

The Origins of Disorder: Why Do Nations Fail to Thrive?

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Abstract

It is now widely agreed that when it comes to achieving robust wellbeing in the present, whether measured as wealth, longevity, health, investments in human capital, or political stability and good governance, 'history matters.' Moreover, most economic historians and their peers working in development also now subscribe to some version of the theory that 'good' institutions undergird the stunning modern prosperity of the west, as well as any catching-up by others. Systems that preserve private property rights, the rule of law, enforceable contracts, and broad access of opportunity give rise to prosperity in all its features; and those that don't suffer the consequences. Above all else, the Haves have good governance. But as Avner Greif lamented over two decades ago: "little is known about the origins of various systems of societal organization and the factors that make these systems path dependent. Thus we cannot address a question that seems to be at the heart of developmental failures: Why do societies fail to adopt the organization of more economically successful ones?" (*JPE*, 1994:913-14). Tremendous effort has been devoted to answering this question. In this paper, we build on the literature of why nations fail, adding a new variable to the list of possible explanands: the form of gender inequality and female subjugation associated with the practice of polygamy. We employ a comparative historical analysis of marriage systems (past and present) in conjunction with a new international dataset coded for the presence of male plural marriage to argue that the polygamy-induced chronic scarcity of marriageable females produces persistent effects that reach far beyond the family. At the micro level, a scarcity of women leads to misogyny *qua* hoarding—for instance female infanticide, female genital mutilation, sex-asymmetric justice, sequestration, and typically strong prohibitions against homosexual partnerships as well. Marauding or civil unrest follow in the course of relieving that scarcity, and levels of social trust outside the kin group remain low. At the national level, these conditions are strongly predictive of increased state fragility (i.e. the absence of 'good' institutions) and the unfavorable health and human development outcomes and stunted economic growth that go with them. We find that the effects of gender inequality, in particular marriage inequality, are more strongly predictive of state failure and low levels of living standards than are the more fully explored factors of European colonialism, natural resource endowments, ethnic diversity, or latitude.

Introduction

A central question, arguably the central question of economic history is why are some people so rich while others remain desperately poor? Or as Greg Clark once framed it in a paper title, why isn't the whole world developed?¹ Given the importance of this question, and the tremendous collective effort that has gone into answering it, there is remarkably little consensus on an answer. Yet most economic historians do agree on one thing: that when it comes to achieving robust wellbeing in the present, whether measured as wealth, longevity, health, investments in human capital, or political stability and good governance, 'history matters.' And following Douglass North, the history that matters most is the one that delivers the so-called 'good' institutions which are often invoked as under-girding the stunning modern prosperity of the west, as well as any catching-up by others. Systems that preserve private property rights, the rule of law, enforceable contracts, and broad access of opportunity give rise to prosperity in all its features; and those that don't suffer the consequences. Above all else then, the 'haves' of this world have good governance. But as Avner Greif lamented over two decades ago: "little is known about the origins of various systems of societal organization and the factors that make these systems path dependent. Thus we cannot address a question that seems to be at the heart of developmental failures: Why do societies fail to adopt the organization of more economically successful ones?"² If good institutions are what is required for wealth, long life, and technological advance, then everyone should surely adopt those institutions posthaste. That they have not is sufficient cause for a reexamination of the model itself.

From North the discipline has learned well the lesson that good governance facilitates economic exchange and its concomitant wealth-making potential. To put it simply, "price-making markets require well defined and enforced property rights;" or more broadly, "it is the successes and failures in human organization that account for the progress and retrogression of societies."³ But this should not be the only thing we learn from North. In the same foundational work he warned his readers "that there is no neat supply function of new institutional arrangements specified in the framework... Institutional innovation is a public good with all the characteristics of such goods, including the free rider problem."⁴ Wealth-enhancing governance structures don't just appear in some fortunate isles out of whole cloth, but must be developed, invested in, and fought for. In short they are costly. Indeed, North argues, "the measurement costs of constraining behavior are so high that in the absence of ideological convictions to constrain individual maximizing, the viability of economic organization is threatened. Investment in

¹ Gregory Clark, "Why Isn't the Whole World Developed? Lessons from the Cotton Mills," *Journal of Economic History*, 1987, 47(1): 141-73.

² Avner Greif, "Cultural Beliefs and the Organization of Society: A Historical and Theoretical Reflection on Collectivist and Individualist Societies," *Journal of Political Economy*, 1994, 102(5): 913-14.

³ Douglass North, *Structure and Change in Economic History*, Norton: New York, 1981, 42 and 59.

⁴ North, 1981, 68.

legitimacy is as much a cost of economic organization as are the measurement and enforcement costs” of standard neoclassical theory.⁵

Furthermore, as Deirdre McCloskey has observed, good institutions *qua* rules are not enough on their own, regardless of how costly they might be to secure. In the most recent volume of her work on the so-called ‘great enrichment,’ *Bourgeois Equality*, she has this to say about the rule of law: “Mainly ethics—not mainly law—held societies together... Norms are ethical persuasions, bendable, arguable, interpretable. Rules are, well, rules, such as that bribes are illegal in Delhi, or that jaywalking is illegal in Evanston. The rules of bribery in Stockholm are probably the same as in Delhi, and the jaywalking rules in Berlin the same as in Evanston. The difference is ethics.”⁶ Strong, wealth-enhancing institutions work best (or maybe even only) when undergirded by a broadly shared ethic of compliance, itself dependent on bonds of trust across society that serve as a counterweight to the free-rider problems invoked by North in his fullest analysis. The failure of ethics -- or its companion trust -- in some places and not others may well be the answer to Avner Greif’s question, but this takes us ahead of our story. We will return to the issue of trust at the conclusion of this paper.

Both Greif and McCloskey, one an avowed New Institutionalists and the other not, find a single irritant in North’s formulation; institutions alone do not seem up to the task of explaining why Denmark has more and better institutions than Somalia. On the other hand, wealth, the putative dependent variable of the New Institutionalists, explains very well why Saudi Arabia’s institutions are more abundant and stronger than Yemen’s. So, if North teaches that institutions beget wealth, the evidence before us suggests that wealth also begets institutions. And, if North teaches that institutions evolve incrementally⁷, then upon inclusion of the complementary truth we may infer that institutions and economic performance coevolve, seeking a level set by exogenous factors, natural resource wealth likely being one of them. This is a big claim. Does support for it extend beyond the Arabian Peninsula?

Social Entropy

Institutions correlate with economic performance, a fact which, in conjunction with the persuasive narrative, drives the prevailing dogma, the hypothesis that institutions beget wealth. We examine that correlation for 177 countries in a coordinate system we call the Sea of States wherein the inequality-adjusted Human Development Index (iHDI) is our proxy for wealth or individual well-being and the Worldwide Governance Index⁸ (WGI) is our proxy for institutional

⁵ North, 1981, 44.

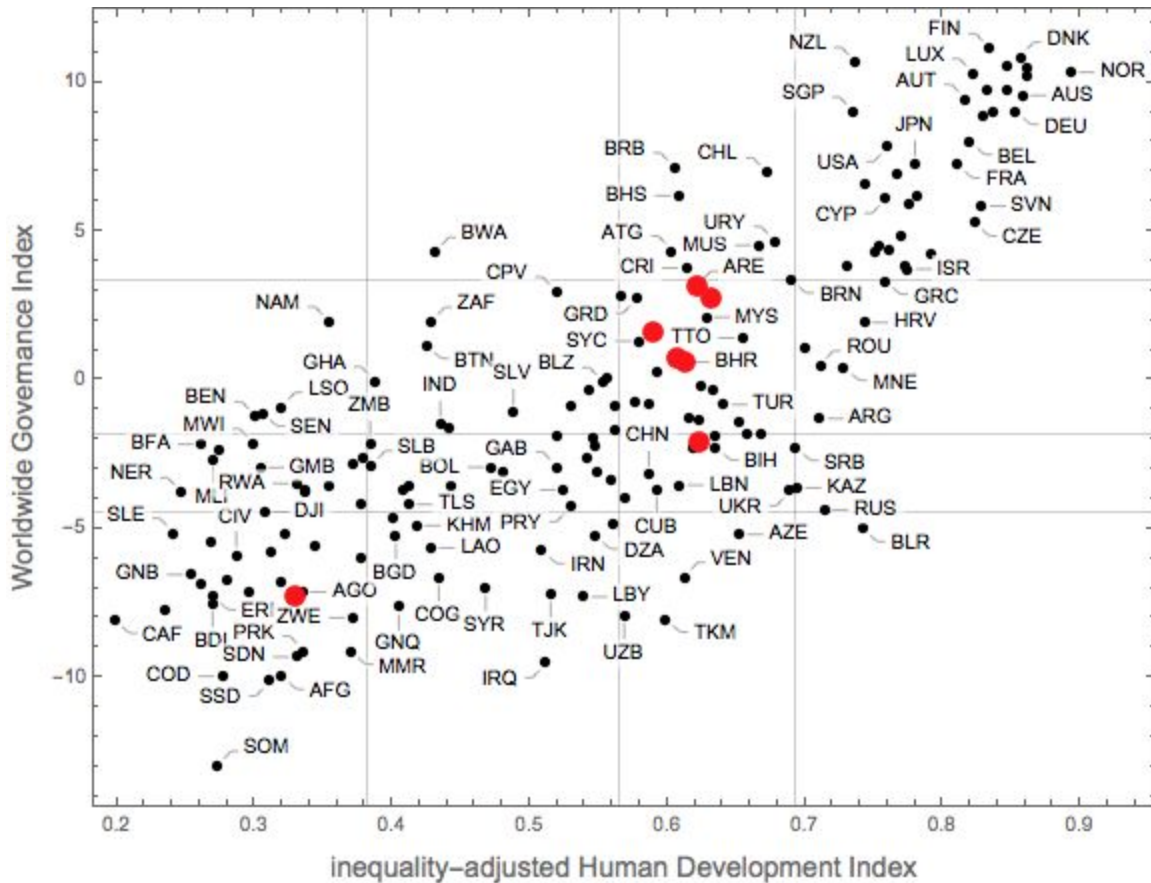
⁶ Deirdre McCloskey, *Bourgeois Equality*, University of Chicago Press: 2016, p. 112-113.

⁷ His precise wording is, [Institutions] “evolve incrementally, connecting the past with the future; history in consequence is largely a story of institutional evolution in which the historical performance of economies can only be understood as a part of a sequential story.” Douglass C. North, *Journal of Economic Perspectives*- Volume 5, Number 1-Winter 1991-Pages 97-112

⁸ We form the Worldwide Governance Index by summing all six of the World Bank’s Worldwide Governance Indicators: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption

well-being. As Figure 1 makes plain, they are not merely correlated, they are very highly correlated, an observation which neither proves nor disproves the prevailing dogma. The fact that Yemen and oil rich states of the Gulf Cooperation Council (GCC) all lie along what appears to be the first principal component of the cluster of all states should give us pause, though, because if oil wealth is exceptional, then why do the Saudi Kingdom and its brethren behave like the great majority of other states?

Figure 1: Institutional and individual well-being in 177 states.

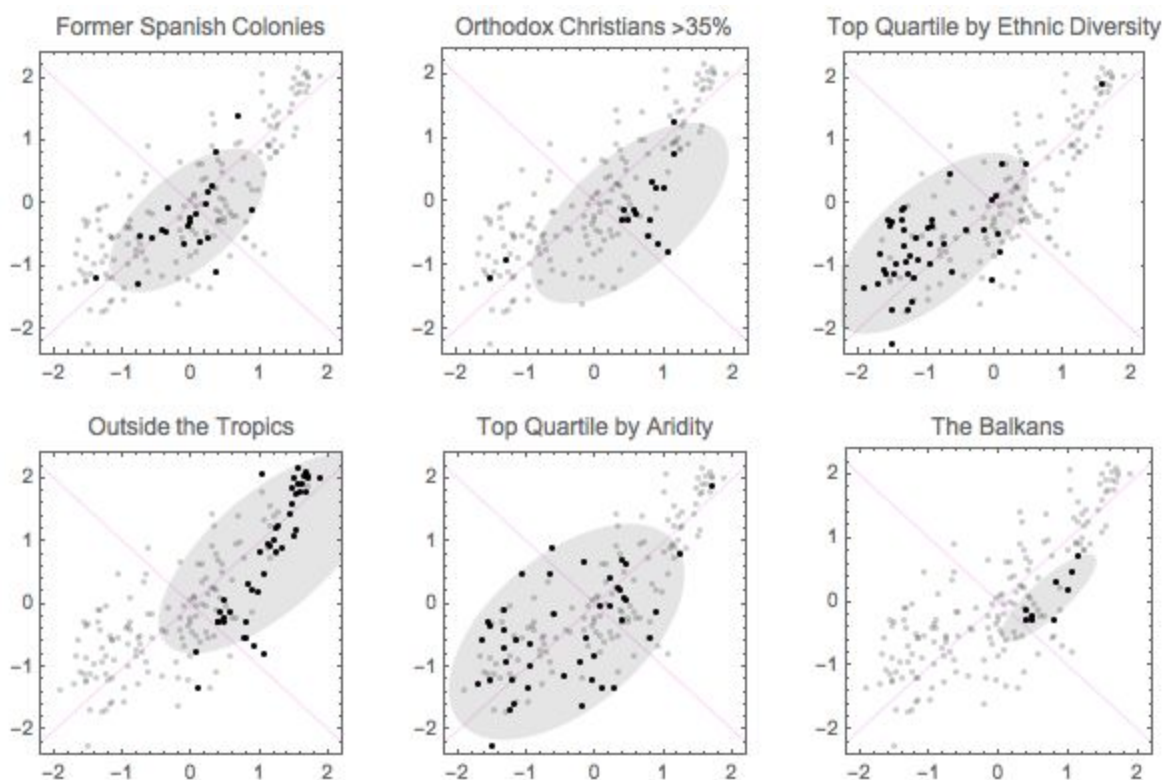


The correlation coefficient is 0.78. The seven states of the Arabian Peninsula—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the Emirates, and Yemen in the lower left— are highlighted in red. Vertical and horizontal lines are quartiles of the distributions.

Let us examine an alternative hypothesis: institutions are a form of wealth, and no more arguably first in the begetting of other forms of it than an egg is first in the begetting of chicken. Institutions cannot explain prosperity; they are a feature of prosperity. They are two sides of the same coin, expanding together in virtuous circles, or in cases of “retrogression”, vicious cycles, seeking a level, an equilibrium set by exogenous factors. We observe that level in the first principal component of the cluster, which we denote as μ .

If this were true, then we should see evidence of homophily within the macro cluster in Figure 1. That is, states that share some exogenous-factor similarity, or states with like “treatments” should cluster together in the Sea of States, or should have like μ . Indeed, the GCC show exactly that. In each of the sub-figures in Figure 2, where the data is standardized, meaning rescaled to have zero mean and unit variance in each dimension, we observe clustering in accord with treatments drawn from the usual suspects, for instance, climate, geography, religion, diversity, ideology, and conquest. Readers of a certain disposition might see in Figure 2 a path to formulating the central problem of economic history, for the entire world, as the sum of a few, carefully chosen, treatments.

Figure 2: Homophily within the Sea of States.



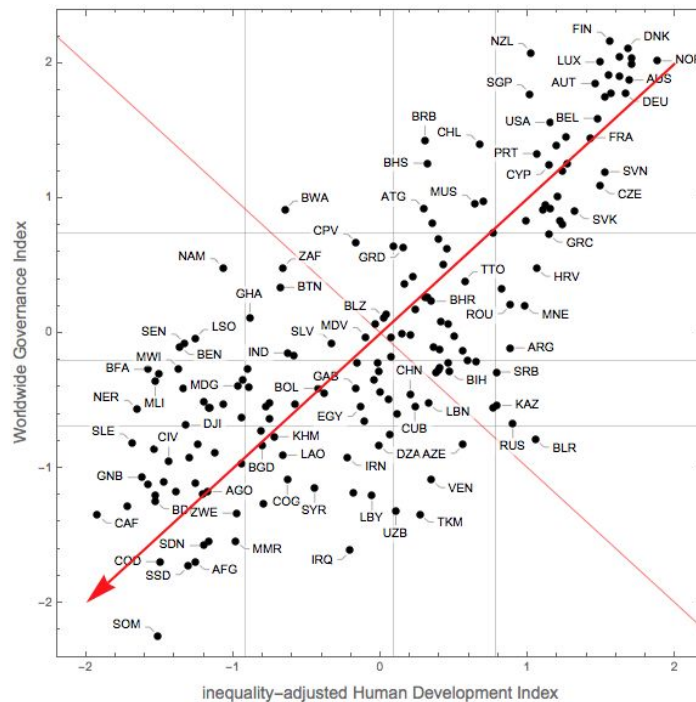
These binary, univariate, simplistic examples illustrate, and serve only to illustrate, the point that states cluster in accord with exogenous treatments. The northeast- and southeast-running diagonals are axes of the 1st and 2nd principal components, respectively, of the observable universe. For each treatment, the major (or minor) radius of the shaded ellipse is two standard deviations of the treated (black) states in the direction of the respective principal component.

On the strength of this evidence, we aver that the deployment of the prevailing dogma as an equation in which institutions play the part of cause, that is an independent variable, and wealth, however measured, plays the part of effect, that is, the dependent variable, is a tautology, a

category error. The strength of the correlation, essentially unity, obscures the impact of other factors that might matter to the procurement of both.

Thus, our contribution to the question of who has and who has not begins by first offering a new dependent variable—not GDP, nor even HDI, but a composite measure, μ , that captures attainment and governance together—and by removing both attainment and governance from the list of its possible causes.⁹ Formally, μ , is the first principal component of well-known measures of attainment and governance, namely, the inequality-adjusted UN HDI and the World Bank Worldwide Governance Indicators, respectively. In so-called standardized units, wherein the mean of the data is zero and its variance is identically one, μ is the sum of attainment and governance. It is our prerogative to choose the sign, and so we negate it. As this negated sum increases from Norway to Somalia, it seems to quantify what we mean by social, political, or economic disorder. In keeping with the best known measure of disorder, we call μ the Social Entropy. In Figure 3, the southeast-running diagonal is the $\mu=0$ contour. The lower half of the distribution, the have-nots, have abundant, positive, Social Entropy. The haves have negative Social Entropy.

Figure 3. The Sea of States in standardized units.



The arrow points in the direction of increasing Social Entropy. In these units, the range of μ is approximately -4 to 4. The southeast-running diagonal is the $\mu=0$ contour separating the haves from the have-nots.

⁹ We note, in addition, that the observed correlation is so strong that either governance or attainment would serve as a satisfactory dependent variable for modeling purposes, though Social Entropy is preferred. However, in the event that the researcher chooses to use only one, that does not free said researcher to deploy the other as an independent variable.

Homo sapiens order nature in an effort to be free of nature, and therein lies a naming dilemma. Entropy is an imperfect label because at the institutional level, order, implying lower entropy, reduces uncertainty and facilitates exchange, whereas individuals in an ordered society seem to be less constrained, implying a higher level of entropy, than in disordered ones. Obvious dyads—built around terms like civilization, complexity, fragility, freedom, and so forth—suffer similar shortcomings. While we have a measure which combines both institutional and individual elements, we select Social Entropy as a label for its institutional valence rather than for its individual sense because it is the one that seems most useful.

Social Entropy so-defined is dimensionless, relative, and per capita. If, by the waving of some magic wand, the highest entropy state was lifted out of poverty and all other nations were lifted by the same amount, μ as measured here would not change. If by the same wand, the life expectancy of every global citizen was doubled, then again, μ as measured here would not change. This kind of measure is best suited to our primary concern; why the haves have and the have-nots haven't. The question of why the ratio of infant deaths per million at one end of the spectrum is about 250 times what it is at the other, or what that ratio was before the Industrial Revolution, is beyond the scope of this work. Finally, as a per capita measure, it tells us something about the individual. Interpretation of polity-level Social Entropy, the product of μ and a polity's population, is also beyond the scope of this work.

To the early Greeks, the bright object setting in the western sky was Hesperus and the bright object rising in the eastern sky was called Phosphorus. Later Greeks recognized that Hesperus *is* Phosphorus, both being manifestations of the same wandering star, Aphrodite, or as we know it, Venus. Had those careful ancient observers not invalidated the hypothesis that two were one, Newton's quantitative gravitational astronomy would have predicted perturbations of planetary motions that did the same. While the problem with reading the relationship between institutions and wealth as sequential and unidirectional has not gone entirely unnoticed in the literature,¹⁰ the recognition that economic performance *is* institutions, both being manifestations of social, economic, and political order, or its negative, Social Entropy, is new and consequential.

With this Social Entropy variable in hand, we are positioned to evaluate order (or true 'having') as a function of a host of testable factors not themselves an integral part of the state of progress or retrogression of societies that North had as his object of inquiry. Factors typically called upon for investigation are drawn from the realms of geography, and its correlates with latitude, aridity, ruggedness, access to waterways, natural resources, and disease; demography; political competition; historical patterns of conquest and settlement; and cultural beliefs and practices. Though long and time-honored, we find this list informative but incomplete. Being incomplete, models that rely on factors only from this list will suffer from omitted variable bias.

¹⁰ Daron Acemoglu, Simon Johnson and James Robinson, "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 2001, 91(5): 1395.

The Marriage Factor

Anthropologists and social conservatives alike argue, from rather different starting points, that family is the atom of society. Yet, insofar as research assessing the effect of family on the outcomes of society is concerned, there is not so much as a molehill compared to the mountain of the others.

Consider polygyny or male plural marriage. Practically speaking, there is so little polyandry in the world that polygyny and polygamy are synonyms and we use them as such. Polygamy is an instance of marriage law. It is not about sex or sexual practices. It has nothing to do with polyamory, serial monogamy, adultery, homosexuality, or out of wedlock couplings. Under polygyny, the woman, and only the woman, resigns her right to further marriage. By its very nature, inescapably, polygamy creates an insatiable demand for, and therefore a chronic scarcity of marriageable females, not dissimilar from the case in societies experiencing very high sex ratios. Women are scarce goods and are commoditized accordingly. It follows then, by both logic and evidence, that polygamous society—where only the rare man’s harem is full and every man’s harem is under siege—is and must be one of low trust. The credo, “Me against my brother, me and my brother against my cousin, us against the tribe, and the tribe against the world,” freely embraced among the polygamous Bedouins, is emblematic of this condition.

Of low trust societies in general, Francis Fukuyama writes, “Lacking a trusted public authority, family and individuals were thrown back on their own resources and engaged in a low-level war of ‘every man against every man’.”¹¹ By that Hobbes-evoking reasoning, only the establishment of some impersonal state and the rule of law, that is political order, suffices to break the circle of distrust. The trust-corroding nature of polygamy suggests why it is that certain societies have not developed much of such political order.

Furthermore, polygamy stratifies the male population into those who have mates and those who do not.¹² Fukuyama, following Hegel, asserts that thymos¹³ is the part of the human personality that demands recognition of one’s inner dignity, and the seat of emotion of pride, anger, and of shame.¹⁴ What then of men denied mates, or men who deem themselves worthy of more mates than they have? Is there, after the first needs of food, water, and shelter, any greater need felt by humans than the need to mate? A population of men in polygamy-induced thymotic-deficit is likely to be a drag on social development, a source of Social Entropy. This is consonant with the more widely reported, though less consequential, phenomenon of elevated violence among unmarried men in high sex ratio societies.¹⁵

¹¹ Francis Fukuyama, *Political Order and Political Decay*: Farrar, Straus and Giroux, 2014, p. 100.

¹² Robin Fox, *The Red Lamp of Incest*: Dutton, 1980, p. 150.

¹³ A Greek word discussed in Plato’s *Republic*, meaning, roughly, spiritedness, is pronounced thu-mos.

¹⁴ Francis Fukuyama, *Identity and the End of History*, *The American Interest*, 08/23/2018

¹⁵ Valerie M. Hudson and Andrea M. den Boer, *Bare Branches*, MIT Press: Cambridge, 2005.

Social norms—for instance sequestration and honor killing, early marriage for females, and stratification of males according to those who can and cannot marry—are, of necessity, established to support polygamy for the few, and it is necessarily for the few. But once established, these norms take on religious, cultural, or legal status apart from their origins. Therefore, should it happen that a once-polygamous society comes to criminalize it, those norms, perceived as having nothing to do with polygamy, could persist for generations. Thus, putting an end to polygamy, as was the case for instance in the Soviet states of central Asia, does not bring a swift end to the consequences of a long history of it. Should there be any doubt as to the durability of norms, consider the Emancipation Proclamation of 1863 which brought an official end to slavery in the United States. Emancipated or not, the shadow of slavery's institutions lingers over race relations in America 155 years later.

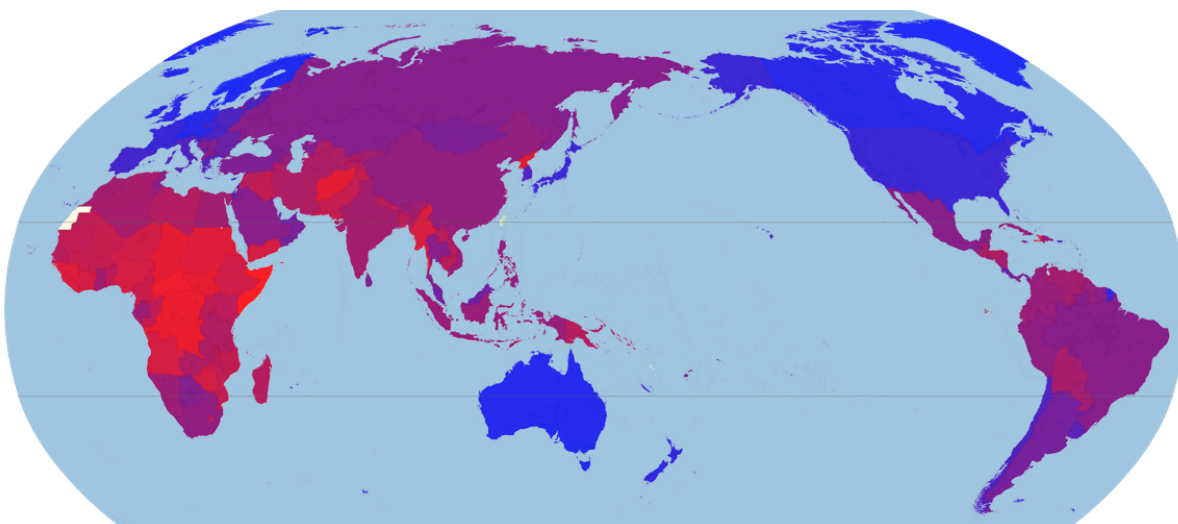
So to the list of factors that might explain the state of 'having' (or its absence) to include family law, in particular marriage law and polygamy, we add a marriage factor, *gamos*, the Greek word for marriage. *Gamos*, *g*, measures the cultural shift originating in polygamy. We expect that *g* will increase with the prevalence of polygamous marriage and, in as much as norms don't change in a day, with the period of time during which polygamy prevailed.

Now we move on to modeling μ , that is disorder or Social Entropy.

The World According to μ

Details of the 177 individual national-level Social Entropies aside, how can we explain the concentration of disorder in Africa and South Asia evident in Figure 4?

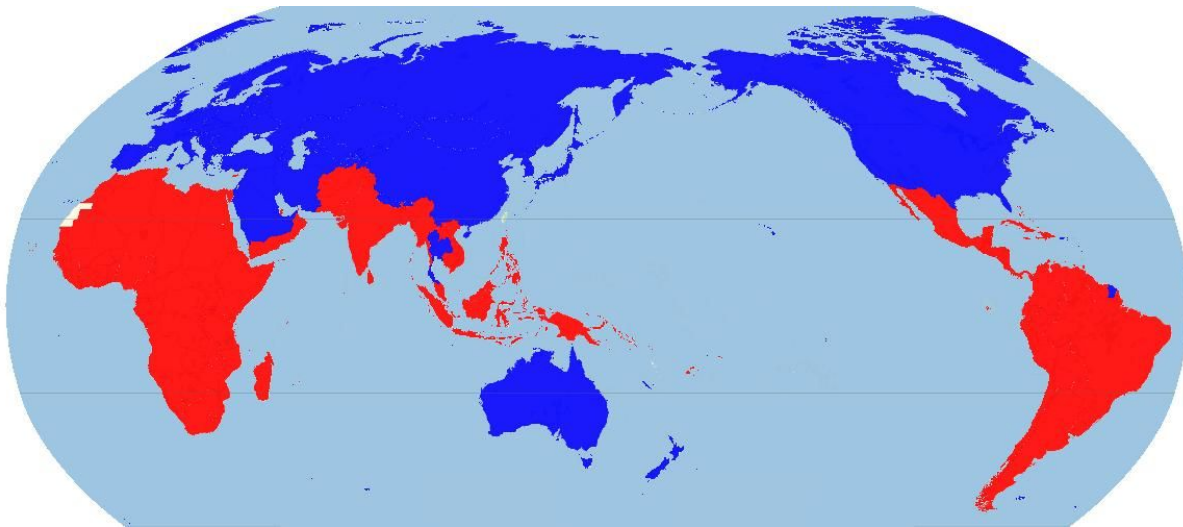
Figure 4: The disordered planet.



Social entropy, μ , is mapped on a decreasing scale from maximum (red) to minimum (blue). All countries in the world are included, other than the disputed territory of Western Sahara which is left in white.

European Colonialism, see Figure 5, is distributed more or less equally around the global south.

Figure 5: European Colonialism



Former colonies of European Empire (in red), excluding the so-called Neo Europes; Australia, Canada, New Zealand, and the United States.¹⁶

Whatever role colonialism may have played in the current state of disorder, it cannot explain the left-right asymmetry in Figure 4. That European colonialism had a much longer history in South America, where μ is relatively lower than it is in Africa, only exacerbates the problem, at least if the presumption is (and reasonably so) that time spent under conditions of colonial extractive regimes would contribute to disorder. Likewise, empire is not a reasonable explanation for the wealth and prosperity of the haves. Although some of the low- μ nations did indeed cultivate empires at one time, or even until relatively recently, this is not what made them rich. As McCloskey argues so cogently, “to suppose that the hurt from domination must somehow correspond to the economic gain from empire is a persistent error in thinking about European imperialism. Empire can be a way to a few private fortunes, such as Cecil Rhodes’s, but not to national wealth.”¹⁷

Another common proposition that fails under closer scrutiny is the most basic geographic one. Ibn Khaldun noted the effects of heat on lassitude in the 14th century.¹⁸ Montesquieu equated that with distance from the equator, and modern economists express it as the Latitude

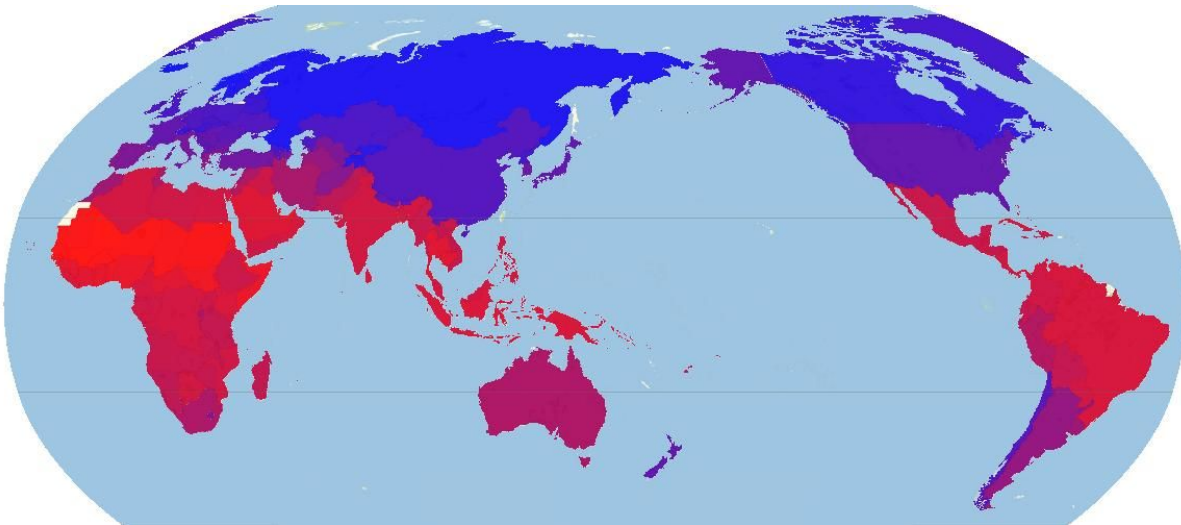
¹⁶ The Neo Europes, more properly called the New Englands, are a challenge for any economic history model because their outcomes seem to go against the grain of outcomes of other former colonies. One solution is to exclude them. But exclusion is tantamount to increasing model complexity, a price for which must be acknowledged and paid.

¹⁷ McCloskey, (2016), p. 88 and 90.

¹⁸ Ibn Khaldun (1332-1406), *Prolegomena (The Muqaddimah)*. See in particular the Fourth Preferatory Discussion of Chapter 1. The full text can be found at: https://asadullahali.files.wordpress.com/2012/10/ibn_khaldun-al_muqaddimah.pdf

Hypothesis.¹⁹ If there were ever a source term that was incapable of explaining the observed concentration of μ in the longitudes of Africa and the Near East, it is the necessarily longitude-invariant Latitude Hypothesis. Temperature on the other hand, which was the original content of Ibn Khaldun's wisdom, could, in principle, be at work, although in what specific way remains contested.

Figure 6: Country-Averaged, Mean Monthly High Temperature, 1901-2016



While this map does not suggest any particular evidence for the longitudinal configuration of μ noted above, it does reveal a marked north/south asymmetry, like μ and like colonialism. Temperature will therefore compete for attention with colonialism in any regression, and without *deus ex Neo Europa*.

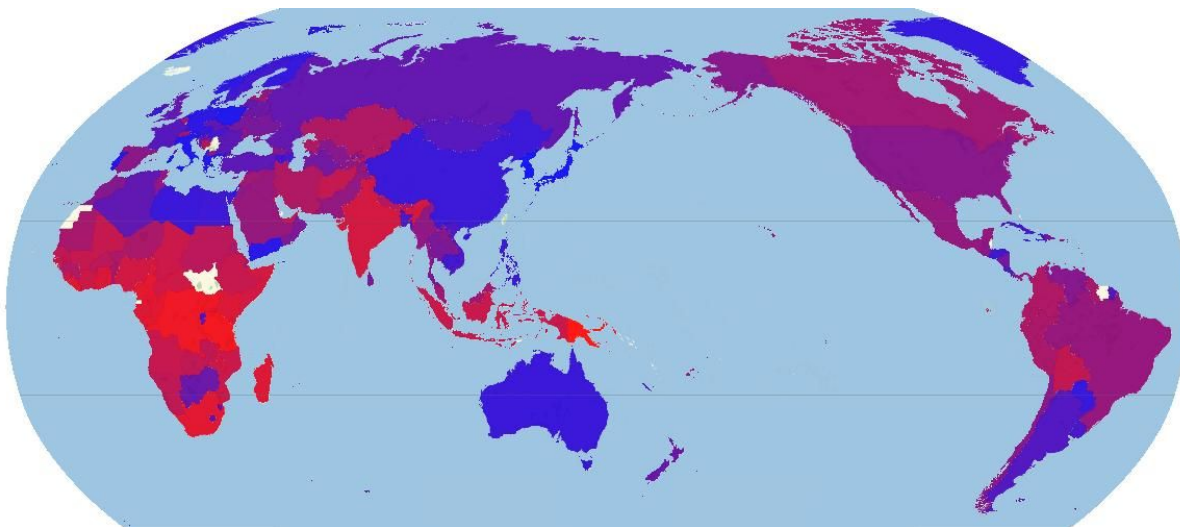
Furthermore, although we do not show equivalent maps for each of these in turn, neither Christianity nor Islam, not in toto or by sect or by combination of sects; not monotheism, or animism, or atheism; not Communism; not oil or diamonds; not even access to waterways and deep ports, or an abundance of international trade, has the observed longitudinal dependence of μ which requires explanation.

¹⁹ Montesquieu, *The Spirit of Laws*, 1750. See in particular Book XIV, Chapter 2. See also among others: Daron Acemoglu, Simon Johnson, and James A. Robinson, "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution." *Quarterly Journal of Economics*, 2002, 117(4): 1231-94; William Nordhaus, "Geography and Macroeconomics: New Data and Findings." *Proceedings of the National Academy of Sciences of the United States of America*, 2006, 103(10): 3510-17; and Jeffrey D. Sachs, Andrew D. Mellinger, and John L. Gallup, "The Geography of Poverty and Wealth," *Scientific American*, 2001, 284: 70-76.

Introducing Continental Fixed Effects or Dummy Variables,²⁰ that is, the assignment of a constant μ on the basis of geography without an associated mechanism, is a desperate measure that comes with its own price. The assertion that being in Africa makes you more inclined to social disorder, or more susceptible to disorder by colonialism or heat, carries with it a scent of racial determinism that is neither intended nor sound. Further, in an Occam's Razor sense, a price for special treatment of any group of countries must be paid.

Of all the dozens of variables we've considered, only two have the requisite asymmetry that might account for the longitudinal clustering of μ . The first of these is ethnic fractionalization. (See Figure 7.) The argument that trust erodes at ethnic boundaries, and with it the ability to form alliances over national distances, is one that can't be ignored. This distribution is good enough to make us hopeful.

Figure 7: Fearon Ethnic Fractionalization²¹



The second of them is gamos, the marriage factor, denoted as g . (See Figure 8) This is a measure that sums up the prevalence of polygamy over time. A detailed discussion of the foundation of g is beyond the scope of this manuscript²², but its distribution is in close agreement with assessments of 20th and 21st century polygamy by McDermott²³ and by

²⁰ See for example: Acemoglu, Johnson, and Robinson, "Reversal of Fortune: Geography and Institutions in the Making of the Modern World," *Quarterly Journal of Economics*, 2002, 117:1246; or Oded Galor and Marc Klemp, "Roots of Autocracy," NBER Working Paper 23301, 2017, pp. 16-17.

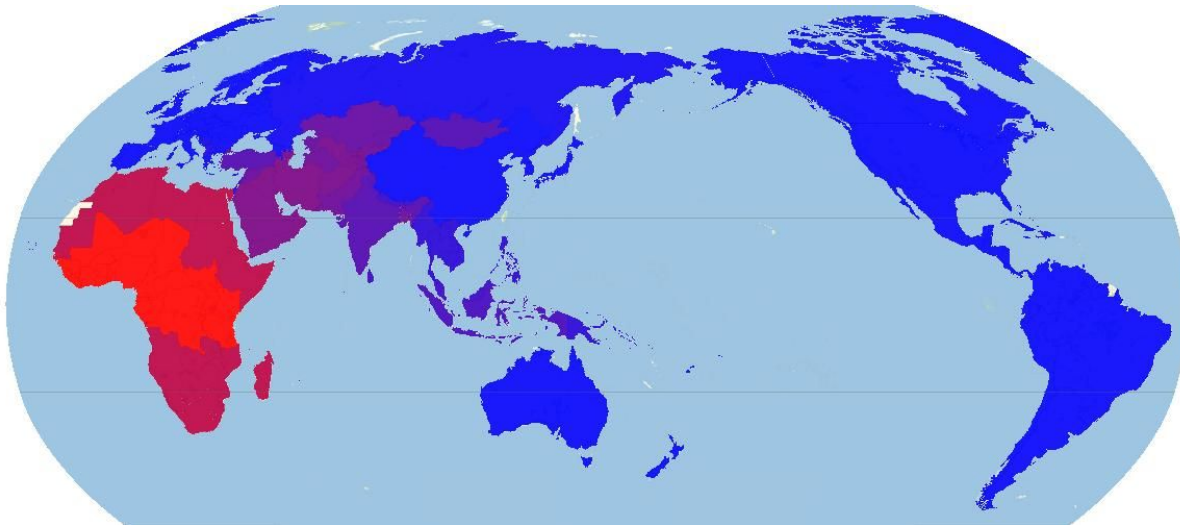
²¹ James D. Fearon, "Ethnic and cultural diversity by country," *Journal of Economic Growth*, 2003, 8:195-222.

²² Anne McCants and Dan Seligson, "The Marriage Factor", manuscript in development

²³ Rose McDermott, <http://www.womanstats.org/CodebookCurrent.htm#PW>

Fenske.²⁴ Visual inspection suggests that it has the sought after geographic alignment with the world map of μ .

Figure 8: Gamos, g , cumulative polygamy, CE 600 to the present.



Modeling and Heterodox Model Selection

Univariate analyses—for instance, each one of the map-focused short discussions above—are inherently incomplete. At most they can be suggestive. We may have disparaged colonialism for its impotence in unknotting the longitudinal dependence of μ , but that limitation says little about its importance when embedded in the context of other relevant variables. Only after multivariate analysis with model selection will we make the case that some variables are truly important and others not. For reference and for curiosity, we provide in Table 1 a list of some of the variables we test and their correlations with μ .

²⁴ James Fenske, “African Polygamy: Past and Present”, *Journal of Development Economics*, 2015, 117: 58–73

Table 1: Univariate correlations with the Social Entropy, μ .

Factor	Correlation	Factor	Correlation
Communist Legacy	0.02	Latitude	0.45
Natural Resources	0.04	Not-Spanish Conquest	0.45
Orthodoxy	0.06	Ethnic Fractionalization	0.48
Spanish Conquest	0.07	European Conquest	0.51
Longitude	0.08	Mean High Temp	0.62
Catholics and Protestants	0.21	Latitude Hypothesis	0.65
Elevation	0.23	Marriage Factor	0.70
Aridity	0.27	Lapse Rate Adjusted Temp	0.74
Islamic Conquest	0.35		

We construct linear²⁵ models of μ from N -element subsets of independent variables, and we apply the method of least squares to estimate model parameters. We select among the many tens of thousands of possible models using two separate criteria, one from frequentist statistics and a second from Bayesian. Such heterodox approaches are rare but not heretical.²⁶ First, a model is rejected if any one of its parameters is poorly determined. Quantitatively, if the t-statistic, the ratio of a parameter to its standard error, is less than 3, or equivalently if the P-value is greater than 0.02, that model is rejected. The second criterion pertains to the Bayes Factor, B , an *a posteriori* summary of the evidence provided by the data in support of a statistical representation of theory,²⁷ that is, of a model. In this formulation, all theories are assumed to be equally likely *a priori*. B increases in tandem with (i) unexplained model variance and (ii) model complexity, N . Given two explanatory models of the same data, there exists more evidence in favor of the one with lower B , and thus the Bayes Factor is a quantitative, dimensionless Occam's Razor. The Bayes Information Criterion, BIC, is an easy-to-calculate approximation to $2 \cdot \text{Log}(B)$. Kass and Raftery teach that models are practically indistinguishable if $\Delta\text{BIC} < 6$, where ΔBIC is the difference between their respective BICs,²⁸ as summarized in Table 2. The evidence in favor of the model with the lower BIC mounts exponentially thereafter.

²⁵ To assume anything other than linearity as a point of departure is to impose some judgement that the simplest of all possible models, linear models, are inadequate, a judgement that cannot be reached without having first gone through the process of evaluating linear models.

²⁶ Kass and Raftery, "Bayes Factors," *Journal of the American Statistical Association*, 1995, 90(430):789-790.

²⁷ Kass and Raftery, 1995, 777.

²⁸ Ibid.

Table 2: On using BIC for Model Selection

$\Delta BIC = BIC(\text{model 2}) - BIC(\text{model 1})$	Evidence that Model 1 is preferred
0 to 6	weak
6 to 10	strong
> 10	very strong

Given two models, Kass and Raftery offer these guidelines for discriminating between them. Model 1 is assumed to have the lower BIC.

We proceed as follows: From the set of all N -parameter models, we compute BIC for each one and then find the minimum, DKE_{okp}^P . We select for consideration and analysis all those and only those models satisfying $DKE_{okp}^P - DKE_{okp}^{P-3} \leq 6$. Then we increment N and repeat the process. As N increases and the unexplained model variance decreases, we will find for each succeeding N that $DKE_{okp}^{P-3} < DKE_{okp}^P$ until such time as the penalty for additional complexity is offsetting.

Bear in mind that this approach makes R^2 , the fractional explained variance, an output of model selection, not an input to it. Adding complexity leads to overfitting, as William of Occam intuited eight centuries ago, so we must be somewhat skeptical of R^2 when comparing models of different complexity. The complexity penalty baked in to BIC is an explicit embodiment of Occam's warning. What about when comparing models of the same complexity? The BIC cautions us again, but for a different reason. Consider a family of pretty good N -parameter models, each of whose R^2 is close to the others, whatever close may mean. For a dataset of n points, we may write for any two such models,

$$DKE \approx p, \frac{T^4}{3 T^4}$$

If $R^2=0.67$ and $n=177$, as we have, the selection criterion, $\Delta BIC=6$, is triggered when $\Delta R^2=0.01$. But does any researcher take such small differences in R^2 seriously? We state without proof that the answer to this question is no. Thus, pretty good models of the same complexity may have substantially identical R^2 and yet substantially different BIC. It follows that R^2 is of no use as an input to model selection.

In an ideal world, the optimal N will be easily discerned, there will be only one model satisfying the condition $\Delta BIC < 6$, and the output of model selection will be unambiguous. Should it happen that we do not live in an ideal world, and if we find a large number of optimal but indistinguishable models, or models that are optimal by this measure yet which defy understanding, or no models which satisfy us on the basis of their complexity, quality, or implications, we will reject the hypothesis that this approach is any better than the prevailing dogma that we critique here.

The Selected Model

Of the dozens of variables we've considered and the tens of thousands of possible combination models they've spawned, a single 5-variable model, \mathbf{u} , survives Heterodox Model Selection. Its variables, chosen by the selection algorithm, not hand-coded, are climatological, geographic, geological, political, and social. The climate and social variables, both discussed and illustrated above, are mean monthly high temperature, in °C relative to the global median, and the marriage factor, on a scale we have coded from 0 to approximately 4. In this system, 0 corresponds to practically no polygamy, and 4 corresponds to a time-averaged polygamy-prevalence of 25%, that is one of every four married men has two wives or more. The period of time-averaging is 600 CE to the present.

The geographic factor is mean elevation, L , specified in kilometers above sea level. High elevation demands remoteness from deep water ports and therefore implies obstacles to trade, not to mention terrain that is difficult to navigate and cultivate, and harsh weather, too. Elevation is a good proxy for what is disparagingly called Geographic Determinism. Air cools as it rises, at a rate of about 6.5°C per kilometer, a property known as the lapse rate. Though model selection treats T and L as independent variables, we ask about the magnitude of their coefficients in \mathbf{u} . Table 1 says that their ratio is 6.9, a value very close to the lapse rate. If we specify L in units of temperature, then the observed correlation of Social Entropy and lapse-rate adjusted temperature, $T^*=T+L$, is larger than that of any single variable.

An abundance of natural resources, in particular oil, is a major contributor to the wealth of some nations. It would be disconcerting if some measure of it did not appear as an important independent variable. Our term, NRR , is the logarithm of natural resource rents per annum²⁹ per capita, normalized on a scale from 0 to 1. The fifth variable, CCW , codifies a polity's legacy of Communism and the Cold War, and is equal to the duration, measured in decades, of its communist rule.

Expressed as a linear equation, \mathbf{u} is:

$$? \quad 2 - "V - "N" - "PTT - "EEY - "i$$

Not surviving the selection criteria are climate variables linked to aridity, precipitation, transpiration, and the Latitude Hypothesis. Also rejected are density, land mass, terrain ruggedness, Continental Fixed Effects, World War II, various encodings of European and Islamic conquests, and anything to do with religion or ethnicity.

²⁹ World Bank, <https://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS>

Economists are wont to construct models whose variables are specified in dimensionless units on a scale from 0 to 1, as doing so facilitates comparison. Chief among the good reasons for not doing so is that such models are neither easily interpreted nor applicable for use by non-economists. In an effort to reach such non-economists, we use conventional or native units where possible.

As for the overall quality of \mathbf{u} , whose parameter values are summarized in Table 3, the explained variance, $R^2=0.81$. This rather large value suggests that no nonlinear analysis³⁰ or econometric gymnastics is warranted. More telling is the standard deviation of \mathbf{u} 's residuals normalized to the range of Social Entropy, $\sigma=0.11$. Exploiting μ 's logarithmic dependence on GNI³¹, we infer that in $\frac{2}{3}$ of all cases, \mathbf{u} 's prediction of GNI falls within a range of -43% to +76% of its observed value. A more detailed discussion of the effects of input and output noise is beyond the scope of this paper.

Table 3: A summary of the selected model, \mathbf{u} .

variable	symbol	units	parameter	t-statistic	oomph ³²
constant	N/A	N/A	$\mu_2 = 20.8$	8.0	N/A
Temperature	T	°C	$\mu_T = 20.8$	15.4	4.9
Elevation	L	km	$\mu_L = 30$	8.4	3.2
Natural Resources	NRR	N/A	$\mu_{NRR} = 30$	4.1	1.9
Communist Legacy	CCW	decades	$\mu_{CCW} = 20.3$	10.9	2.3
Marriage Factor	g	N/A	$\mu_g = 20.7$	9.9	2.0

Models were culled if the t-statistic of each of its parameters did not exceed 3. In \mathbf{u} they exceed 4, implying P-values of less than 6×10^{-6} . Oomph, a colloquial term, is the extent to which a variable may move, whose own range is approximately -4 to 4. In models whose dependent and independent variables are placed on a scale from 0 to 1, the regression coefficients themselves are the oomph.

³⁰ Elements of a long but not exhaustive list of 2nd order terms has been tested and rejected.

³¹ We state without proof that the following is approximately true: $\mu = \text{constant} - \log_2(\text{GNI})$.

³² With appreciation for the use of this term to Stephen Ziliac and Deirdre McCloskey, *The Cult of Statistical Significance: How the Standard Error Costs Us Jobs, Justice, and Lives*, University of Michigan Press, 2008.

And what do we learn? Ibn Khaldun was right; heat and lassitude go together like macaroni and cheese, to paraphrase George Eliot.³³ Ruggedness is bad, moreover, as we have learned from Jared Diamond³⁴ and Jeffrey Sachs.³⁵ Natural resources, though sometimes a curse, are in general a blessing, that is, ordering. A decade of communism costs its citizens approximately 20% in annual income. And finally, polygamy is a major source of disorder in more than half the world's nations. This is a plausibly fixable problem, though it might take several hundred years to get the new ethics and gender equity norms sorted out.³⁶

Conclusion

This paper makes four broad claims and offers a new answer to the vexing question of how the distribution of attainment and good governance has come to be, two centuries on since the advent of the Industrial Revolution and the 'Great Enrichment' that accompanied it.³⁷ The claims are these.

1. North's core insight about the absolute necessity of institutions of trust and legitimacy for economic development is that institutions beget wealth, however measured, is incomplete. Good institutions and wealth are mutually reinforcing strands of development, no more isolable than two poles of a magnet. As long as social scientists place institutions on one side of their models and attainment on the other, those models will mislead and social scientific understanding will suffer.
2. Owing to their inseparability, either wealth or institutional health may serve as a reasonable objective function for modeling, but a measure that combines both, in open recognition of the observation that life without society is nasty, brutish and short would be better. The first principal component of governance and individual attainment together, what we call μ , disorder, or Social Entropy is such a measure, and as such is a superior objective function against which to construct a model of the sources of the Great Divergence.
3. Humans order nature to free ourselves from the constraints of nature. We innovate. But sources of disorder, that is positive terms in the selected model, obstruct innovation. We speculate that this explains why the Industrial Revolution emerged where it did as well as where its fruits have been adopted. However, societies encumbered with conditions

³³ George Eliot, *Romola*, 1863, "Good-day, Messer Domenico," said Nello to the foremost of the two visitors who entered the shop, while he nodded silently to the other. "You come as opportunely as cheese on macaroni." <https://www.gutenberg.org/files/24020/24020-h/24020-h.htm>

³⁴ Jared Diamond, *Guns, Germs, and Steel*, W.W. Norton: NYC, 1997.

³⁵ Jeffrey Sachs, *Institutions Matter, but Not for Everything*, 2003, <https://www.imf.org/external/pubs/ft/fandd/2003/06/pdf/sachs.pdf>

³⁶ In as much some states have 10^5 citizens and some more than 10^9 , a proper accounting of the global impact of these different parameters demands a more subtle analysis beyond the scope of this work.

³⁷ This phrase is offered by Deirdre McCloskey in her trilogy about the state of having, the most recent installment of which is, *Bourgeois Equality: How Ideas, Not Capital or Institutions, Enriched the World*, University of Chicago Press: 2016.

that fuel Social Entropy do not nurture innovation. Indeed, they have often been outright hostile to it, even when possible welfare benefits are in plain sight. Social Entropy offers a compelling answer to Avner Greif's question about the failure of "successful" institutions to be broadly adopted.

4. Family law matters. The chronic scarcity of marriageable females that is an inescapable consequence of polygamy produces a pervasive culture of distrust that acts as a brake on the development of institutions essential to individual development and political order. This is consonant with its less consequential but better known sister effect in high sex ratio societies. A new measure of polygamy that accounts for its long term influence is needed. When this marriage factor, g , is omitted from development models where g is non-zero, they will suffer accordingly.

The factors that do emerge as explaining the global distribution of μ do so with vigor and robustness of fit. One, temperature, is a variation on an old proxy, latitude. The other is a long-overlooked variable of marriage law and practice, specifically the taking of multiple wives by one man. Gender equality as a precursor of economic development is an idea that has gained a fair degree of traction in the recent literature, but polygamy is on few people's radar, especially in the West where it is only infrequently in evidence. Yet this is not the situation globally. Nor should we be surprised that the structure of the family should matter so fundamentally to economic development. After all, family is the atom of society, and as such it is the locus where habits of trust, and institutions of legitimacy are either developed or not. Our first education in ethics is found in the family, in the values (or virtues) that radiate out into the larger society where they continue the work of either facilitating innovation or squelching it, and of enhancing knowledge accumulation or closing it off to secrecy or hoarding. Furthermore, commoditizing women, as polygamy so forcefully does (even more so than high sex ratios alone) introduces sources of instability and violent competition over the scarce resource (marriageable women) that directly translate into Social Entropy, destabilizing the institutions of trust and legitimacy required for economic development -- or more accurately, never letting them form in the first place.

To close then, we return to the place that we began, with an insight from Douglass North. In the Preface to *Understanding the Process of Economic Change* he writes:

"economic change, therefore, is for the most part a deliberate process shaped by the perceptions of the actors about the consequences of their actions. The perceptions come from the beliefs of the players... The focus of our attention, therefore, must be on human learning – on what is learned and how it is shared among the members of a society and on the incremental process by which the beliefs and preferences change, and on the way in which they shape the performance of economies through time."³⁸

³⁸ Douglass North, *Understanding the Process of Economic Change*, Princeton University Press: 2005, viii.

What more critical site of human learning is there than the family -- the first and often most persistently influential wellspring of our beliefs, preferences, and values? Where else do we learn so well behavioral norms, which when dysfunctional nonetheless prove incredibly resilient to re-education despite the tremendous social resources which are often employed to that end? Economies cannot grow without trust at ever greater levels of remove, yet trust in agglomeration institutions is hard to develop, and especially so if trust has not first been learned in the family. Family institutions that work against trust, such as polygamy quite spectacularly, must take their rightful place at the top of the list of explanands for the persistence of 'not having' in sadly too many regions of the world.