survey. Mexico: Siglo XXI Editores.

44. World Bank (2011) World Bank Governance Indicators.

610

45. Hampden-Turner C, Trompenaars F (2000) Building Cross-Cultural Competence: How to Create WEalth from Conflicting Values. New Haven: Yale University Press.

46. Schwartz S (2009) Causes of culture: national differences in cultural embeddedness. In: Gari A, Mylonas K, editors. Quod Erat Demonstrandum From Herodotus' ethnographic journeys to cross-cultural research. Athens: Pedio Books Publishing.

615

pp. 1-12.

47. Bersoff JG, Miller DM (1992) Culture and moral judgment: how are conflicts between justice and interpersonal responsibilities resolved? Journal of Personality and Social Psychology 62: 541-554.

48. World Bank (2011) World Bank Indicators.

620   49. Acemoglu D, Johnson S, Robinson JA (2001) The colonial origins of comparative development: an empirical investigation. The American Economic Review 91: 1369-1401.

50. McNeill W (1977) Plagues and Peoples. New York: Random House.

51. Acemoglu D, Johnson S, Robinson JA (2011) Hither thou shalt come, but no further:
625   Reply to "The colonial origins of comparative development: an empirical investigation: comment.". National Bureau of Economic Research.

52. Weber M (1951) The Religion of China: Confucianism and Taoism. Girth HH, translator. Glencoe, IL: Free Press.

53. Lipset SM, Lenz GS Corruption, culture and markets. In: Harrison LE, Huntington SP,
630   editors. Culture Matters: How Values Shape Human Progress. New York: Basic Books. pp. 112-124.

54. Treisman D (2000) The causes of corruption: a cross-national study. Journal of Public Economics 76: 399-457.

55. Atran S, Henrich J (2010) The Evolution of Religion: How Cognitive By-Products,
635   Adaptive Learning Heuristics, Ritual Displays, and Group Competition Generate Deep Commitments to Prosocial Religions. Biological Theory 5: 1-13.

56. Algan Y, Cahuc P (2010) Inherited Trust and Growth. American Economic Review 100: 2060-2092.

57. Fisman R, Miguel E (2007) Corruption, norms, and legal enforcement: Evidence from
640   diplomatic parking tickets. Journal of Political Economy 115: 1020-1048.

58. Giuliano P, Alesina A (2010) The power of the family. Journal of Economic Growth 15: 93-125.

59. Guiso L, Sapienza P, Zingales L (2006) Does culture affect economic outcomes? Journal of Economic Perspectives 20: 23-48.

645   60. Henrich J, Boyd R, Bowles S, Camerer C, Fehr E, et al. (2005) "Economic man" in cross-cultural perspective: Behavioral experiments in 15 small-scale societies. Behavioral and Brain Sciences 28: 795-855.

61. Henrich J, Ensminger J, McElreath R, Barr A, Barrett C, et al. (2010) Market, religion, community size and the evolution of fairness and punishment. Science 327: 1480-
650   1484.

62. Sachs J (2003) Institutions don't rule: direct effects of geography on per capita income. NBER Working Paper 9490.

63. Thornhill R, Fincher CL, Aran D (2008) Parasites, democratization, and the liberalization of values across contemporary countries. Biological Reviews 84: 113-
655   131.

DERIVATION AND DESCRIPTION OF VARIABLES

IN-GROUP PREFERENCES

Our eight measures of in-group preferences vary in terms of their emphasis on: (1) kin relationships (family members and friends and compatriots), (2) size of in-group (friends and family vs. compatriots), (3) the nature of observation (reports of others' behaviors vs. report of own behaviors and preferences), and (4) the social tradeoff involved (investment in self, in out-group members, in following a norm, or no specific tradeoff).   Here we describe the source and derivation of these variables.

The three measures used in the Main text

Van der Vliert's In-Group Favoritism. Van der Vliert developed a scale of in-group favoritism from three highly correlated international assessments of: (1) familism, (2) nepotism, and (3) compatriotism [1] (Cronbach's α = 0.89). Familism is preferential concern for and investment in one's closest relatives (parents, children and siblings) and is assessed from middle managers in each of 60 countries about how parents and children respect each other and live together [2]. Nepotism is favoring relatives over non-relatives in the allocation of resources, and was measured from a multi-country survey of business executives from nationally representative samples of firms about the degree to which senior management positions are chosen based either on superior qualifications or on one's kin relationship [3]. Compatriotism is favoring members of the one's own nationality over others, and was derived from questions in the World Values Survey (1999-2002 wave) about whether employers should give priority to compatriots [4].   Further explanation of these scale components is provided under "Alternative Measures" below.

Collectivism. Collectivism is the tendency to care about the consequences of one's behavior for in-group members and to be willing to sacrifice personal interests for collective gains [5,6]. One of the most commonly used measures of collectivism at the national level is reported by Hofstede (2001) who assessed work attitudes from over 100,000 IBM employees worldwide. From these data Hofstede estimated collectivism scores for 68 specific geopolitical regions included in our analyses. Hofstede's measure correlates strongly with an alternative measure constructed by Suh et al. (ρ = 0.91), and Suh's score was used to calculate a comparable collectivism score for Nepal, Nigeria, Zimbabwe, and Egypt which were not reported in Hofstede [7](Hofstede = -9.537+Suh*10.749). We use an inverse of Hofstede's score (100 – individualism), so that a higher score indicates greater collectivism.

Fincher and Thornhill's Strength of Family Ties. In order to compare our results with recent findings by Fincher and Thornhill about the pathogen stress hypothesis, we use the measure of in-group preference—strength of family ties—they use in a recent publication. Fincher and Thornhill (2012) derived this measure as the sum of five items in the 1981-2007 pooled dataset of the World Values Survey about the value placed on immediate

40   family. The items included statements about the importance of: (1) family in one's life, (2) loving and respecting parents despite their faults, (3) doing one's best for one's children even at expense of one's own well-being, and (4) making one's parents proud. The last item asked if people lived with their parents (Cronbach's α = 0.86).

45   **Five Alternative measures**

Familism. Family investment is preferential investment in one's closest relatives (parents, children and siblings). This is the first component of Van der Vliert's measure of ingroup favoritism (see above). This measure is based on data from House et al. (2004) and derived
50   by Van de Vliert (2011). Between 1994 and 1997, House et al. sampled middle managers (n = 17,370) from domestic organizations in each of 60 countries in the target industries of food processing, financial services, and telecommunications [2]. Participants answered four questions about interactions with family members as observed in their society (1 = *strongly disagree*, 7 = *strongly agree*). These were: "In this society, children take pride in the
55   individual accomplishments of their parents", "In this society, parents take pride in the individual accomplishments of their children", "In this society, aging parents generally live at home with their children", "In this society, children generally live at home with their parents until they get married". The internal consistency of these four items was good (Cronbach's α = .77), and reported estimates are response bias corrected [2]. A higher
60   score indicates greater familism.

Nepotism. Nepotism is the favoring of relatives over non-relatives in the allocation of resources. This is the second component of Van der Vliert's measure of ingroup favoritism (see above). Data were used from a multi-country survey of business executives from
65   nationally representative samples of firms [3]. Executives responded to a 7-point likert scale, "Senior management positions in your country are: (1) held by professional managers chosen based on superior qualifications, ..., (7) usually held by relatives." Here we use standardized values provided by Van de Vliert (2011).

70   *Compatriotism.* Compatriotism is favoring members of the one's own nationality over others. This is the third component of Van der Vliert's measure of ingroup favoritism (see above), and is derived from data for nationally representative subsamples of adults from 73 countries from the 1999-2002 wave of the World Values Survey [4]. Professional interviewers substituted their own nationality for "British" when asking: "Do you agree or
75   not agree with the following statement? When jobs are scarce, employers should give priority to [British] people over immigrants" (3-point response scale: agree, disagree, or neither). We use the variable reported by Van de Vliert (2011), which is a standardized score based on the percentage of individuals in a country who agreed with the statement.

80   *Schwartz's Cultural Embeddedness.* Based on a reviewer's earlier suggestion, we included Schwartz's dimension of cultural embeddedness as an alternative measure of in-group preference. This dimension captures the relationship between the individual and the

group, and involves an emphasis on maintenance of the status quo, propriety, and restraint of actions or inclinations that might disrupt group solidarity or the traditional order [8].

85   *Particularism*. Particularism is the preference for helping kith and kin over following universally applicable rules of fairness [9]. In several publications, Trompenaars and Hampden-Turner describe the responses of multi-national corporate managers to the passenger's dilemma, whereby one must make the choice between telling the truth under oath and helping a friend [10-12]. The variable reported by Trompenaars and Hampden-

90   Turner is the probability that a respondent from a country stated either: (1) that the friend has a definite right to expect the respondent to lie for him or (2) that the respondent would lie under oath. As data was updated in successive publications, more recent publications take precedence over earlier publications. This measure of particularism correlates moderately with other measures collected by Trompenaars and Hampden, including the

95   willingness to give a friend insider information from one's corporation ($\rho = 0.66$, 1993, n =35 countries), the willingness to lie about a friend's medical exam to improve his insurance premium ($\rho =0.51$, 1998, $n = 28$), and the willingness to lie about a friend's restaurant in a published review ($\rho = 0.65, 0.69$, 1993,1998, $n = 32$, $n = 30$).

INSTITUTIONS AND MATERIAL SECURITY

100   The key variable used for our analyses in the main text was the World Bank measure of government effectiveness as a measure of quality of government services. In the supplementary materials below we also examine related measures that assess: (1) material resources available per capita (GDP per capita), (2) general material security, and (3) food security.

105   *Quality of Government Services (1996):* To assess quality of government services, we used the World Bank's measure of government effectiveness which indexes the quality of public and civil services in a country, including roads, schools, hospitals, and courts[i].

Material Resources: To assess material resources, we used log(GDP per capita) (World
Bank 1996 measure, gross domestic product per capita purchasing power parity in 2005
dollars).

Material Security: We used the United Nations human development index (HDI), which
Norris and Inglehart have used previously as a measure of "existential security" grounded
in social and economic development [13,14]. This measure includes indices of health, and
thus is directly measuring both the quality of institutions and pathogen stress. For this
reason, we do not use this as the primary measure for analyses.

Food Insecurity: Food insecurity was assessed using country-level data for proportion of
total household consumption expenditure devoted to food.[ii] The larger share of overall
household consumption devoted to food, the more sensitive household budgets are to
changing food prices and the more prone they are too food insecurity.

PREDOMINANT RELIGION

We use world religious tradition with a plurality of adherents in a country as determined
by Inglehart and Norris (2004). The categories included Muslim, Jewish, Christian-Catholic,
Christian-Orthodox, and Christian-Protestant, and Eastern (which included a combination
of Hindu, Buddhist, Shinto and Confucian traditions). Eastern religions were aggregated
into a single category as no single religion was sufficiently numerous in the sample to
permit further stratification. When Inglehart and Norris did not specify the world religion,
we assessed the world religion having a plurality of adherents in the country [15]. We use
Catholic as the reference category in regressions.

WORLD REGION

To adjust for potential confounding effects of shared social, political, and cultural history,
we use world regions defined by the World Bank, including sub-Saharan Africa, Middle East
and North Africa, East Asia, South Asia, Latin America and the Caribbean, and Europe and
Central Asia. The World Bank does not classify upper income countries. We classified
upper income countries based on shared cultural heritage--Japan as East Asia, continental
European countries, U.K., U.S., Canada, New Zealand and Australia under Europe/Central
Asia. We use Europe and Central Asia as the reference category in regressions.

4

Supplementary Table 1. Descriptives for key variables

Variables	N	Mean (SD)
Key Ingroup Measures		
Van der Vliert Ingroup Favoritism	121	0.14 (0.86)
Hofstede Collectivism	72	57.5 (23.7)
F & T Strength of Family Ties	71	0.03 (3.91)
Alternative Ingroup Measures		
Schwartz Cultural Embeddedness	71	10.3 (5.3)
Familism	57	0.00 (1.00)
Nepotism	118	0.01 (1.00)
Compatriotism	76	0.01 (1.00)
Particularism	43	27.9 (17.6)
Institutions and Material Security		
Quality of Public Services	128	0.16 (1.00)
Human Development Index	122	0.72 (0.20)
GDP per capita (PPP in 1000 USD)	123	10.89 (11.13)
% of household budget on food	113	0.40 (0.17)
Pathogen Stress		
Non-Zoonotic Pathogen Prevalence	128	0.14 (1.93)
Zoonotic Pathogen Prevalence	128	0.46 (0.88)
Historical pathogen prevalence	128	0.08 (0.63)

Variable	GE	Log(GDP)	HDI	FS	NZPS	ZPS
Log(GDP)	0.78 (123)					
Human Development Index (HDI)	0.70 (122)	0.93 (119)				
Food Insecurity (FS)	-0.75 (112)	-0.76 (109)	-0.70 (107)			
Non-zoonotic Pathogen Stress (NZPS)	-0.50 (128)	-0.64 (123)	-0.66 (122)	0.28** (112)		
Zoonotic Pathogen Stress (ZPS)	-0.19 (128)*	-0.22 (123)*	**-0.16 (122)**	**0.06 (112)**	0.52 (128)	
Historical Pathogen Prevalence (HPP)	-0.54 (127)	-0.63 (122)	-0.62 (122)	0.37 (112)	0.79 (127)	0.36 (127)

Supplementary Table 2. Bivariate correlations between institutions, material security, and pathogen stress measures. Sample sizes in parentheses. GE = government effectiveness.

Significant at 0.001 level unless otherwise noted. * p < 0.05, ** p < 0.005. *Non-significant* results (> 0.05 level) are in bold italics.

Supplementary Table 3. Bivariate correlations between in-group preferences. Sample sizes in parentheses.

Variable	Collect	IN	FA	NP	CO	PA	EM
Ingroup (IN)	0.70 (70)						
Familism (FA)	0.74 (49)	0.93 (57)					
Nepotism (NP)	0.66 (69)	0.87 (118)	0.69 (56)				
Compatriotism (CO)	0.59 (58)	0.85 (76)	0.82 (42)	0.44 (74)			
Particularism (PA)	0.80 (42)	0.70 (41)	0.75 (35)	0.60 (41)	0.58 (38)		
Embeddedness (EM)	0.61 (56)	0.67 (70)	0.65 (46)	0.58 (69)	0.61 (59)	0.62 (40)	
Family Ties	0.65 (52)	0.56 (70)	0.70 (39)	0.50 (68)	0.42 (67)	0.49 (32)	0.74 (52)

Significant at 0.001 level unless otherwise noted.

ROBUSTNESS CHECKS

REDUNDANT MEASURES

F&T use two measures of in-group favoritism—strength of family ties and assortative sociality. The second measure is a composite of the strength of family ties measure and a measure based on religiosity. The first and second measure are highly correlated ($\rho > 0.95$) so we focus on the direct measure of family ties [16]. However, results do not change if the second measure is used. F&T also use two measures of contempory pathogen stress—non-zoonotic pathogen stress and combined pathogen stress, These are also highly correlated ($\rho > 0.95$), and for clarity we use the more direct measure. Again results do not change if combined pathogen stress is used [16].

In Tables 4.S. and 5.S. we examine how the effect sizes and p-values change for key relationships when controlling for: (1) World Region, (2) World Region + measures for the alternative hypothesis, (3) World Region + Dominant religion. After regional controls only one pathogen stress variable, historical pathogen prevalence, remains. After control for government effectiveness of world religion, that measure only remains significantly associated with one measure of in-group investment

Supplementary Table 4. Relationship of 3 major in-group preferences with alternative measures of pathogen stress using three sets of controls			
	Collectivism	**In-group Favoritism**	**Strength of Family Ties**
Regional control			
Non-zoonotic Pathogen Stress	0.26	0.41*	0.32
Zoonotic Pathogen Stress	0.01	0.10	-0.03
Historical Pathogen Prevalence	0.31*	0.51***	0.60***
Regional + Government Effectiveness Controls			
Non-zoonotic Pathogen Stress	-0.01	0.05	0.14
Zoonotic Pathogen Stress	-0.14	0.00	-0.05
Historical Pathogen Prevalence	0.06	0.17	0.46***
Regional and Religion Control			
Non-zoonotic Pathogen Stress	0.04	0.18	0.15
Zoonotic Pathogen Stress	-0.10	0.04	-0.04
Historical Pathogen Prevalence	0.02	0.20	0.36*
$p < 0.05$, ** $p < 0.005$, *** $p < 0.001$			

We apply the same approach to alternative measures of government effectiveness or material security/insecurity. All measures remain significantly associated with all measures of in-group investment with regional controls or control for non-zoonotic parasite stress. When controlling for religion these measures remain significantly associated with two of the three in-group investment measures.

Supplementary Table 5. Relationship of 3 major in-group preferences with alternative measures of institutions and material security using three sets of controls			
	Collectivism	**In-group Favoritism**	**Strength of Family Ties**
Regional Controls			
Government Effectiveness (1996)	-0.52***	-0.77***	-0.38***
Log(GDP 1996)	-0.49***	-0.80***	-0.40***
Human Development Index (1995)	-0.51***	-0.89***	-0.46***
% Household budget on food	0.42***	0.64***	0.28*
Regional + Non-zoonotic pathogen stress Controls			
Government Effectiveness (1996)	-0.52***	-0.76***	-0.36***
Log(GDP 1996)	-0.46***	-0.81***	-0.36***
Human Development Index (1995)	-0.47**	-0.88***	-0.42***
% Household budget on food	0.39***	0.62***	0.24*
Regional + Religion Controls			
Government Effectiveness (1996)	-0.29*	-0.63***	-0.11
Log(GDP 1996)	-0.26*	-0.67***	-0.13
Human Development Index (1995)	-0.35*	-0.73***	-0.23
% Household budget on food	0.26*	0.51***	0.07
p < 0.05, ** p < 0.005, *** p < 0.001			

WITHIN REGION ANALYSIS

To examine associations within the major world regions, we conducted regressions for each region predicting each of the 8 measures of in-group favoritism with the following two predictors—effectiveness of government institutions and non-zoonotic pathogen stress. To avoid small sample sizes, we focused on the 17 samples where there were more than 10 countries within a region which had data on a specific measure of in-group favoritism. All eight measures had sufficiently large samples from Europe and Central Asia. Three measures had sufficiently large samples for East Asia and for Latin America and the Caribbean. Two measures had sufficiently large samples for sub-Saharan Africa, and one measure had a sufficiently large sample for Middle East and North Africa. South Asia never had sufficiently large samples.

Among these 17 samples, GE significantly increased in-group favoritism in 12 (8 of 8 in Europe and Central Asia, 2 of 3 East Asia, and 2 of 3 in Latin American and Caribbean). Notably, PS significantly increased in-group favoritism in only 1 sample.

EFFECT OF 3 IN-GROUP PREFERENCE MEASURES ON ECONOMIC GROWTH, HUMAN DEVELOPMENT INDEX, AND GOVERNMENT EFFECTIVENESS

Supplementary Table 6. Standardized coefficients of 13-year change in GDP per capita and quality of public services by three major in-group favoritism measures. Adjusting for region and religion			
Variables	**Collectivism**	**Ingroup Favoritism**	**Strength of Family Ties**
GDP_{2009}/GDP_{1996}	0.25*	0.26**	-0.04
$HDI_{2010} - HDI_{1995}$	-0.10	0.21*	-0.07
$PublicService_{2009} - PublicService_{1996}$	0.14	0.15	-0.13
* $p < 0.05$, ** $p < 0.005$, *** $p < 0.001$			

INSTRUMENTAL VARIABLE ANALYSIS

Following work in economics [17], we deploy the mortality rates of early settlers in European colonies (1600-1875) as an instrumental variable which is expected to affect contemporary government effectiveness (see below). Acemoglu et al. provide ample historical evidence that Europeans avoided settling in places with high mortality for Europeans, such as in the Belgian Congo, and instead set up extractive systems in these places. In situations of low mortality, on the other hand, colonizers settled in larger numbers and brought with them institutions, such as

respect of private property, checks and balances in government, and equality of opportunity, which in turn fostered greater government effectiveness that persisted even after independence. These measures of settler mortality allow us to identify that portion of the variance in government institutions that is due to early (exogenously caused) settlement patterns. We can then use these predicted values—now unbiased by omitted variables and confounding—to predict our cultural variables and identify a causal relationship. This analysis shows an effect indistinguishable from that observed in the standard regression analysis, which indicates that the standard analysis is unlikely to suffer from the omitted variables biases and confounding that would otherwise jeopardize causal inference.

Using settler mortality as an instrumental variable, we fit a two-stage OLS regression. At level one, settler mortality predicts modern government effectiveness. At level two, the component of government effectiveness predicted by early settler mortality (the predicted value) is used to predict modern in-group favoritism. We include pathogen stress in both regressions to control for any potential confounding due to pathogens in the environment causing both early settler mortality and modern in-group preference (See Table 6.S). Settler mortality was significantly associated with government effectiveness (ρ = -0.54, p < 0.001) and non-zoonotic pathogen stress (ρ = 0.49, p < 0.001).

We use the "robustness check" data series for settler mortality (Acemoglu et al. 2005). We report all results for the sub-samples for which settler mortality is available.
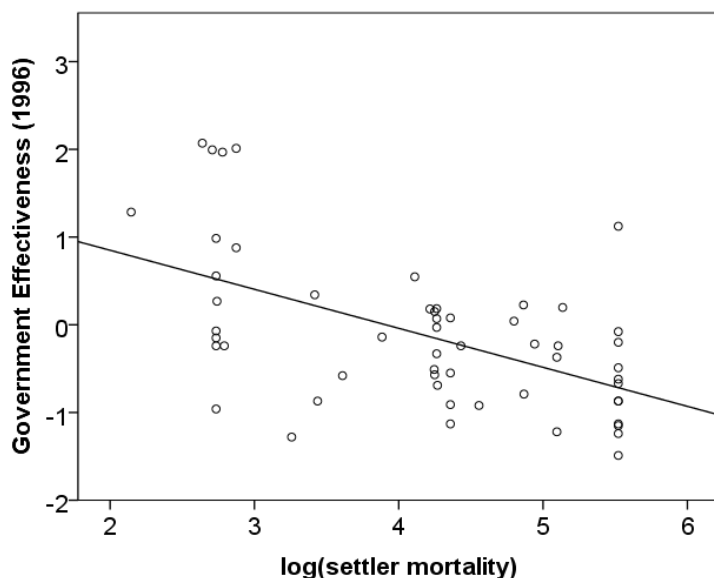
Note that since we are using only former European colonies in this analysis, our sample size is smaller.

A Durbin-Wu-Hausman test assesses whether the estimate from an OLS regression is different from the estimate from instrumental variable regressions. For In-group favoritism and strength of family ties, the estimates from each procedure are not statistically different. Since estimates from instrumental variable (IV) regressions are less efficient than those from OLS regressions, and since there is no difference between the OLS and IV estimates, the OLS regression estimates are preferred. Note, however, that for all three of our dependent measures the IV coefficient estimates are larger in magnitude than the OLS coefficients, and for Collectivism, they are significantly larger in magnitude.
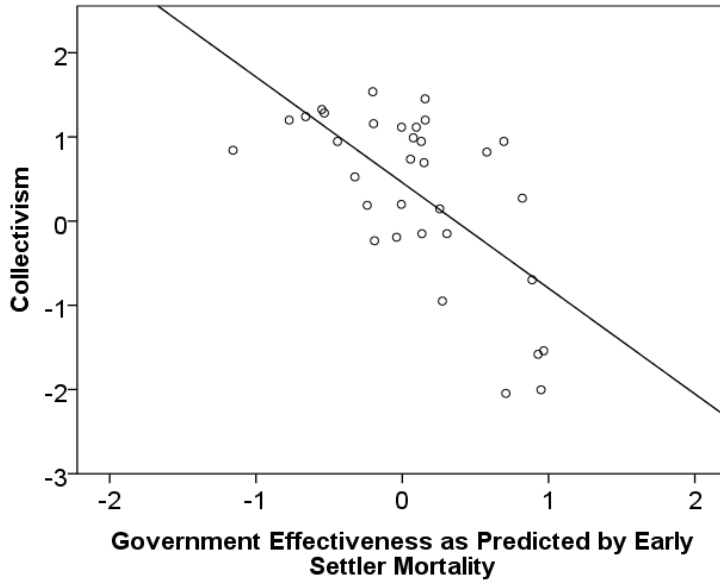
Supplementary Table 7. Comparison of estimated effect of quality of government services on in-group preferences using OLS and instrumental variable estimation (on colonial sub-sample).			
Variables	**Collectivism (n=33)**	**Ingroup Favoritism (n=52)**	**Strength of Family Ties (n=27)**
Panel A: Two Stage Least Squares			
Government Effectiveness	-1.95* (1.10)	-0.89* (0.37)	-0.89* (0.42)
Non-zoonotic Pathogens	-0.28 (0.35)	-0.06 (0.11)	-0.10 (0.15)
Panel B: First-Stage for Government Effectiveness			
Non-zoonotic Pathogens	-0.25 (0.07)***	-0.20 (0.06)***	-0.20 (0.09)*
Log(settler mortality)	-0.22 (0.13)	-0.28 (0.10)**	-0.38 (0.16)*
R^2	0.42	0.42	0.54
Panel C: Ordinary Least Squares Regression			
Government Effectiveness	-0.49* (0.20)	-0.78*** (0.14)	-0.41* (0.17)
Non-zoonotic Pathogens	0.15 (0.10)	-0.02 (0.06)	0.06 (0.08)
Durbin-Wu-Hausman Test (p-value)	0.02	0.75	0.17
* $p < 0.05$, ** $p < 0.005$, *** $p < 0.001$. 1-sided tests			

Supplementary Figure 1 plots log(early settler mortality) versus government effectiveness in 1996. Figures 2.S, 3.S. and 4.S. plots settler-mortality-predicted government effectiveness against each of the three in-group preference measures.

Supplementary Figure 1. Government effectiveness (1996) against log(settler mortality).
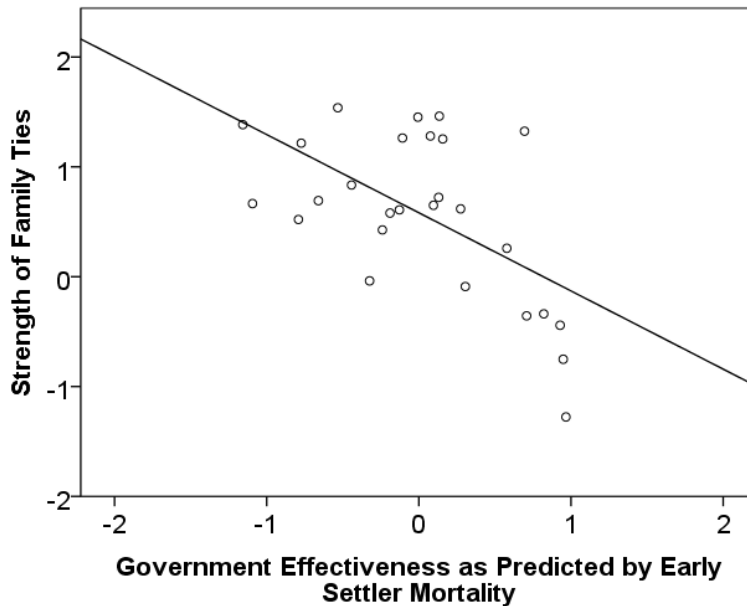
Supplementary Figure 2. Collectivism by Government Effectiveness (as predicted by early settler mortality). Collectivism standardized to mean = 0 and standard deviation = 1.

Supplementary Figure 3. In-group Favoritism by Government Effectiveness (as predicted by early settler mortality). In-group favoritism standardized to mean = 0 and standard deviation = 1.

Supplementary Figure 4. Strength of Family Ties by Government Effectiveness (as predicted by early settler mortality). Strength of Family Ties standardized to mean = 0 and standard deviation = 1.

FULL MODELS FOR ALL 8 IN-GROUP PREFERENCES

Table 8.S. presents the full model (with regional and religion dummies) for all 8 in-group preferences considered in the main text and the supplementary materials. Table 9.S. presents the adjusted R^2 for the base world region model, and the increase in adjusted R^2 from adding Government Effectiveness and Pathogen Stress to Model as well as Dominant Religion.

For the simpler model (excluding religion dummies, but keeping regional dummies , non-zoonotic pathogen stress and government effectiveness controls), all eight measures are significantly associated with government effectiveness and none of the eight measures are significantly associated with pathogen stress.   We also examined the same model as in 8.S., but including historical pathogen stress instead of contemporary non-zoonotic pathogen stress as a predictor. The relationship with historical pathogen stress was only significant for one of the eight outcome measures (F&T's strength of family ties, p = 0.013).

Supplementary Table 8. Full regressions for each of 8 In-group preference measures by Non-zoonotic Pathogen stress and government effectiveness (with regional and religion controls) : collectivism (Coll), ingroup favoritism (In), Strength of Family Ties (FT), Cultural Embeddedness (EM), familism (FA), nepotism (NP), compatriotism (CO), particularism (PA).

	Coll N = 72	In N = 120	FT N= 71	EM N=71	FA N=57	NP N=117	CO N=76	PA N=43
Government Effectiveness	-0.31*	-0.63***	-0.08	-0.59***	-0.62***	-0.70***	-0.39*	-0.34
Pathogen Stress	-0.06	-0.01	0.13	-0.12	-0.02	-0.09	-0.06	-0.02
Religion								
Catholic	--	--	--	--	--	--	--	--
Protestant	-0.27**	-0.33***	-0.33*	0.02	-0.58***	-0.22**	-0.37*	-0.19
Islam	0.09	-0.08	0.30*	0.07	-0.29*	0.11	-0.43*	-0.07
Eastern	-0.03	-0.08	-0.08	-0.04	-0.25	0.01	-0.22	-0.17
Orthodox	0.14	0.06	0.08	0.03	-0.02	0.14*	-0.07	0.13
Jewish	0.02	-0.09	--	-0.11	-0.22*	-0.01	-0.39*	--
Region								
Europe/Central Asia	--	--	--	--	--	--	--	--
Africa	0.21*	0.10	0.42***	0.45***	0.05	0.03	0.21	-0.00
East Asia	0.50***	0.17	0.26*	0.48***	0.35*	0.01	0.35*	0.59*
South Asia	0.17	-0.02	0.13	0.19*	0.10	-0.08	0.17	0.41*
Latin America	0.49***	0.05	0.23	0.11	-0.24	0.12	-0.03	0.20
Middle East/N. Africa	-0.00	0.18*	0.20	0.29**	0.22*	0.05	0.48***	--
Adjusted R^2	0.72	0.64	0.63	0.76	0.73	0.71	0.34	0.59
ΔR^2	0.03	0.22	0.00	0.16	0.22	0.30	0.06	0.01

$p < 0.05$, ** $p < 0.005$, *** $p < 0.001$.

ΔR^2 = Change in Adjusted R^2 from adding Government Effectiveness and Pathogen Stress to Model with Regional and Religion dummies.

Supplementary Table 9. Change in Adjusted R^2 by adding Government Effectiveness (GE) and Religion dummies to world region base models								
	Coll **N = 72**	**In** **N = 120**	**FT** **N= 71**	**EM** **N=71**	**FA** **N=57**	**NP** **N=117**	**CO** **N=76**	**PA** **N=43**
Based Region Model R^2	0.49	0.09	0.40	0.47	0.16	0.05	0.14	0.42
GE over Region ΔR^2	+0.18	+0.49	+0.12	+0.29	+0.43	+0.61	+0.13	+0.18
GE over Region & Religion ΔR^2	+0.07	+0.23	+0.00	+0.16	+0.13	+0.30	+0.07	+0.02
Religion over GE & Region ΔR^2	+0.05	+0.07	+0.11	+0.00	+0.15	+0.05	+0.08	+0.00

TESTS OF PROPOSED INTERACTIONS

An earlier reviewer of the paper proposed testing for specific interactions—between pathogen stress and government effectiveness and between government effectiveness and a measure of temperature variability [1]. Here we show the results of those tests, none of which were significant

Supplementary Table 10. Interaction of Government Effectiveness and Non-zoonotic pathogen stress (adjusted for regional controls, standardized beta coefficients):			
	Collectivism	**In-group Favoritism**	**Strength of Family Ties**
Government Effectiveness	-0.49***	-0.72***	-0.24
Pathogen Stress	0.01	0.09	0.21
Government Effectiveness*Pathogen Stress	0.04	0.05	0.13
$p < 0.05$, ** $p < 0.005$, *** $p < 0.001$.			

Supplementary Table 11. Interaction of Government Effectiveness and Temperature Variability (see Van der Vliert 2011) (adjusted for regional controls, standardized beta coefficients):			
	Collectivism	**In-group Favoritism**	**Strength of Family Ties**
Government Effectiveness	-0.46***	-0.73***	-0.41***
Temp Range	0.00	-0.04	-0.59***
Government Effectiveness*Temp Range	-0.11	-0.08	0.00
p < 0.05, ** p < 0.005, *** p < 0.001.			

ASSESSING CONFOUNDING BY HISTORICAL PATHOGEN STRESS

It is possible that the association between institutions and in-group favoritism are confounded by historical pathogens. We address those two concerns here. First, it is possible that historical pathogen stress is an underlying confounder which independently inhibited modern-day institutions and fostered modern tendencies to in-group investment. When we adjust for historical pathogen stress, the relationship between institutions and in-group investment remains significant and maintains a similar strength for in-group favoritism and reduced strength for the other two measures. These findings suggest that this first alternative hypothesis cannot account (at least fully) for the observed effects.

The second hypothesis is that settler mortality led to settlement patterns which independently: (1) inhibited specific institutions and (2) led to inter-group division and hence in-group investment. This is easily checked by estimating the effect of institutions on in-group investment after controlling for early settler mortality. When we adjust for early settler mortality the relationship between institutions and in-group investment remains significant for the measures of collectivism and in-group favoritism. These findings suggest this alternative hypothesis is implausible.

	Collectivism	In-group Favoritism	Strength of Family Ties
No control	-0.68***	-0.74***	-0.52***
Controlling historical pathogens	-0.50***	-0.66***	-0.20*
Controlling early settler mortality	-0.43*	-0.67***	-0.40

Supplementary Table 12. Standardized beta for effect of Government effectiveness on 3 measures of in-group favoritism

p < 0.05, ** p < 0.005, *** p < 0.001.

MEDIATION ANALYSIS: GOVERNMENT EFFECTIVENESS AS A MEDIATOR OF THE EFFECT OF HISTORICAL PATHOGENS ON

To assess the plausibility of the hypothesis that historical pathogens have an effect on contemporary levels of in-group favoritism through the effect of institutions, we conducted a mediation analysis. Historical pathogen prevalence is associated with government effectiveness even after adjusting for regional dummies (standardized beta = -0.51, p < 0.001). To test for mediation of the relationship between historical pathogens and current in-group favoritism by government effectiveness, we conducted a bootstrap mediation test [18] for each of the eight measures of in-group favoritism.

Contemporary government effectiveness significantly mediated the effect of historical pathogen prevalence on seven of the eight in-group preferences (p < 0.05), with the effect on compatriotism marginally significant (p < 0.10).

1. Van de Vliert E (2011) Climato-economic origins of variation in ingroup favoritism. Cross-Cultural Psychology 42: 494-515.
2. House RJ, Hanges PJ, Javidan M, Dorfman PW, Gupta V (2004) Culture, leadership, and organizations: the GLOBE study of 62 societies. Thousand Oaks, CA: Sage.
3. Blanke J, Loades E (2005) The executive opinion survey: an essential tool for measuring country competitiveness. In: Lopez-Claros A, Porter ME, Schwab K, editors. The Global Competitiveness Report 2005-2006. New York: Palgrave MacMillan.
4. Inglehart R, Basanez M, Diez-Medrano J, Halman L, Luijkz R (2004) Human Beliefs and Values: A Cross-Cultural Sourcebook Based on the 1999-2002 Values Survey. Mexico: Siglo XXI Editores.

5. Hofstede GH (2001) Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations across Nations. Thousand Oaks, CA: Sage Publications.
6. Triandis HC, Bontempo R, Villareal MJ, Masaaki A, Lucca N (1988) Individualism and collectivism: cross-cultural perspectives on self-ingroup relationships. Journal of Personality and Social Psychology 54: 323-338.
7. Suh E, Diener E, Oishi S, Triandis HC (1998) The shifting basis of life satisfaction judgments acros cultures: emotions versus norms. Journal of Personality and Social Psychology 74: 482-493.
8. Schwartz S (2006) A theory of cultural value orientations: explication and applications. Comparative Sociology 5: 137-182.
9. Parsons T, Shils E (1951) Toward a General Theory of Action. Cambridge, MA: Harvard University Press.
10. Trompenaars F (1998) Riding the Waves of Culture. New York: McGraw Hill.
11. Trompenaars F (1996) Resolving international conflict: culture and business strategy. Business Strategy Review 7: 51-68.
12. Trompenaars F (1993) Riding the Waves of Culture. London: Brealey.
13. Norris P, Inglehart R (2004) Sacred and Secular: Religion and Politics Worldwide. Cambridge: Cambridge University Press.
14. Nations U (1998) Human Development Report 1998: United Nations.
15. Barrett DB, Kurian GT, Johnson TM (2001) World Christian Encyclopedia. Oxford: Oxford University Press.
16. Fincher CL, Thornhill R (2012) Parasite-stress promotes in-group assortative sociality: the cases of strong family ties and heightened religiosity. Behavioral and Brain Sciences 35: 61-79.
17. Acemoglu D, Johnson S, Robinson JA (2001) The colonial origins of comparative development: an empirical investigation. The American Economic Review 91: 1369-1401.
18. Preacher KJ, Hayes AF (2004) SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behavior Research Methods, Instruments, and Computers 36: 717-731.

---

[i] Data accessed from http://info.World Bank.org/governance/wgi/index.asp on November 1, 2011.

[ii] Data accessed from http://www.fao.org/economic/ess/ess-fs/fs-data/ess-fadata/en/ on November 1, 2011.

Our eight measures of in-group preferences vary in terms of their emphasis on: (1) kin relationships (family members and friends and compatriots), (2) size of in-group (friends and family vs. compatriots), (3) the nature of observation (reports of others' behaviors vs. report of own behaviors and preferences), and (4) the social tradeoff involved (investment in self, in out-group members, in following a norm, or no specific tradeoff). Here we describe the source and derivation of these variables.

The three measures used in the Main text

Van der Vliert's In-Group Favoritism. Van der Vliert developed a scale of in-group favoritism from three highly correlated international assessments of: (1) familism, (2) nepotism, and (3) compatriotism [1] (Cronbach's α = 0.89). Familism is preferential concern for and investment in one's closest relatives (parents, children and siblings) and is assessed from middle managers in each of 60 countries about how parents and children respect each other and live together [2]. Nepotism is favoring relatives over non-relatives in the allocation of resources, and was measured from a multi-country survey of business executives from nationally representative samples of firms about the degree to which senior management positions are chosen based either on superior qualifications or on one's kin relationship [3]. Compatriotism is favoring members of the one's own nationality over others, and was derived from questions in the World Values Survey (1999-2002 wave) about whether employers should give priority to compatriots [4].   Further explanation of these scale components is provided under "Alternative Measures" below.

Collectivism. Collectivism is the tendency to care about the consequences of one's behavior for in-group members and to be willing to sacrifice personal interests for collective gains [5,6]. One of the most commonly used measures of collectivism at the national level is reported by Hofstede (2001) who assessed work attitudes from over 100,000 IBM employees worldwide. From these data Hofstede estimated collectivism scores for 68 specific geopolitical regions included in our analyses. Hofstede's measure correlates strongly with an alternative measure constructed by Suh et al. (ρ = 0.91), and Suh's score was used to calculate a comparable collectivism score for Nepal, Nigeria, Zimbabwe, and Egypt which were not reported in Hofstede [7](Hofstede = -9.537+Suh*10.749). We use an inverse of Hofstede's score (100 – individualism), so that a higher score indicates greater collectivism.

Fincher and Thornhill's Strength of Family Ties. In order to compare our results with recent findings by Fincher and Thornhill about the pathogen stress hypothesis, we use the measure of in-group preference—strength of family ties—they use in a recent publication. Fincher and Thornhill (2012) derived this measure as the sum of five items in the 1981-2007 pooled dataset of the World Values Survey about the value placed on immediate

40   family. The items included statements about the importance of: (1) family in one's life, (2) loving and respecting parents despite their faults, (3) doing one's best for one's children even at expense of one's own well-being, and (4) making one's parents proud. The last item asked if people lived with their parents (Cronbach's α = 0.86).

45   **Five Alternative measures**

Familism. Family investment is preferential investment in one's closest relatives (parents, children and siblings). This is the first component of Van der Vliert's measure of ingroup favoritism (see above). This measure is based on data from House et al. (2004) and derived

50   by Van de Vliert (2011). Between 1994 and 1997, House et al. sampled middle managers (n = 17,370) from domestic organizations in each of 60 countries in the target industries of food processing, financial services, and telecommunications [2]. Participants answered four questions about interactions with family members as observed in their society (1 = *strongly disagree*, 7 = *strongly agree*). These were: "In this society, children take pride in the

55   individual accomplishments of their parents", "In this society, parents take pride in the individual accomplishments of their children", "In this society, aging parents generally live at home with their children", "In this society, children generally live at home with their parents until they get married". The internal consistency of these four items was good (Cronbach's α = .77), and reported estimates are response bias corrected [2]. A higher

60   score indicates greater familism.

Nepotism. Nepotism is the favoring of relatives over non-relatives in the allocation of resources. This is the second component of Van der Vliert's measure of ingroup favoritism (see above). Data were used from a multi-country survey of business executives from

65   nationally representative samples of firms [3]. Executives responded to a 7-point likert scale, "Senior management positions in your country are: (1) held by professional managers chosen based on superior qualifications, ..., (7) usually held by relatives." Here we use standardized values provided by Van de Vliert (2011).

70   *Compatriotism.* Compatriotism is favoring members of the one's own nationality over others. This is the third component of Van der Vliert's measure of ingroup favoritism (see above), and is derived from data for nationally representative subsamples of adults from 73 countries from the 1999-2002 wave of the World Values Survey [4]. Professional interviewers substituted their own nationality for "British" when asking: "Do you agree or

75   not agree with the following statement? When jobs are scarce, employers should give priority to [British] people over immigrants" (3-point response scale: agree, disagree, or neither). We use the variable reported by Van de Vliert (2011), which is a standardized score based on the percentage of individuals in a country who agreed with the statement.

80   *Schwartz's Cultural Embeddedness.* Based on a reviewer's earlier suggestion, we included Schwartz's dimension of cultural embeddedness as an alternative measure of in-group preference. This dimension captures the relationship between the individual and the

group, and involves an emphasis on maintenance of the status quo, propriety, and restraint of actions or inclinations that might disrupt group solidarity or the traditional order [8].

85   *Particularism.* Particularism is the preference for helping kith and kin over following universally applicable rules of fairness [9]. In several publications, Trompenaars and Hampden-Turner describe the responses of multi-national corporate managers to the passenger's dilemma, whereby one must make the choice between telling the truth under oath and helping a friend [10-12]. The variable reported by Trompenaars and Hampden-

90   Turner is the probability that a respondent from a country stated either: (1) that the friend has a definite right to expect the respondent to lie for him or (2) that the respondent would lie under oath. As data was updated in successive publications, more recent publications take precedence over earlier publications. This measure of particularism correlates moderately with other measures collected by Trompenaars and Hampden, including the

95   willingness to give a friend insider information from one's corporation (ρ = 0.66, 1993, *n* =35 countries), the willingness to lie about a friend's medical exam to improve his insurance premium (ρ =0.51, 1998, *n* = 28), and the willingness to lie about a friend's restaurant in a published review (ρ = 0.65,0.69, 1993,1998, *n* = 32, *n* = 30).

INSTITUTIONS AND MATERIAL SECURITY

100   The key variable used for our analyses in the main text was the World Bank measure of government effectiveness as a measure of quality of government services. In the supplementary materials below we also examine related measures that assess: (1) material resources available per capita (GDP per capita), (2) general material security, and (3) food security.

105   *Quality of Government Services (1996):* To assess quality of government services, we used the World Bank's measure of government effectiveness which indexes the quality of public and civil services in a country, including roads, schools, hospitals, and courts[i].

Material Resources: To assess material resources, we used log(GDP per capita) (World Bank 1996 measure, gross domestic product per capita purchasing power parity in 2005 dollars).

Material Security: We used the United Nations human development index (HDI), which Norris and Inglehart have used previously as a measure of "existential security" grounded in social and economic development [13,14]. This measure includes indices of health, and thus is directly measuring both the quality of institutions and pathogen stress. For this reason, we do not use this as the primary measure for analyses.

Food Insecurity: Food insecurity was assessed using country-level data for proportion of total household consumption expenditure devoted to food.[ii] The larger share of overall household consumption devoted to food, the more sensitive household budgets are to changing food prices and the more prone they are too food insecurity.

PREDOMINANT RELIGION

We use world religious tradition with a plurality of adherents in a country as determined by Inglehart and Norris (2004). The categories included Muslim, Jewish, Christian-Catholic, Christian-Orthodox, and Christian-Protestant, and Eastern (which included a combination of Hindu, Buddhist, Shinto and Confucian traditions). Eastern religions were aggregated into a single category as no single religion was sufficiently numerous in the sample to permit further stratification. When Inglehart and Norris did not specify the world religion, we assessed the world religion having a plurality of adherents in the country [15]. We use Catholic as the reference category in regressions.

WORLD REGION

To adjust for potential confounding effects of shared social, political, and cultural history, we use world regions defined by the World Bank, including sub-Saharan Africa, Middle East and North Africa, East Asia, South Asia, Latin America and the Caribbean, and Europe and Central Asia. The World Bank does not classify upper income countries. We classified upper income countries based on shared cultural heritage--Japan as East Asia, continental European countries, U.K., U.S., Canada, New Zealand and Australia under Europe/Central Asia. We use Europe and Central Asia as the reference category in regressions.

Supplementary Table 1. Descriptives for key variables

Variables	N	Mean (SD)
Key Ingroup Measures		
Van der Vliert Ingroup Favoritism	121	0.14 (0.86)
Hofstede Collectivism	72	57.5 (23.7)
F & T Strength of Family Ties	71	0.03 (3.91)
Alternative Ingroup Measures		
Schwartz Cultural Embeddedness	71	10.3 (5.3)
Familism	57	0.00 (1.00)
Nepotism	118	0.01 (1.00)
Compatriotism	76	0.01 (1.00)
Particularism	43	27.9 (17.6)
Institutions and Material Security		
Quality of Public Services	128	0.16 (1.00)
Human Development Index	122	0.72 (0.20)
GDP per capita (PPP in 1000 USD)	123	10.89 (11.13)
% of household budget on food	113	0.40 (0.17)
Pathogen Stress		
Non-Zoonotic Pathogen Prevalence	128	0.14 (1.93)
Zoonotic Pathogen Prevalence	128	0.46 (0.88)
Historical pathogen prevalence	128	0.08 (0.63)

Supplementary Table 2. Bivariate correlations between institutions, material security, and pathogen stress measures. Sample sizes in parentheses. GE = government effectiveness.

Variable	GE	Log(GDP)	HDI	FS	NZPS	ZPS
Log(GDP)	0.78 (123)					
Human Development Index (HDI)	0.70 (122)	0.93 (119)				
Food Insecurity (FS)	-0.75 (112)	-0.76 (109)	-0.70 (107)			
Non-zoonotic Pathogen Stress (NZPS)	-0.50 (128)	-0.64 (123)	-0.66 (122)	0.28** (112)		
Zoonotic Pathogen Stress (ZPS)	-0.19 (128)*	-0.22 (123)*	**-0.16 (122)**	**0.06 (112)**	0.52 (128)	
Historical Pathogen Prevalence (HPP)	-0.54 (127)	-0.63 (122)	-0.62 (122)	0.37 (112)	0.79 (127)	0.36 (127)

Significant at 0.001 level unless otherwise noted. * p < 0.05, ** p < 0.005. *Non-significant* results (> 0.05 level) are in bold italics.

Supplementary Table 3. Bivariate correlations between in-group preferences. Sample sizes in parentheses.

Variable	Collect	IN	FA	NP	CO	PA	EM
Ingroup (IN)	0.70 (70)						
Familism (FA)	0.74 (49)	0.93 (57)					
Nepotism (NP)	0.66 (69)	0.87 (118)	0.69 (56)				
Compatriotism (CO)	0.59 (58)	0.85 (76)	0.82 (42)	0.44 (74)			
Particularism (PA)	0.80 (42)	0.70 (41)	0.75 (35)	0.60 (41)	0.58 (38)		
Embeddedness (EM)	0.61 (56)	0.67 (70)	0.65 (46)	0.58 (69)	0.61 (59)	0.62 (40)	
Family Ties	0.65 (52)	0.56 (70)	0.70 (39)	0.50 (68)	0.42 (67)	0.49 (32)	0.74 (52)

Significant at 0.001 level unless otherwise noted.

ROBUSTNESS CHECKS

REDUNDANT MEASURES

F&T use two measures of in-group favoritism—strength of family ties and assortative sociality. The second measure is a composite of the strength of family ties measure and a measure based on religiosity. The first and second measure are highly correlated ($\rho > 0.95$) so we focus on the direct measure of family ties [16]. However, results do not change if the second measure is used. F&T also use two measures of contempory pathogen stress—non-zoonotic pathogen stress and combined pathogen stress, These are also highly correlated ($\rho > 0.95$), and for clarity we use the more direct measure. Again results do not change if combined pathogen stress is used [16].

In Tables 4.S. and 5.S. we examine how the effect sizes and p-values change for key relationships when controlling for: (1) World Region, (2) World Region + measures for the alternative hypothesis, (3) World Region + Dominant religion. After regional controls only one pathogen stress variable, historical pathogen prevalence, remains. After control for government effectiveness of world religion, that measure only remains significantly associated with one measure of in-group investment

Supplementary Table 4. Relationship of 3 major in-group preferences with alternative measures of pathogen stress using three sets of controls

	Collectivism	In-group Favoritism	Strength of Family Ties
Regional control			
Non-zoonotic Pathogen Stress	0.26	0.41*	0.32
Zoonotic Pathogen Stress	0.01	0.10	-0.03
Historical Pathogen Prevalence	0.31*	0.51***	0.60***
Regional + Government Effectiveness Controls			
Non-zoonotic Pathogen Stress	-0.01	0.05	0.14
Zoonotic Pathogen Stress	-0.14	0.00	-0.05
Historical Pathogen Prevalence	0.06	0.17	0.46***
Regional and Religion Control			
Non-zoonotic Pathogen Stress	0.04	0.18	0.15
Zoonotic Pathogen Stress	-0.10	0.04	-0.04
Historical Pathogen Prevalence	0.02	0.20	0.36*

p < 0.05, ** p < 0.005, *** p < 0.001

We apply the same approach to alternative measures of government effectiveness or material security/insecurity. All measures remain significantly associated with all measures of in-group investment with regional controls or control for non-zoonotic parasite stress. When controlling for religion these measures remain significantly associated with two of the three in-group investment measures.

Supplementary Table 5. Relationship of 3 major in-group preferences with alternative measures of institutions and material security using three sets of controls			
	Collectivism	**In-group Favoritism**	**Strength of Family Ties**
Regional Controls			
Government Effectiveness (1996)	-0.52***	-0.77***	-0.38***
Log(GDP 1996)	-0.49***	-0.80***	-0.40***
Human Development Index (1995)	-0.51***	-0.89***	-0.46***
% Household budget on food	0.42***	0.64***	0.28*
Regional + Non-zoonotic pathogen stress Controls			
Government Effectiveness (1996)	-0.52***	-0.76***	-0.36***
Log(GDP 1996)	-0.46***	-0.81***	-0.36***
Human Development Index (1995)	-0.47**	-0.88***	-0.42***
% Household budget on food	0.39***	0.62***	0.24*
Regional + Religion Controls			
Government Effectiveness (1996)	-0.29*	-0.63***	-0.11
Log(GDP 1996)	-0.26*	-0.67***	-0.13
Human Development Index (1995)	-0.35*	-0.73***	-0.23
% Household budget on food	0.26*	0.51***	0.07
p < 0.05, ** p < 0.005, *** p < 0.001			

WITHIN REGION ANALYSIS

To examine associations within the major world regions, we conducted regressions for each region predicting each of the 8 measures of in-group favoritism with the following two predictors—effectiveness of government institutions and non-zoonotic pathogen stress. To avoid small sample sizes, we focused on the 17 samples where there were more than 10 countries within a region which had data on a specific measure of in-group favoritism. All eight measures had sufficiently large samples from Europe and Central Asia. Three measures had sufficiently large samples for East Asia and for Latin America and the Caribbean. Two measures had sufficiently large samples for sub-Saharan Africa, and one measure had a sufficiently large sample for Middle East and North Africa. South Asia never had sufficiently large samples.

Among these 17 samples, GE significantly increased in-group favoritism in 12 (8 of 8 in Europe and Central Asia, 2 of 3 East Asia, and 2 of 3 in Latin American and Caribbean). Notably, PS significantly increased in-group favoritism in only 1 sample.

EFFECT OF 3 IN-GROUP PREFERENCE MEASURES ON ECONOMIC GROWTH, HUMAN DEVELOPMENT INDEX, AND GOVERNMENT EFFECTIVENESS

Supplementary Table 6. Standardized coefficients of 13-year change in GDP per capita and quality of public services by three major in-group favoritism measures. Adjusting for region and religion			
Variables	**Collectivism**	**Ingroup Favoritism**	**Strength of Family Ties**
GDP_{2009}/GDP_{1996}	0.25*	0.26**	-0.04
$HDI_{2010} - HDI_{1995}$	-0.10	0.21*	-0.07
$PublicService_{2009} - PublicService_{1996}$	0.14	0.15	-0.13
* $p < 0.05$, ** $p < 0.005$, *** $p < 0.001$			

INSTRUMENTAL VARIABLE ANALYSIS

Following work in economics [17], we deploy the mortality rates of early settlers in European colonies (1600-1875) as an instrumental variable which is expected to affect contemporary government effectiveness (see below). Acemoglu et al. provide ample historical evidence that Europeans avoided settling in places with high mortality for Europeans, such as in the Belgian Congo, and instead set up extractive systems in these places. In situations of low mortality, on the other hand, colonizers settled in larger numbers and brought with them institutions, such as

respect of private property, checks and balances in government, and equality of opportunity, which in turn fostered greater government effectiveness that persisted even after independence. These measures of settler mortality allow us to identify that portion of the variance in government institutions that is due to early (exogenously caused) settlement patterns. We can then use these predicted values—now unbiased by omitted variables and confounding—to predict our cultural variables and identify a causal relationship. This analysis shows an effect indistinguishable from that observed in the standard regression analysis, which indicates that the standard analysis is unlikely to suffer from the omitted variables biases and confounding that would otherwise jeopardize causal inference.

Using settler mortality as an instrumental variable, we fit a two-stage OLS regression. At level one, settler mortality predicts modern government effectiveness. At level two, the component of government effectiveness predicted by early settler mortality (the predicted value) is used to predict modern in-group favoritism. We include pathogen stress in both regressions to control for any potential confounding due to pathogens in the environment causing both early settler mortality and modern in-group preference (See Table 6.S). Settler mortality was significantly associated with government effectiveness (ρ = -0.54, p < 0.001) and non-zoonotic pathogen stress (ρ = 0.49, p < 0.001).

We use the "robustness check" data series for settler mortality (Acemoglu et al. 2005). We report all results for the sub-samples for which settler mortality is available.
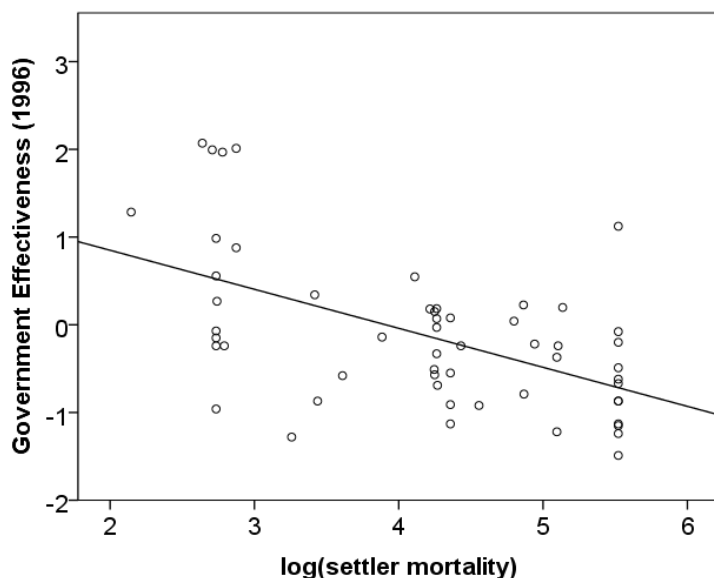
Note that since we are using only former European colonies in this analysis, our sample size is smaller.

A Durbin-Wu-Hausman test assesses whether the estimate from an OLS regression is different from the estimate from instrumental variable regressions. For In-group favoritism and strength of family ties, the estimates from each procedure are not statistically different. Since estimates from instrumental variable (IV) regressions are less efficient than those from OLS regressions, and since there is no difference between the OLS and IV estimates, the OLS regression estimates are preferred. Note, however, that for all three of our dependent measures the IV coefficient estimates are larger in magnitude than the OLS coefficients, and for Collectivism, they are significantly larger in magnitude.
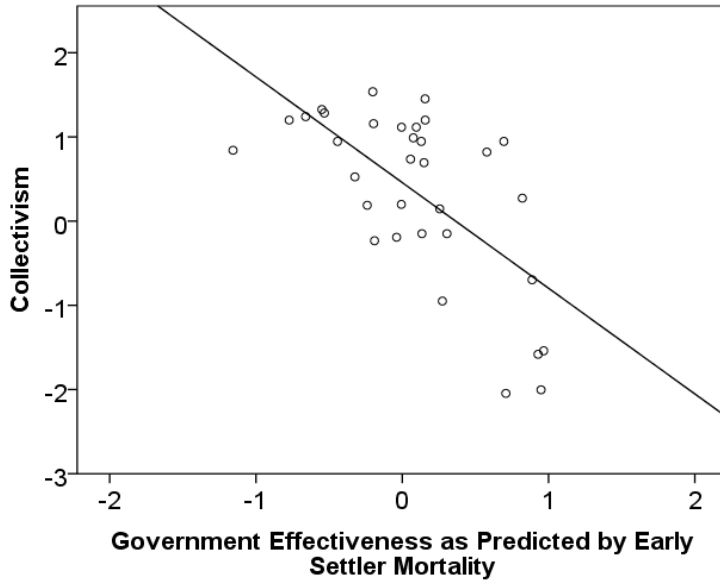
Supplementary Table 7. Comparison of estimated effect of quality of government services on in-group preferences using OLS and instrumental variable estimation (on colonial sub-sample).

Variables	Collectivism (n=33)	Ingroup Favoritism (n=52)	Strength of Family Ties (n=27)
Panel A: Two Stage Least Squares			
Government Effectiveness	-1.95* (1.10)	-0.89* (0.37)	-0.89* (0.42)
Non-zoonotic Pathogens	-0.28 (0.35)	-0.06 (0.11)	-0.10 (0.15)
Panel B: First-Stage for Government Effectiveness			
Non-zoonotic Pathogens	-0.25 (0.07)***	-0.20 (0.06)***	-0.20 (0.09)*
Log(settler mortality)	-0.22 (0.13)	-0.28 (0.10)**	-0.38 (0.16)*
R^2	0.42	0.42	0.54
Panel C: Ordinary Least Squares Regression			
Government Effectiveness	-0.49* (0.20)	-0.78*** (0.14)	-0.41* (0.17)
Non-zoonotic Pathogens	0.15 (0.10)	-0.02 (0.06)	0.06 (0.08)
Durbin-Wu-Hausman Test (p-value)	0.02	0.75	0.17
* $p < 0.05$, ** $p < 0.005$, *** $p < 0.001$. 1-sided tests			

Supplementary Figure 1 plots log(early settler mortality) versus government effectiveness in 1996. Figures 2.S, 3.S. and 4.S. plots settler-mortality-predicted government effectiveness against each of the three in-group preference measures.
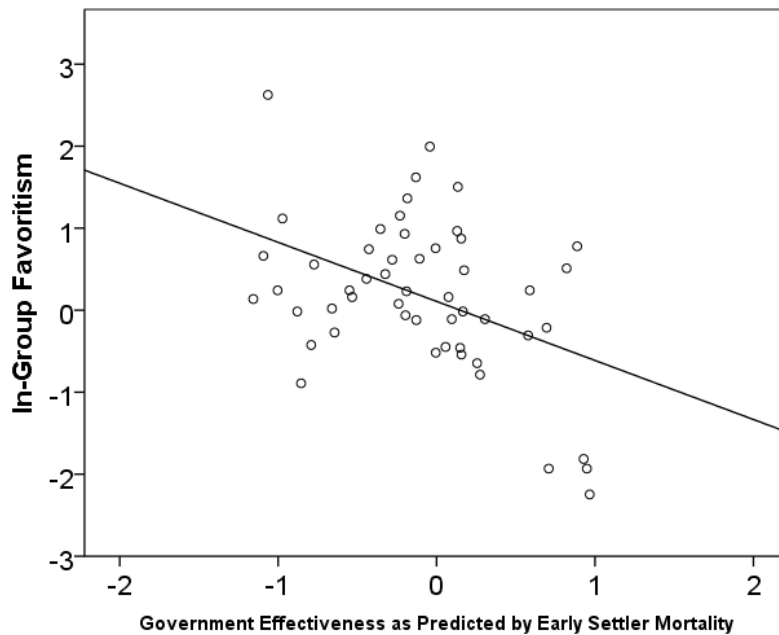
Supplementary Figure 1. Government effectiveness (1996) against log(settler mortality).
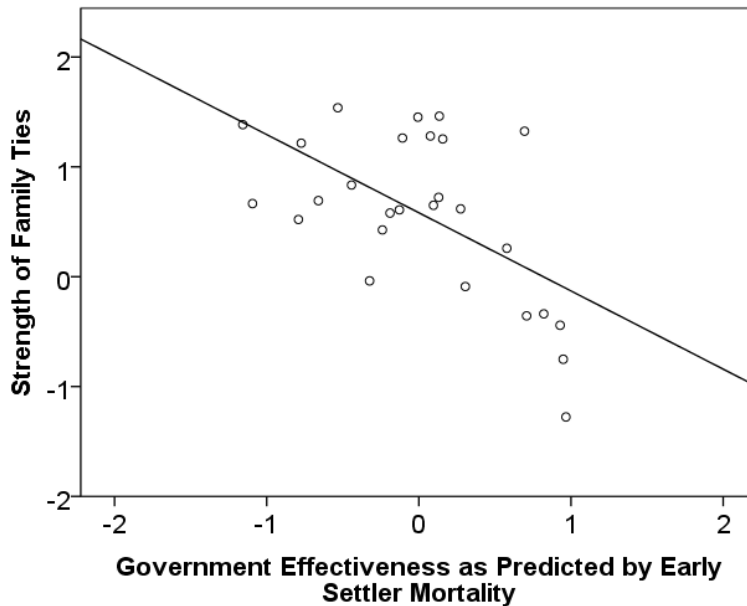
Supplementary Figure 2. Collectivism by Government Effectiveness (as predicted by early settler mortality). Collectivism standardized to mean = 0 and standard deviation = 1.

Supplementary Figure 3. In-group Favoritism by Government Effectiveness (as predicted by early settler mortality). In-group favoritism standardized to mean = 0 and standard deviation = 1.

Supplementary Figure 4. Strength of Family Ties by Government Effectiveness (as predicted by early settler mortality). Strength of Family Ties standardized to mean = 0 and standard deviation = 1.

FULL MODELS FOR ALL 8 IN-GROUP PREFERENCES

Table 8.S. presents the full model (with regional and religion dummies) for all 8 in-group preferences considered in the main text and the supplementary materials. Table 9.S. presents the adjusted R^2 for the base world region model, and the increase in adjusted R^2 from adding Government Effectiveness and Pathogen Stress to Model as well as Dominant Religion.

For the simpler model (excluding religion dummies, but keeping regional dummies , non-zoonotic pathogen stress and government effectiveness controls), all eight measures are significantly associated with government effectiveness and none of the eight measures are significantly associated with pathogen stress.   We also examined the same model as in 8.S., but including historical pathogen stress instead of contemporary non-zoonotic pathogen stress as a predictor. The relationship with historical pathogen stress was only significant for one of the eight outcome measures (F&T's strength of family ties, p = 0.013).

Supplementary Table 8. Full regressions for each of 8 In-group preference measures by Non-zoonotic Pathogen stress and government effectiveness (with regional and religion controls) : collectivism (Coll), ingroup favoritism (In), Strength of Family Ties (FT), Cultural Embeddedness (EM), familism (FA), nepotism (NP), compatriotism (CO), particularism (PA).

	Coll N = 72	In N = 120	FT N= 71	EM N=71	FA N=57	NP N=117	CO N=76	PA N=43
Government Effectiveness	-0.31*	-0.63***	-0.08	-0.59***	-0.62***	-0.70***	-0.39*	-0.34
Pathogen Stress	-0.06	-0.01	0.13	-0.12	-0.02	-0.09	-0.06	-0.02
Religion								
Catholic	--	--	--	--	--	--	--	--
Protestant	-0.27**	-0.33***	-0.33*	0.02	-0.58***	-0.22**	-0.37*	-0.19
Islam	0.09	-0.08	0.30*	0.07	-0.29*	0.11	-0.43*	-0.07
Eastern	-0.03	-0.08	-0.08	-0.04	-0.25	0.01	-0.22	-0.17
Orthodox	0.14	0.06	0.08	0.03	-0.02	0.14*	-0.07	0.13
Jewish	0.02	-0.09	--	-0.11	-0.22*	-0.01	-0.39*	--
Region								
Europe/Central Asia	--	--	--	--	--	--	--	--
Africa	0.21*	0.10	0.42***	0.45***	0.05	0.03	0.21	-0.00
East Asia	0.50***	0.17	0.26*	0.48***	0.35*	0.01	0.35*	0.59*
South Asia	0.17	-0.02	0.13	0.19*	0.10	-0.08	0.17	0.41*
Latin America	0.49***	0.05	0.23	0.11	-0.24	0.12	-0.03	0.20
Middle East/N. Africa	-0.00	0.18*	0.20	0.29**	0.22*	0.05	0.48***	--
Adjusted R^2	0.72	0.64	0.63	0.76	0.73	0.71	0.34	0.59
ΔR^2	0.03	0.22	0.00	0.16	0.22	0.30	0.06	0.01

$p < 0.05$, ** $p < 0.005$, *** $p < 0.001$.

ΔR^2 = Change in Adjusted R^2 from adding Government Effectiveness and Pathogen Stress to Model with Regional and Religion dummies.

Supplementary Table 9. Change in Adjusted R^2 by adding Government Effectiveness (GE) and Religion dummies to world region base models								
	Coll N = 72	**In** N = 120	**FT** N= 71	**EM** N=71	**FA** N=57	**NP** N=117	**CO** N=76	**PA** N=43
Based Region Model R^2	0.49	0.09	0.40	0.47	0.16	0.05	0.14	0.42
GE over Region ΔR^2	+0.18	+0.49	+0.12	+0.29	+0.43	+0.61	+0.13	+0.18
GE over Region & Religion ΔR^2	+0.07	+0.23	+0.00	+0.16	+0.13	+0.30	+0.07	+0.02
Religion over GE & Region ΔR^2	+0.05	+0.07	+0.11	+0.00	+0.15	+0.05	+0.08	+0.00

TESTS OF PROPOSED INTERACTIONS

An earlier reviewer of the paper proposed testing for specific interactions—between pathogen stress and government effectiveness and between government effectiveness and a measure of temperature variability [1]. Here we show the results of those tests, none of which were significant

Supplementary Table 10. Interaction of Government Effectiveness and Non-zoonotic pathogen stress (adjusted for regional controls, standardized beta coefficients):			
	Collectivism	**In-group Favoritism**	**Strength of Family Ties**
Government Effectiveness	-0.49***	-0.72***	-0.24
Pathogen Stress	0.01	0.09	0.21
Government Effectiveness*Pathogen Stress	0.04	0.05	0.13
$p < 0.05$, ** $p < 0.005$, *** $p < 0.001$.			

Supplementary Table 11. Interaction of Government Effectiveness and Temperature Variability (see Van der Vliert 2011) (adjusted for regional controls, standardized beta coefficients):			
	Collectivism	**In-group Favoritism**	**Strength of Family Ties**
Government Effectiveness	-0.46***	-0.73***	-0.41***
Temp Range	0.00	-0.04	-0.59***
Government Effectiveness*Temp Range	-0.11	-0.08	0.00
p < 0.05, ** p < 0.005, *** p < 0.001.			

ASSESSING CONFOUNDING BY HISTORICAL PATHOGEN STRESS

It is possible that the association between institutions and in-group favoritism are confounded by historical pathogens. We address those two concerns here. First, it is possible that historical pathogen stress is an underlying confounder which independently inhibited modern-day institutions and fostered modern tendencies to in-group investment. When we adjust for historical pathogen stress, the relationship between institutions and in-group investment remains significant and maintains a similar strength for in-group favoritism and reduced strength for the other two measures. These findings suggest that this first alternative hypothesis cannot account (at least fully) for the observed effects.

The second hypothesis is that settler mortality led to settlement patterns which independently: (1) inhibited specific institutions and (2) led to inter-group division and hence in-group investment. This is easily checked by estimating the effect of institutions on in-group investment after controlling for early settler mortality. When we adjust for early settler mortality the relationship between institutions and in-group investment remains significant for the measures of collectivism and in-group favoritism. These findings suggest this alternative hypothesis is implausible.

Supplementary Table 12. Standardized beta for effect of Government effectiveness on 3 measures of in-group favoritism			
	Collectivism	**In-group Favoritism**	**Strength of Family Ties**
No control	-0.68***	-0.74***	-0.52***
Controlling historical pathogens	-0.50***	-0.66***	-0.20*
Controlling early settler mortality	-0.43*	-0.67***	-0.40
p < 0.05, ** p < 0.005, *** p < 0.001.			

MEDIATION ANALYSIS: GOVERNMENT EFFECTIVENESS AS A MEDIATOR OF THE EFFECT OF HISTORICAL PATHOGENS ON

To assess the plausibility of the hypothesis that historical pathogens have an effect on contemporary levels of in-group favoritism through the effect of institutions, we conducted a mediation analysis. Historical pathogen prevalence is associated with government effectiveness even after adjusting for regional dummies (standardized beta = -0.51, p < 0.001). To test for mediation of the relationship between historical pathogens and current in-group favoritism by government effectiveness, we conducted a bootstrap mediation test [18] for each of the eight measures of in-group favoritism.

Contemporary government effectiveness significantly mediated the effect of historical pathogen prevalence on seven of the eight in-group preferences (p < 0.05), with the effect on compatriotism marginally significant (p < 0.10).

1. Van de Vliert E (2011) Climato-economic origins of variation in ingroup favoritism. Cross-Cultural Psychology 42: 494-515.
2. House RJ, Hanges PJ, Javidan M, Dorfman PW, Gupta V (2004) Culture, leadership, and organizations: the GLOBE study of 62 societies. Thousand Oaks, CA: Sage.
3. Blanke J, Loades E (2005) The executive opinion survey: an essential tool for measuring country competitiveness. In: Lopez-Claros A, Porter ME, Schwab K, editors. The Global Competitiveness Report 2005-2006. New York: Palgrave MacMillan.
4. Inglehart R, Basanez M, Diez-Medrano J, Halman L, Luijkz R (2004) Human Beliefs and Values: A Cross-Cultural Sourcebook Based on the 1999-2002 Values Survey. Mexico: Siglo XXI Editores.

5. Hofstede GH (2001) Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations across Nations. Thousand Oaks, CA: Sage Publications.
6. Triandis HC, Bontempo R, Villareal MJ, Masaaki A, Lucca N (1988) Individualism and collectivism: cross-cultural perspectives on self-ingroup relationships. Journal of Personality and Social Psychology 54: 323-338.
7. Suh E, Diener E, Oishi S, Triandis HC (1998) The shifting basis of life satisfaction judgments acros cultures: emotions versus norms. Journal of Personality and Social Psychology 74: 482-493.
8. Schwartz S (2006) A theory of cultural value orientations: explication and applications. Comparative Sociology 5: 137-182.
9. Parsons T, Shils E (1951) Toward a General Theory of Action. Cambridge, MA: Harvard University Press.
10. Trompenaars F (1998) Riding the Waves of Culture. New York: McGraw Hill.
11. Trompenaars F (1996) Resolving international conflict: culture and business strategy. Business Strategy Review 7: 51-68.
12. Trompenaars F (1993) Riding the Waves of Culture. London: Brealey.
13. Norris P, Inglehart R (2004) Sacred and Secular: Religion and Politics Worldwide. Cambridge: Cambridge University Press.
14. Nations U (1998) Human Development Report 1998: United Nations.
15. Barrett DB, Kurian GT, Johnson TM (2001) World Christian Encyclopedia. Oxford: Oxford University Press.
16. Fincher CL, Thornhill R (2012) Parasite-stress promotes in-group assortative sociality: the cases of strong family ties and heightened religiosity. Behavioral and Brain Sciences 35: 61-79.
17. Acemoglu D, Johnson S, Robinson JA (2001) The colonial origins of comparative development: an empirical investigation. The American Economic Review 91: 1369-1401.
18. Preacher KJ, Hayes AF (2004) SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behavior Research Methods, Instruments, and Computers 36: 717-731.

---

[i] Data accessed from http://info.World Bank.org/governance/wgi/index.asp on November 1, 2011.

[ii] Data accessed from http://www.fao.org/economic/ess/ess-fs/fs-data/ess-fadata/en/ on November 1, 2011.