Abstract:

The central quest of economic history is to explain why the haves have and the have-nots haven't. Inspired by the work of Douglass North on institutions, their evolution, and their role as the constraints of economic performance, much contemporary scholarship reduces to a treatment of institutions as cause and of income as effect. The undue primacy given to institutions in a dynamical system which is inherently symmetrical and coevolutionary, has obscured the dominant feature of that system, its equilibrium, whose signature is the 1st principal component of the inequality-adjusted Human Development Index from the UN and the unweighted sum of all six Worldwide Governance Indicators from the World Bank. We call this measure of social, economic, and political disorder, the Social Entropy.

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“The same equations have the same solution.” - Richard P. Feynman

Introduction

Why are there rich countries and poor ones? Why does political order exist in some places and not in others? Or, to use Hemingway’s phraseology as echoed by UNESCO, the PEW Research Center, and others concerned with the matter of international and domestic development, why do the have-haves and the have-nots not? This is the central question of Economic History. Douglass North writes in answer:

“Institutions are the humanly devised constraints that structure political, economic, and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, and property rights). Throughout history, institutions have been devised by human beings to create order and reduce uncertainty in exchange. Together with the standard constraints of economics they define the choice set and therefore determine the transaction and production costs and hence the profitability and feasibility of engaging in economic activity. They 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. Institutions provide the incentive structure of an economy; as that structure evolves, it shapes the direction of economic changes towards growth, stagnation, or decline.”

Figure [1] is a simplistic but nonetheless instructive illustration of the aforementioned incremental evolution connecting the past with the future.

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2 Hemingway, E. To Have and Have Not
5 North, Institutions, J Econ Perspectives, 1991 p.97

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Figure [1] In this illustration of history as institutional evolution per North, a state’s institutions at time (1) engender economic growth, whose proceeds at time (2) fund the construction of new institutions, engendering more growth, and so on until a later time (3).

North’s *Institutions, Institutional Change, and Economic Performance* is among the 25 most cited books in the social sciences, so perhaps everything worth saying about it has been said, but then again, perhaps not. Three decades later, and nearly 50 years since the birth of the New Institutionalism, the central question remains open, and we have little understanding of, as Francis Fukuyama put it, why China, the first bureaucratic state, crystallized into existence from tribal society. Nor do we have agreement across the social sciences about what institutions are, how they form, and what role they play. The analytic sociologist Mark Granovetter, writes that

“norms, culture, and institutions are important influences on economic action, but far less coherent and more variable than often portrayed. [...] We need much more theoretical attention to the processes that create over a long period of time in a society the particular set or “menu” of perceived viable alternatives that actors call upon in solving economic problems, how [...] solutions themselves circle back to impose norms, culture, and action in ways that shape future activity.”

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7 Green, Elliott, *What are the most cited publications in the social sciences according to google scholar?*, London School of Economics Blog, http://bit.ly/2I6rZtL  
8 Citation Needed  
9 Fukuyama, Francis, *Origins of Political Order*, p97  

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We argue that real progress towards the central issue of economic history and economic development, which “is to account for the evolution of political and economic institutions that create an economic environment that induces increasing productivity,” remains elusive because the prevailing dogma, that institutions beget wealth, is incomplete; indeed, it is not even half of the story.

We offer no principled objection to dogma. For instance, the central dogma of molecular biology, that DNA begets RNA and RNA begets protein, simplifies a complex reality. Can one argue that progress in molecular biology has not inspired awe, even if the simplification shows signs of age after 60 years? But when dogma does not lead to much progress after 30 years, then it is time to question the dogma itself.

It is our aim to address the central question of Economic History, that is, to investigate and ultimately to quantitatively explain \( D \), the global distribution of wealth, with a compact model, \( M \), that has the whiff of causality. In this first of several papers, we document the origins and shortcomings of the prevailing dogma. This suggests both a new variable, one we introduce as the Social Entropy, \( \mu \), and a framework for using it to construct \( M \). A world map of Social Entropy suggests some likely causal suspects. In forthcoming work we introduce time-dependent equations for \( \mu \) and discuss the short- and long-term stability of its distribution. Using the aforementioned framework, we show a 5-variable \( M \) that explains more than 80% of the observed variance of \( D \).

The Prevailing Dogma and the GCC

“The Colonial Origins of Comparative Development” by Acemoglu, Johnson, and Robinson, it’s long form companion, *Why Nations Fail*, and “Institutions Rule” by Rodrik, Subramanian, and Trebbi, are founded on North’s assertion that “institutions are the rules of the game.” These widely cited works serve as templates for a large body of scholarship across social science disciplines and in the policy world. The resulting econometric models are predominantly static, such as Equation [1] below, in which wealth, income, or some other measure of economic performance (typically GDP) is the dependent variable, \( U \), while institutional health, \( I \), and a selection of factors drawn from geography, geology, climate, colonial history, legal history, and

\[ U = \alpha I + \beta_1 G + \beta_2 C + \beta_3 C_l + \beta_4 C_m + \beta_5 C_e + \beta_6 C_g + \epsilon \]

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11 North, Institutions, p98  
12 To say that the dogma is prevailing does not mean that it is universally acclaimed. See Deirdre McCloskey for a pointed critique. Also, ….  
13 Francis Crick, 1958.  
14 Missing reference on epigenetics  
15 McCants and Seligson, *Economic History: A Model*, in manuscript  
16 AJR 2001  
17 Why Nations Fail, Acemoglu and Robinson.  
18 Institutions Rule, Rodrik, 2004  
19 North, 1990, p. 3
religion, for instance, comprise the set of independent controls. The superscripts denote the individual polities.

\[ U^j = \alpha \times I^j + f(x_1^j, x_2^j, \ldots, x_n^j) \]  \hspace{1cm} \text{Equation [1]}

These are multivariate encodings of the dogma that institutions beget wealth. Being static, they ignore the time-dependence implicit in North’s formulation and as illustrated in Figure [1]. Has begetting been assumed to be instantaneous, at the expense of the temporality condition of causality; that is, the requirement that cause precede effect? Or do these equations purport to explain time averaged or equilibrium behavior? It is not clear, but few objections have been raised by North or others.

If these ideas and the accompanying methodology are to promote the construction of a global model of Economic History, then we would hope to see some kind of monotonic relationship, as in Figure [1] though not necessarily linear, when nation-level wealth is plotted against nation-level institutional health.

As a proxy for national-level wealth, though most researchers use GDP, we prefer the inequality-adjusted Human Development Index (iHDI) from the United Nations. GDP is adequate as a measure of gross domestic production for a single country, and reasonably well-suited to longitudinal studies of a single nation, but is not at all suitable for our purposes. For instance, the GDP of Japan (JPN) in 2017 is materially the same as that of Equatorial Guinea (GNQ). Yet it is only by GDP that Equatorial Guinea is among the haves of this world. By infant death rate per million, GNQ ranks 158th out of 175, and JPN ranks 1st. To ask a model to predict the anomalously high GDP of GNQ is to ask too much. We could, of course, drop GNQ from our data set, but on what basis, and at what cost to understanding? The UN’s Human Development Index has fewer such anomalies because it incorporates different measures of having, thus averaging out the anomalies and leaving us with a better measure of having by another name, that is, human development.

As a proxy for nation-level institutional health we utilize the unweighted sum of the World Bank’s six Worldwide Governance Indicators: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. We call this the Worldwide Governance Index, WGI.

Locating each of 177 countries in a coordinate system of iHDI and WGI, a plane of institutional and economic well-being we sometimes call the I-E plane, we obtain Figure [2]. The wealthy states of Northern Europe, states often used as case studies of political order, have strong

\[ \text{Models that predict growth rates are not subject to this criticism.} \]
\[ \text{The table of iHDI and explanatory notes are given in online Appendix A} \]
\[ \text{The table of WGI and explanatory notes are given in online Appendix B} \]
\[ \text{Fukuyama, The Origins of Political Order, p. 14.} \]

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institutions, and the poor states of Africa have weak ones. The relationship is evidently monotonic, as hoped for, and conveniently linear; the correlation coefficient is 0.78.

The high degree of correlation in the distribution of states, $D$, is the schematized behavior of Figure [1] reassuringly writ large; every state appears to be on a path of migration that is $D$’s trendline. This suggests that Equation [1] is a faithful expression of some average behavior. However, it seems too good to be true. States outside the West have rich institutions that are absent in the West, and yet this chart says that individual longevity and prosperity around the globe is determined only by the extent to which governments have adopted the West’s rulebook. We state without proof that human development anti-correlates with indices that track institutions that are absent in the West. This is a blow to cultural relativists everywhere, but also a blow to Ayn Rand’s subscribers for whom anarchal capitalism is Utopia. In the universe described by $D$, there’s no evidence that anarchy leads to long prosperous lives across a polity’s population, only evidence that it leads to the opposite.

Also, consider Botswana (BWA), whose governance is on par with Israel (ISR) as shown in Figure [2]. Is the former on the verge of becoming the technology powerhouse of Africa, as Equation [1] would suggest, or is the transmutation of the exogenous factors through $f(x)$ so profound as to preclude that. And if $f(x)$ is powerful in the case of BWA, why does the $\alpha l$ term dominate it for almost all other states? You needn’t be a geographic determinist to stand with Jared Diamond or Jeffrey Sachs and acknowledge that climate and geography play a role in social, economic, and political development. You needn’t believe that natural resource extraction by foreign or local players is the be all and end of all of world history to believe that it has played a role in that same development. And you needn’t be a cultural anthropologist to believe that kinship and family matter too. Were there not the whole body of New Institutionalist scholarship behind the reasoning that led us to produce this figure in the first place, we would be tempted to trot out the true but tired trope that correlation is not causation.
More troubling is the fact is that one-way progression of institutions begetting wealth, as encoded in Equation [1], cannot be the whole story. Consider the seven red-highlighted states of Figure [2], Yemen in the lower left and the six members of the Gulf Cooperation Council or GCC: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates in a cluster near the center. Which came first, GCC oil or GCC institutions? The former. Therefore wealth begets institutions in this case. Also, the strong institutions of Yemen’s ancient past have not served it well in the modern world and the historically weak institutions of the GCC states have not been an insurmountable impediment to the harvesting of fossil fuel rents. Without oil, they could be Yemen, more or less. One may argue that the GCC are somehow exceptional desert anomalies beyond explanation given our methods, and thus should be excluded from consideration. But this case of gushing oil is not anomalous at all. It is an example of a general
rule that has escaped no one; institutions are expensive. This happens to be true whether the expense is paid in treasure or in time. Taboos and traditions—examples of informal institutions noted in the citation opening this paper—might as well be called culture, and we state without more than anecdotal proof that cultural change evolves on a time scale of centuries; to wit, the United States ended its slave era by proclamation, but its cultural echoes still reverberate 155 years after the fact.

Thus, as the simplistic characterization of North in Figure [1] makes clear, by virtue of the fact that the stair step of progress could have begun as easily at (2) as at (1), and as the examples above confirm, institutions beget wealth and wealth begets institutions. Neither is any more first in the pecking order than chicken is before egg. They coevolve.

A coevolutionary model of wealth-spawning institutions and institution-spawning wealth must be a dynamical system. The static models that put institutions on one side and wealth on the other ignore coevolution. They ignore the fact that coin- or resource-denominated wealth may precede institutions, as they have done in the oil-rich Persian Gulf, thus engendering Granovetter’s gentle critique, cited above, that institutional influences on the economy are “far less coherent and more variable than often portrayed.”

A Dynamical System with Dissipation

A dynamical system need not be in motion. A struck bell rings only so long. A child on a swing comes to rest. A dynamical system with dissipation seeks a static equilibrium. Imagine an object, \( O \), held in place by two firmly anchored springs. The springs and \( O \) lie along a line defined by the anchor points, A+ and A-. If given a longitudinal displacement and then released, \( O \) will return to equilibrium. Its motion, oscillatory or not, will depend on its mass, the stiffness of the springs, and the precise nature of the dissipative forces. If the stiffness of one spring is increased, the position of static equilibrium will shift toward the stiffened spring’s anchor. Given a transverse displacement, that is if \( O \) is plucked like a string, it will also return to its point of static equilibrium. Longitudinal and transverse displacements obey different dynamical equations.

The dynamical system of a polity’s economic performance and institutional well-being behaves like the system described above. Behind the scenes and over a long period of time, the exogenous factors \( x = x_1, x_2, \ldots, x_n \) of Equation [1] act to create the conditions for the formation of institutions that support economic performance and vice versa. The transduction of \( x \) by

\[ x(n + 1) = a \cdot x(n) + b \cdot u(n) + c \cdot D(n) \]

where \( a \), \( b \), and \( c \) are parameters, \( u(n) \) is the control input, and \( D(n) \) is the disturbance input. The stability of the system is determined by the eigenvalues of the matrix \( A \) associated with the linearized system about the equilibrium point. If the real parts of all eigenvalues are negative, the equilibrium is stable; otherwise, it is unstable.

We leave a discussion of our proposed dynamical equations for a forthcoming publication on the stability of distributions of \( D \) in the I-E plane.

As we have noted earlier, static models ignore time dependence and thus evolution itself, too.

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means of something like $f(x)$ corresponds to the forces of the aforementioned springs whose characteristics determine $O$'s position along the axis of the 1st principal component of the two-dimensional dataset of WGI and iHDI in Figure [2]. In equilibrium, the dynamics are irrelevant, except for the fact that they guarantee a return to equilibrium after a shock.

What we observe in the I-E plane is an ensemble of polities near equilibrium, though how near depends on local history. A glance at the states furthest below the line, e.g. Somalia (SOM), Iraq (IRQ), Turkmenistan (TKM), Venezuela (VEN), and Belarus (BLR), suggests that the recent history of civil war, oil, external intervention, and Communism is particularly salient. It is not possible to discern longitudinal disequilibrium without a putative model, $M$. However, the ratio of variances of the 1st and 2nd principal components is about 9:1, suggesting that the transverse effects, which sooner or later dissipate to zero, are much less significant than the presumably longer term longitudinal effects which locate $O$ somewhere along the line between SOM and DNK. Among the justifications we can offer at this time for why we presume the longitudinal effects are longer term than the transverse ones is the following: the transverse effects appear to be driven by events of the last century, whereas the relative strength of the European economies in the northeast corner of Figure [2] has been little challenged for several centuries. This observation about time scale implies something about the GCC states. Lying close to the axis of the first principal component, as they do, we may infer that the long term potential of these states to become Denmark is small, and that their potential to become the another Yemen will be determined by how effectively these states convert their exhaustible oil capital into relatively inexhaustible human capital.\footnote{Why is human capital relatively inexhaustible? Because children are imbued with human capital at home. As adults, they parent as they were parented, thus imbuing their own children with the human capital inherited from their parents. It is the persistence of human capital by these processes that explains the long (mostly forward) march of technological innovation as well as the persistence of culture, for better or for worse.}

Let us put aside for the moment the matter of dynamical systems and consider again the observation that institutions are expensive.

Two Simultaneous Equations

In the real world, not the world of models and theories, but the actual world of casbahs and Silicon Valleys, “Cash is King” is one way of expressing the idea that growth depends on cash. Only with cash, whether it is capital or income, can you buy raw materials, build product or inventory, maintain systems for quality control, establish sales channels, or invest in and be ready for the future.

This suggests that for every Equation [1] there must be a twin of the same form with the roles of I and U reversed, and that we may use standard methods to solve the resulting system of simultaneous equations. Equations [2a,b] are Equation [1] and its twin, with the substitutions I=WGI and U=iHDI.

\footnote{Anne McCants and Dan Seligson}
$iHDI^i = \alpha \times WGI^i + f(x_1^i, x_2^i, \ldots x_n^i)$  

Equation [2a]

$WGI^i = \beta \times iHDI^i + g(x_1^i, x_2^i, \ldots x_n^i)$  

Equation [2b]

Let us now reconsider Figure [2] in standardized units, that is, with zero mean and unit variance, as in Figure [3].

Figure 3. The I-E plane of Figure 2, but recast in units of zero mean and unit variance, wherein the principal components are, respectively, the sum and difference WGI and HDI. The 1st principal component defines the $\mu$-axis, shown here as the blue arrow pointing to states of high social, political, and economic disorder. The other arrow, the 2nd principal component, $\kappa$, is shorter by 3:1, the ratio of the standard deviations of $\mu$ and $\kappa$. Gridlines delineate quartiles of WGI and iHDI. In as much as the diagonals

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cross at the identically-zero means of those distributions, we see that the means and medians are close. Loosely speaking, the haves and the have-nots cleave along the kappa axis, the mu=0 contour.

We have asserted that equilibrium lies along the data’s trendline, on which $WGI=iHDI$ in this system. One solution to Equations [2a,b] is that $\alpha=1$ and $\beta=1$, but in that case, $f(x)=0$ and $g(x)=0$, implying that no exogenous factors influence economic performance. Yemen and the GCC states disprove this, therefore $\alpha\neq1$ and $\beta\neq1$. Under such conditions, Equations [2a,b] become

\begin{align*}
iHDI^i = \left(\frac{1}{1-\alpha}\right) \times f(x_1^i, x_2^i, \ldots, x_n^i) = WGI^i & \text{ Equation [3a]} \\
WGI^i = \left(\frac{1}{1-\beta}\right) \times g(x_1^i, x_2^i, \ldots, x_n^i) = iHDI^i & \text{ Equation [3b]}
\end{align*}

Because $\alpha$ and $\beta$ are constants, Equations [3a,b] can be satisfied for all polities $i$, if and only if $f$ and $g$ have exactly the same functional dependence on $x=x_1, x_2, \ldots, x_n$ and thus they differ only by a scale factor. Furthermore, the dependence of economic performance, proxied by iHDI, on institutions, proxied by WGI, so loudly trumpeted by the New Institutionalism, is nowhere to be seen. If there is one term above all others that does not belong in Equation [1], it is a measure of institutional health. Equation [1] is a tautology obscured by a phantasm and denial. Economic performance depends, in equilibrium, on average, upon exogenous factors and not at all upon institutions, and because the 2nd principal component is small, almost all states are near equilibrium. Rosencranz and Guildenstern are dead.

There ought to be nothing surprising about this. The same equations have the same solutions, and equations of this sort to describe dynamical systems are centuries old.

### Social Entropy and Imbalance

This claim is a bold one, and though it is founded on small steps of incontrovertible logic, some confirmation of it in the real world would be reassuring and the absence of it would be damning. But before we proceed with confirmation, let us observe the following: economic performance and institutional health being dependent (almost) entirely on exogenous factors, and having a large first principal component, too, we will be well served to focus our modeling on a principal component decomposition of the distribution, $D$.

We define then, the Social Entropy, $\mu$, and the imbalance, $\kappa$,

\begin{align*}
-\mu &= WGI + iHDI & \text{ Equation [4a]} \\
-\kappa &= WGI - iHDI & \text{ Equation [4b]}
\end{align*}

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As mentioned earlier, the 1st principal component lies more or less along a line that runs from political chaos to political order, with commensurate wealth and long life. The choice of signs is arbitrary, ours to make. We have chosen them such that Social Entropy is a minimum in Denmark (DNK) and a maximum in Somalia (SOM), thus increasing from order to disorder, as does entropy of the thermodynamic or information theoretic kind. Entropy, a 19th-century creation from the Greek, means in literal translation, transformation within.

If there is a perfect name for μ, we haven’t found it. Social Entropy as we intend it is shorthand for “the opposite of what is usually associated with social, economic, and political order.”

Humans order the world to free themselves from the constraints of Nature, to facilitate exchange, and to other ends. This ordering seems to be the project of mankind, the end of history itself. But are individuals freer in the ordered world? They are definitely freer from oppression by others, though also less free to oppress others. We might have flipped the sign of μ and called it Development, but development economists already associate a meaning with that term; Human Development has been claimed by the UN; Social, Political, and Economic Development is cumbersome; and Social Development sounds like something other than we intend. Social Entropy is an old, practically unused and consequently ill-defined term, thus at once familiar, but connoting little, and free for the taking.

Philosophers of language distinguish between sense and reference, and they illustrate the distinction with a history of the discovery of the planet Venus. Early Greek astronomers saw a wandering star in the western evening sky. They called it Hesperus. They saw, too, a wandering star in the eastern morning sky. They called it Phosphorus. Later astronomers recognized that the two are one, the planet we now call Venus. When we name Hesperus and Phosphorus, we acknowledge our sensation that they are different; one is seen at dusk and the other at dawn. When we announce that Hesperus is Phosphorus, we refer to our understanding that they are no more different than the setting sun and the rising sun. Economic performance and institutions have been sensed as qualitatively different since long before North. We have shown here that their qualitative differences are but expressions of an underlying, unified reference, the Social Entropy.

A thoughtful reader might ask, “The correlation being high, as it is, why bother with principal components? Why not stick with either economic performance or institutional well-being as the dependent variable?” Indeed, we can do that, and the modeling results are very similar. But doing so invites the inclusion of the other as an independent variable, a tautology that has been widely employed while escaping notice for decades. It is easier to avoid the tautology by including both in the dependent variable. Social Entropy does that. Social Entropy has an added benefit, relative to iHDI, for instance, in that μ explicitly assesses the quality of governance. It is desirable, we believe, to live beneath an umbrella of good governance, where the rule of law is respected, authority is legitimate, regulatory quality is high, vigilantism is low, and the voices

29 Gottlob Frege, *On Sense and Reference*, 1897 p.??

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of many are heard. The World Bank bakes these ideals of liberal democracy into the components WGI, and we unabashedly endorse them. Other researchers may differ and they are free to define their own measures accordingly, with two caveats: researchers and policy makers (1) must make their measures and biases explicit, and (2) should strive to come to a consensus.

WGI is built from 6 indicators. There are $2^6=64$ different ways to combine them with equal or zero weight, and we have tested them all. The differences are small, as we will show in a forthcoming paper. To avoid any semblance of cherry picking, we combine all six indicators with equal weight.

The 2nd principal component, $\kappa$, assesses the imbalance between institutional health and economic performance as observed. It is positive when institutions lag as they do in Belarus (BLR), and negative when institutions lead as they do in Botswana (BWA). Such a term is discussed nowhere in the literature, but it is precisely when $\kappa<0$ that institutions are most likely to beget wealth. In as much as $\kappa=0$ in equilibrium, any non-zero $\kappa$ is a measure of the imbalance between institutional well-being and economic performance. Absent a model, $\mathcal{M}_\kappa$ we refrain here from making any predictions about the evolution of BWA and BLR in the I-E plane. Imbalance in our usage here is a proper noun rather than a completely accurate descriptor.

A Model Framework

Equations [3a,b] inform us that, in equilibrium, wherein $WGI=iHDI$, the dependence of institutions on economic performance is zero and the functional dependence of each on $x$ is identical. Strictly zero in that case, they must, by analytic continuation, be nearly zero near equilibrium, though the terms nearly and near are undefined. Because the 1st principal component dominates, we assert that the observed universe of states is sufficiently near equilibrium that we may write, for all $i$,

$$\mu^i = M_\mu (x_1^i, x_2^i, ..., x_n^i)$$

Equation [5a]

where $\mathcal{M}_\mu$ is explicitly independent of $\kappa$. Though $\kappa$ is small, it is manifestly not equal to zero for all states $i$, and we are led to write

$$\kappa^i = M_\kappa (x_1^i, x_2^i, ..., x_n^i)$$

Equation [5b]

$\mathcal{M}_\kappa$ is explicitly free of any mu-dependence.

To the extent that these approximations are valid, they are more valid in the orthogonal transformation of WGI and iHDI into $\mu$ and $\kappa$ than in any other coordinate transformation. We

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30 A $\kappa=0$ state might be out of equilibrium along the mu-axis, though without modeling to provide estimates of equilibrium, or homophilic states that form a basis for comparison, we wouldn't know.

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thus seek separate functions or models, $m_1$ and $m_2$, the former setting the overall or equilibrium level of social, economic, and political order, and the latter the out-of-equilibrium level. Both take as arguments the same exogenous factors, but we have every expectation that the relevance of those factors will be different in the two instances.

## Growth, Scale, and Inequality

In North’s formulation, history is the evolution of institutions. In the ‘cash is king’ formulation, capital came first. In our formulation, institutions and economic performance seek an equilibrium whose level is set by exogenous factors, at least some of which vary on a time scale of many centuries. However, our individual experience is of progress, notwithstanding human frailty, disease, war, natural and manmade catastrophe, and the triumphs of people we can’t abide. Life expectancy improves. Standards of living improve. Literacy improves. Institutions improve. Communications and communication devices improve. In Shakespeare’s day, long form drama was an afternoon of Hamlet. Now we have 60 episodes of The Wire! How can we square what is before our eyes, changing on a time scale of decades or even days, with the notion of a static equilibrium evolving slowly over many centuries?

Our chosen system of standardized coordinates is scale-free: neither the mean nor the standard deviation of the overall distribution, $D$, evolve over time. The absolute position of any state, and thus its position relative to others, would be unaffected by a tide of rising income. As it lifts us all equally, the tide would change only the means, and the means are zeroed out. Nor would the details of $D$ be affected by a universal expansion of income, multiplicative rather than additive, because rescaling to unit variance takes care of that, too. The same is true for a monotonically trending if not universal expansion.

A state’s locus within $D$ is determined only by relative institutional and individual well-being, by its fortunes relative to others. Change, progressive or regressive, is also exclusively relative. It is beyond the scope of this work to fully analyze the time scale of reversals of fortune, but we can say that the median value of the 20-year standard deviation of the Social Entropy is about 2% of its range.\(^{31}\) Over 80 years, we can expect the median value to be 4%. Therefore, large scale relative motion is rare on the time scale of a human life, so the notion of a state in a near-static equilibrium of institutions and wealth is sound.

This is a system well-suited to asking and perhaps answering, why is Albania not Greece, can Somalia become Denmark, or more generally, why do the haves have and the have-nots not? We will not easily answer the very interesting but different question, why or by how much has absolute global inequality increased since Isaac Newton roamed the halls of Trinity College, Cambridge. These last two questions are entangled in all discussions of the so-called Great Divergence. Disentangling them is progress.

\(^{31}\) The dataset from whence this comes will be discussed in a forthcoming paper.

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Progress or not, inequality remains with us. Can we say how much? In our scale-free system, the range of Social Entropy is approximately -4 to 4, arising from the fact that the range of iHDI and WGI is within 2 standard deviations (σ) of the mean. We have 177 states in our system. If the distribution of institutional well-being or economic performance was normal, that is Gaussian, we would expect a few states at or near +/- 3σ, and a corresponding Social Entropy of at least 5 and perhaps 6. The absence of these particularly high or low Social Entropy states begs an explanation. We posit three: (1) Strong and wealthy states may absorb the weakest and poorest ones, thus lopping off D's highs and lows, (2) institutional innovation in state i is available, thanks to modern transport and communication, for adoption by pragmatic change agents in state j, thus enabling an end run around the destiny of the exogenous factors x, and (3) measurement error by the UN or the World Bank.

Entropy and Social Entropy

In what sense does Social Entropy have anything to do with entropy, or more specifically with thermodynamics where the concept of entropy emerged in the mid-19th century? Consider a northern lake. Any one of its molecules, m, may shake, rattle, or roll near its loosely bound neighbors, but it is quite a project for m to move out of their vicinity. In water vapor, m is not bound to its neighbors and is therefore free to move wherever momentum and collisions take it. It has more so-called degrees of freedom than its counterpart in water. The water in the lake has lower entropy than water vapor. The movement of m in ice is even more severely constrained. It has fewer degrees of freedom, so the frozen lake in winter has lower entropy than the lake in summer.

Entropy is usually associated with the Second Law of Thermodynamics, with irreversibility, and with the idea that all roads lead to gloom. Somewhat more precisely, the Second Law states that, in a closed system, heat cannot be moved from colder to hotter substances without doing work. Thus, refrigeration is expensive. That said, high entropy water and low entropy ice coexist at 0 C in the lake in winter. During a cold snap, heat from the water conducts, convects, and radiates away to the colder ground, air, and sky, increasing the ice fraction in the lake. Within the lake whose temperature is 0 C, entropy falls, but the Second Law does not apply because the lake is not a closed system. It is in contact with sources and sinks of heat. The Second Law applies to the closed system. And yet, on Earth, every new leaf or beetle or tower of steel and glass is more evidence of increasing order. Is not entropy of the closed system in a state of constant decline? Yes, but the Earth is no closed system. The shining sun bestows radiant energy over Earth. A general principle of non-equilibrium thermodynamics is that energy flowing through a system tends to organize and order it.\textsuperscript{32} Gloom is coming, but not yet.

\textsuperscript{32} It cannot be otherwise. Out-of-equilibrium systems, by definition low in entropy, tend to equilibrium, by definition the state of maximum entropy. Only with persistent application of work, that is the flow of energy, is that tendency resisted. For a fuller account, see Chapter VI in Harold Morowitz, \textit{Energy Flow in Biology}, OxBow Press, Woodbridge, 1968.

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For the Social Entropy, the thermodynamic analogy is the partially frozen lake. The exogenous factors, that is, the components of $x$, are (1) sources of heat that melt ice to become water or (2) sinks of heat that freeze water to become ice. Sources of heat increase the number of degrees of freedom, per person rather than per molecule, increase social disorder, and increase the Social Entropy. Sinks work the other way. The case of Yemen and the GCC suggests, rather emphatically, that a model of Social Entropy should include natural resource wealth as a sink, decreasing Social Entropy. We won’t force fit this to the model, but if the model tells us something else, we will be at pains to explain why.

How did we get from tension springs to the entropy of a partially frozen lake? Heat sources and sinks equate to measures of spring stiffness on either side of the mass, $O$; $O$’s resting point equates to the system entropy; and the same equations have the same solutions.

**Homophily**

Returning to the claim that economic performance is dependent almost entirely on exogenous factors, we modify it slightly; The Social Entropy is dependent almost entirely on exogenous factors that govern its equilibrium value. What evidence do we have of these factors? Natural resource wealth in the GCC is one example. More generally, the answer lies in homophily. That is, states that are in some sense similar, as measured by their respective $x$, cluster in the I-E plane. Consider Figure [4] which contains six instances of such clustering. The spread of the selected cluster is indicated by a superimposed ellipse whose radii are two standard deviations wide. The examples here are binary, simplistic by design, and unsuitable for modeling. But they do illustrate the point that states that fly together flock together, and thus they provide the needed evidence of putative driving factors of $\mu$.

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Maps Speak

The world maps of Social Entropy and Imbalance, Figure [5], speak volumes, and while a full explication is the province of forthcoming papers on modeling\(^{33}\), some features must be noted here. The 14th century Tunisian Ibn Khaldun and the 18th century Frenchman Baron de Montesquieu have famously observed and attempted to explain high degrees of what they understood as lassitude among the inhabitants of the equatorial latitudes. If lassitude means weak economic performance, we might expect to see high Social Entropy distributed uniformly across the equatorial states, but we see instead a strong longitudinal dependence. Depending on your perspective, South and Central America have inexplicably low Social Entropy, given their latitude, or alternatively Africa, the Middle East, South Asia, and to a lesser extent the remainder of Asia, have inexplicably high Social Entropy. In the same vein, while economists and economic historians strive to explain Africa’s lagging economies with the *ad hoc* technique

\(^{33}\) McCants and Seligson, The Sources of Social, Economic, and Political Disorder: Manuscript

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known as Africa Fixed Effects, we see in Figure [5a] that the excess of Social Entropy in Africa is nearly matched in the Middle East, and would be matched were it not for oil. These observations echo a wit’s remark that the hot rich countries are rich in oil, and the cold poor countries are rich in communist legacy.

The map of Imbalance restates the points made earlier about the contributions of oil, Communism, civil war, and foreign intervention.
Summary

The prevailing dogma of Economic History is that institutions beget wealth, whereas the prevailing wisdom on the street is that cash is king. These two views are reconciled if we acknowledge the dynamic interplay between them, and interpret the observed linear relationship between them, not as a sign of one begetting the other, but as the outcome of exogenous factors, $x$, driving them toward a static equilibrium. Our preferred system of analysis is one in which institutional health is assessed by the Worldwide Governance Index and economic performance by the UN's inequality-adjusted Human Development Index, both rescaled to zero mean and unit variance, a system in which growth cannot be conflated with change.

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Inasmuch as the variance of the 1st principal component of the distribution of 177 states in this system is approximately 9 times the variance of the 2nd, and that it runs towards states usually associated with social, economic, and political order and away from states usually associated with disorder, we give to that first principal component the name Social Entropy, in analogy with thermodynamic and information theoretic entropy. The thermodynamic system bearing the greatest resemblance to the social system under investigation is a partially frozen lake subject to sources (sinks) of heat which increase (decrease) entropy as the ice fraction decreases (increases). The seven states of the Arabian Peninsula, Yemen and the 6 states of the Gulf Cooperation Council are supporting exemplars of this understanding. The states are indistinguishable but for fossil fuel resources in the GCC, and rents from those resources are a sink whose action is to decrease their Social Entropy. We assert, further, that the centuries-long dominance of Western states and the so-called Neo-Europes on the global stage is evidence that most of the exogenous factors, $\mathbf{x}$, driving Social Entropy are relatively constant on a time scale of centuries. A world map of the Social Entropy finds the Latitude Hypothesis wanting and highlights the limitations of African Fixed Effects in explaining its global distribution.

We associate disequilibrium with the 2nd principal component, and we show, by mapping and other means, that states far off the axis of Social Entropy have oil, Communism, civil war, and/or recent foreign intervention in common.

Analysis of the system dynamics and the long term stability of $\mathbf{D}$, and modeling of both principal components, yielding a compact model $\mathbf{m}$, are the subject of ongoing research and manuscripts in preparation.

The End