The Ecological Origins of Economic and Political Systems

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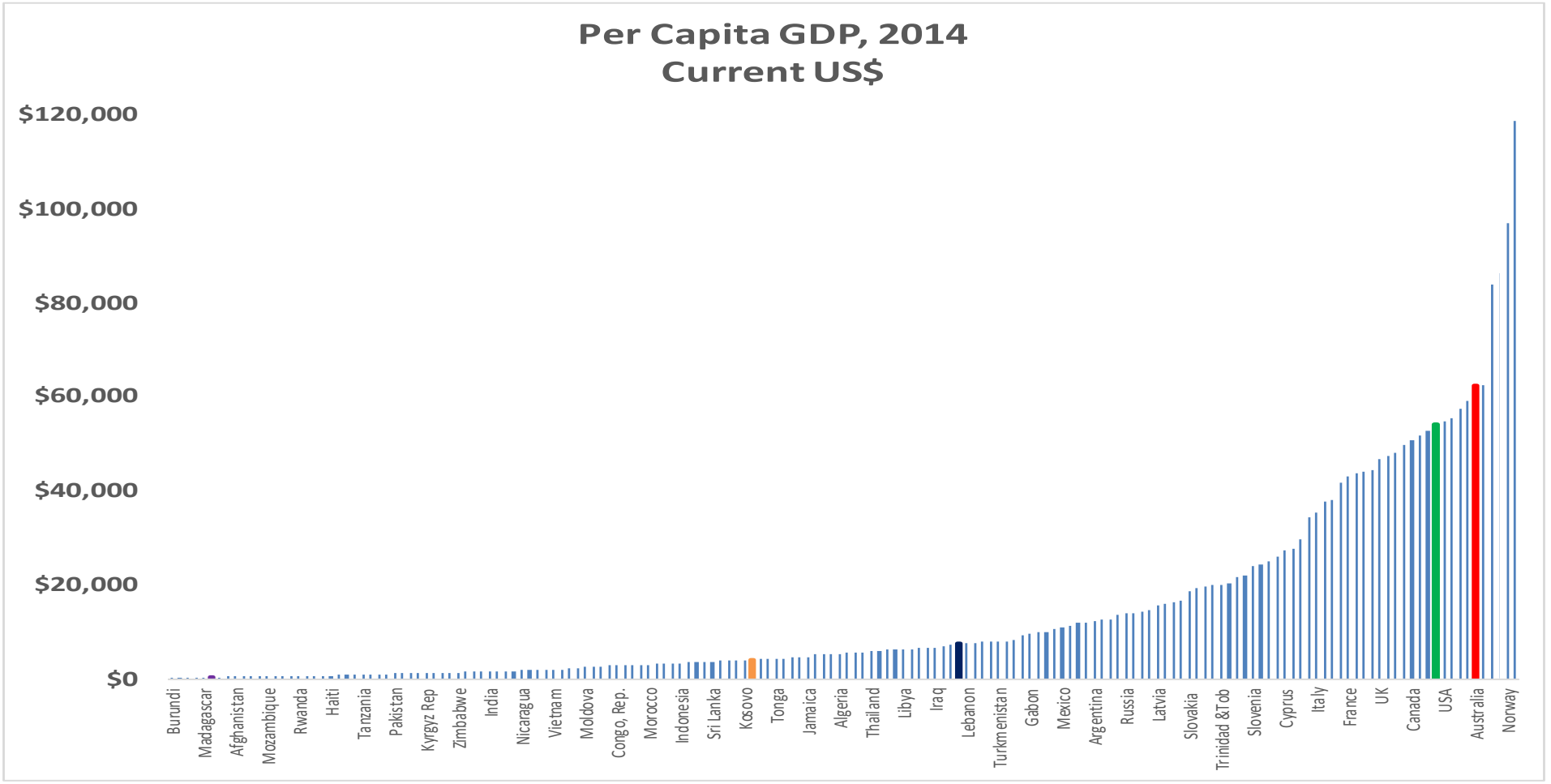
What is the question to which this paper is the answer?



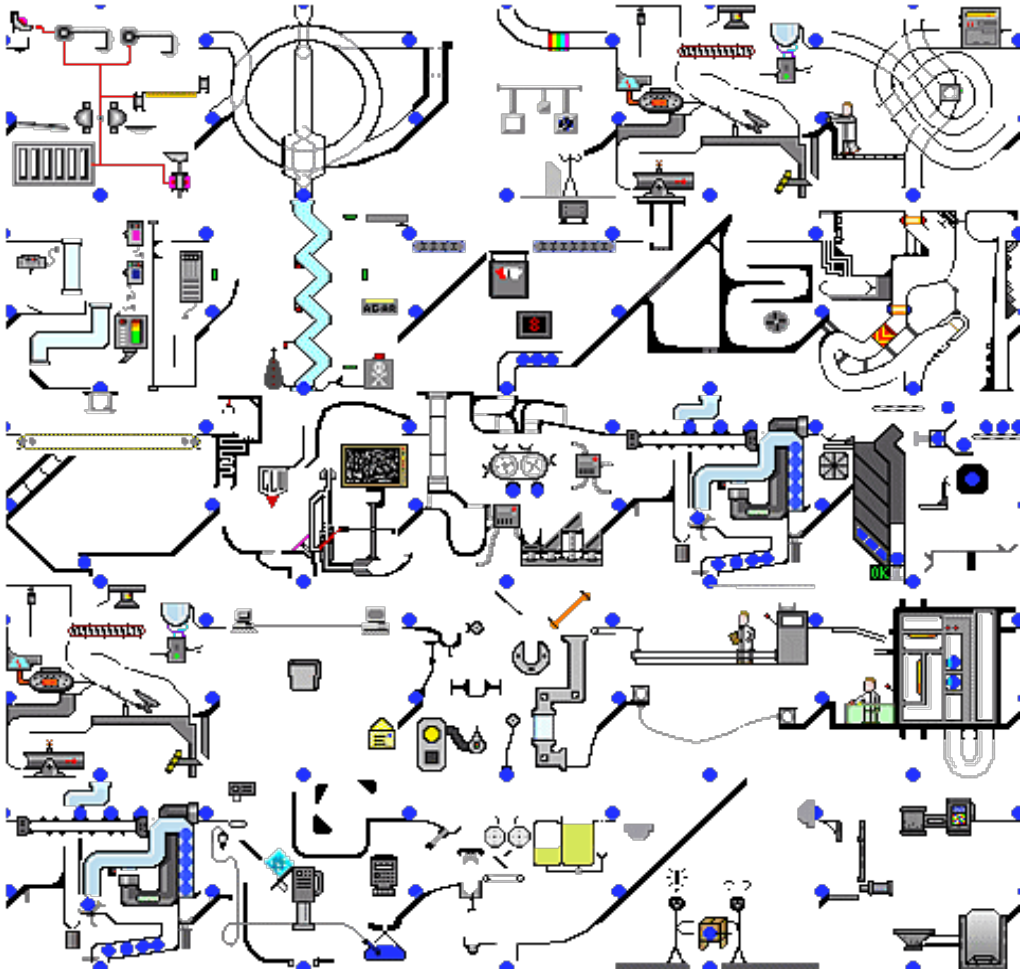
We stand on the shoulders of other scholars in providing an answer

- Climate and Geography shaped development in the past: Aristotle ND; Ibn Khaldun 1377; Montesquieu 1748; Smith 1776; Carneiro 1970; Diamond 1997; Olsson & Hibbs 2005; Hibbs & Olsson 2004; Putterman 2007; Alsan 2015; Scott 2017;; Masters & McMillan 2001; Nunn & Puga 2012; Motamed, Florence, & Masters 2014; Putterman & Weil 2010; Mayshar et al 2019
- Modern economic growth: Kuznets 1966; Comin and Hobijn 2010; Comin and Mestieri 2018.
- Economic development causes democracy: Lipset 1959; Huntington 1968; Przeworski et. al. 2000.
- Democracy causes economic development: North & Weingast 1989; Barro 1998; Acemoglu et al 2014.
- Economic development and democracy are jointly determined: Weingast 1997; Acemoglu et al 2008; Persson & Tabellini 2009; North, Wallis, & Weingast 2009.
- Human capital causes development: Glaeser et al 2004; Gennaoili, et al 2013
- Institutions cause growth, and are inherited from the past: North & Thomas, 1973; Hall & Jones 1999; Acemoglu, Johnson, & Robinson, 2001, 2002; Besley and Persson 2009; Rosenthal and Wong 2011; Ferguson 2011; Acemoglu & Robinson, 2012.
- Institutions cause growth, and are carried by people: Easterly & Levine 2016.
- Climate and geography work on growth directly: Bloom & Sachs 1998; Sachs 2001; Gallup & Sachs 2001; McCord & Sachs 2017; Henderson et al 2018;
- Climate and geography worked on growth through institutions: Engerman & Sokoloff 1997; Easterly & Levine 2003.

Model uncertainty is inherent in the study of long-run economic and political development

A fully specified model would include:

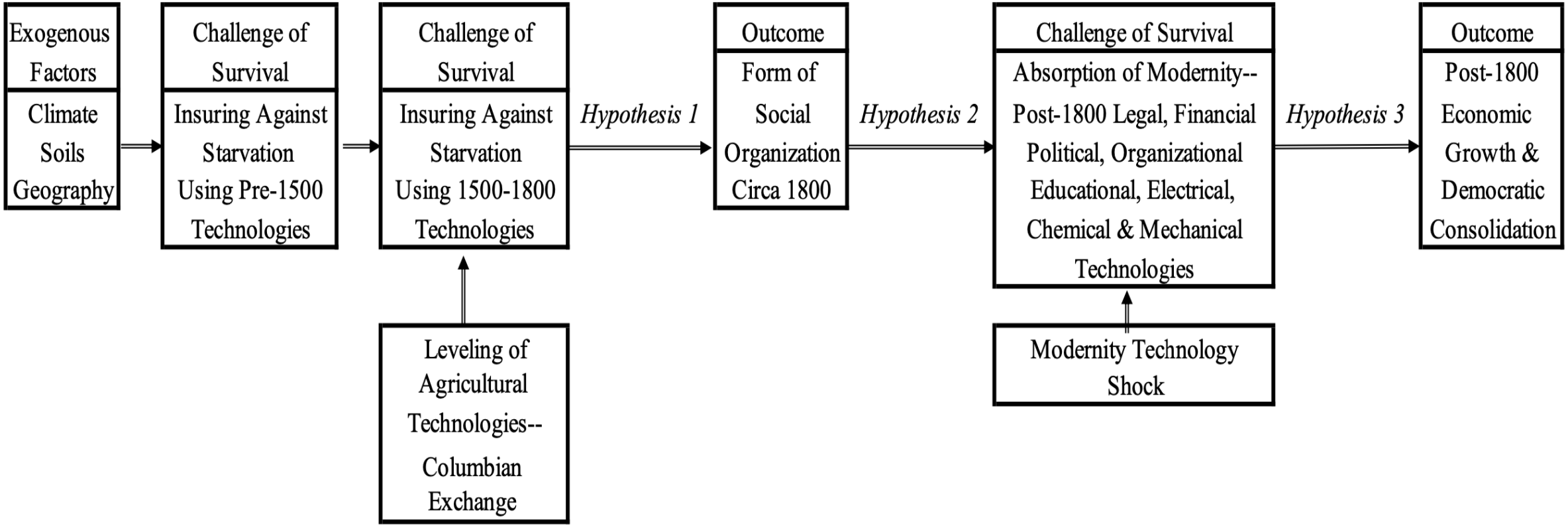
1. A complete list of the observable and unobservable exogenous factors, as well as their distributions
2. A complete list of the observable and unobservable endogenous variables, as well as their distributions
3. The functional forms of the interactions among the exogenous variables
4. The functional forms of the complex, time-dependent, feedback loops among all the endogenous variables.



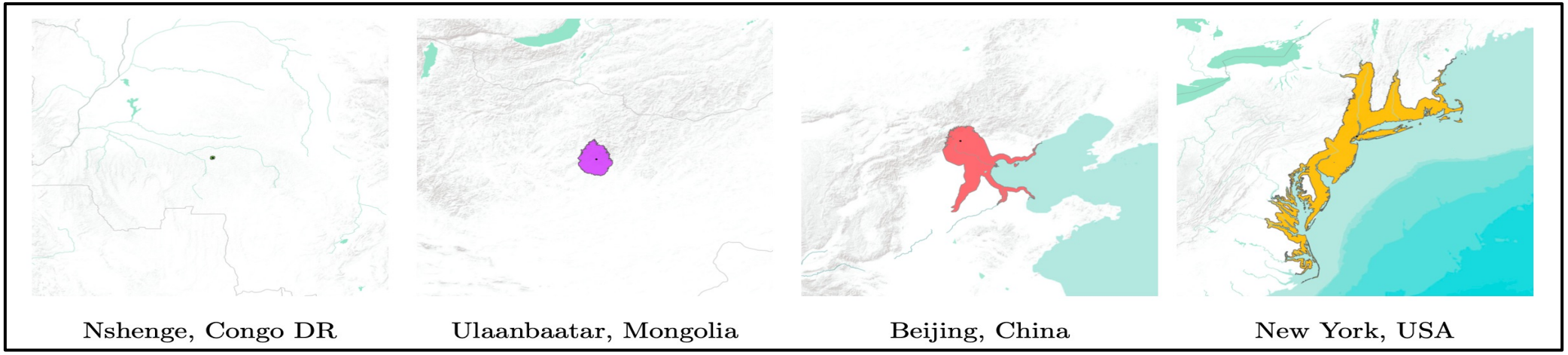
We take an approach that is commonly employed in the physical sciences, as well as in some fields of empirical macroeconomics

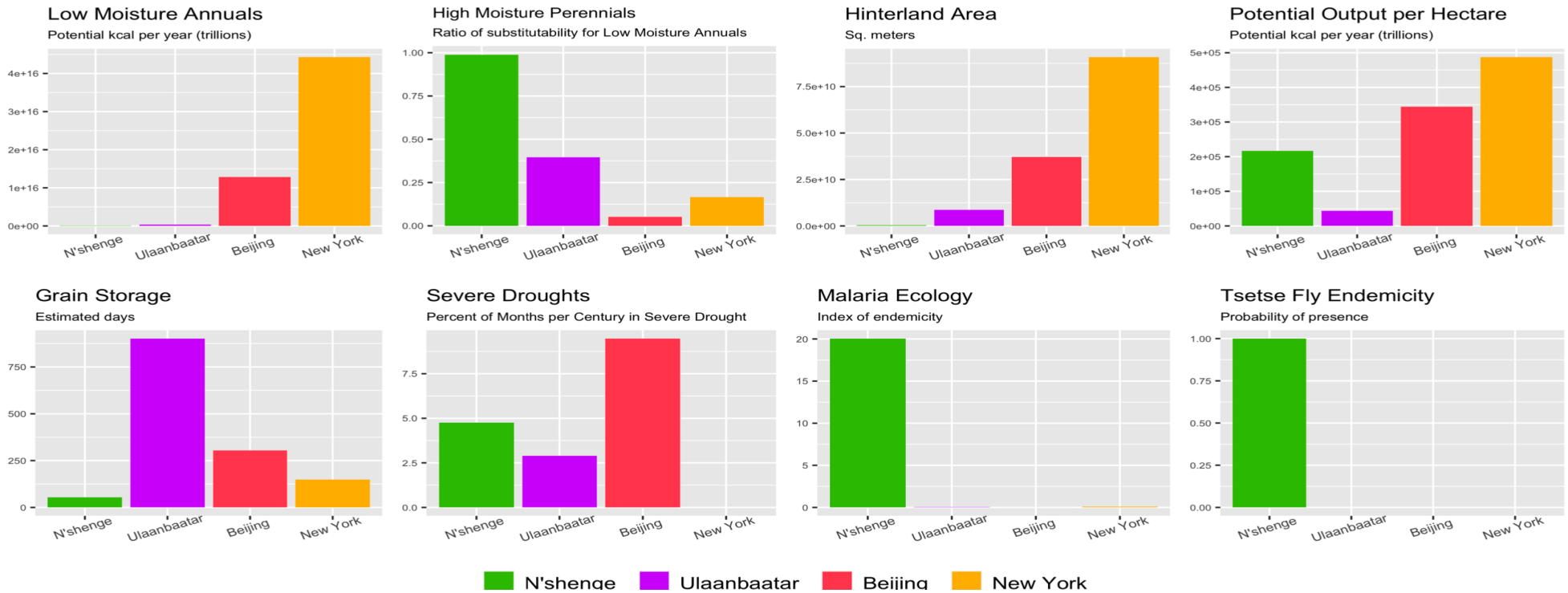
- We focus on explaining variance in a set of *emergent properties* as a function of a vector of exogenous factors that are defined a priori
- The focus is to identify the factors that pushed *a system* to evolve in one direction, instead of another. It is not to identify causal relationships among endogenous variables

Our theory in one slide

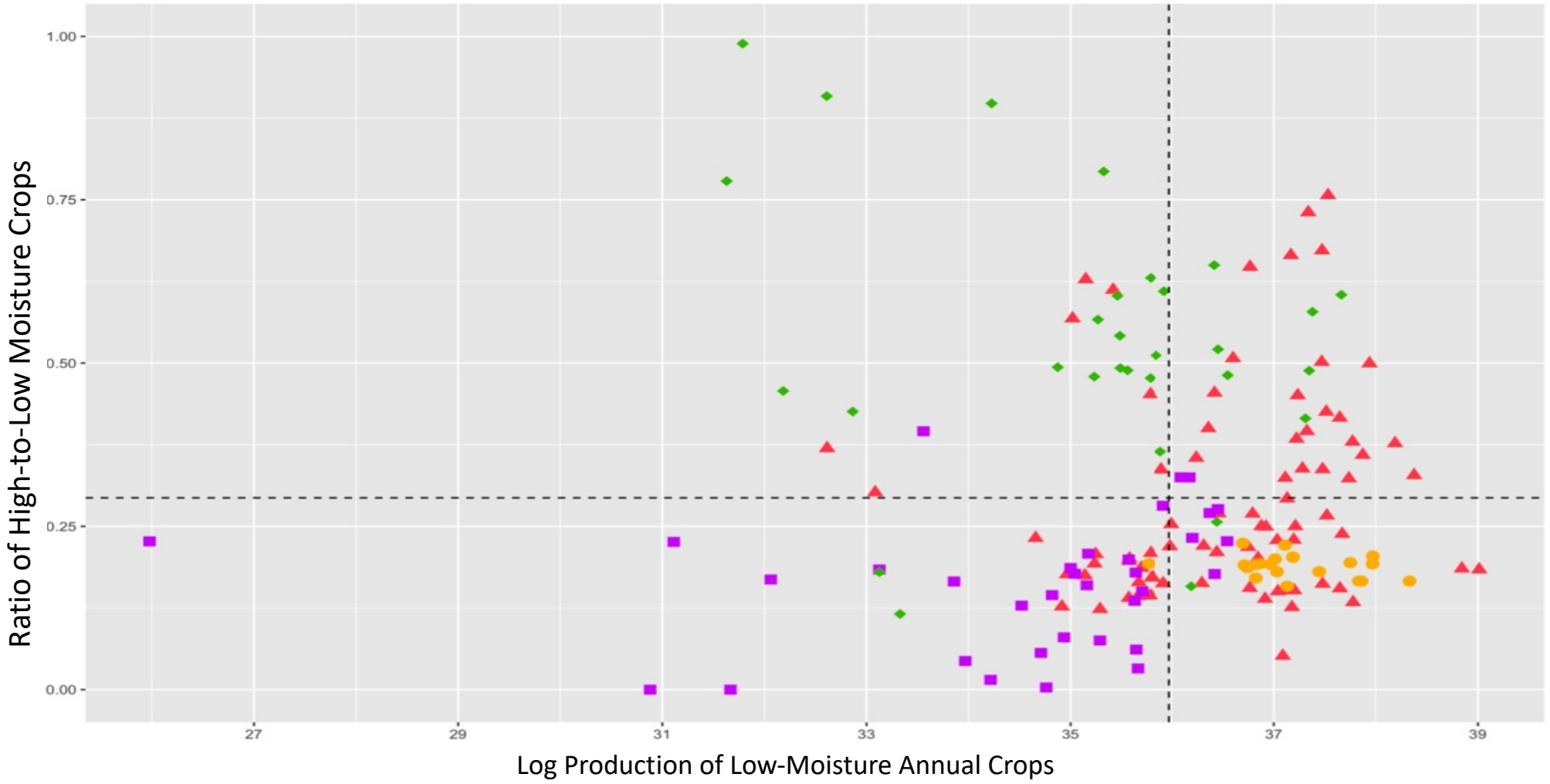


We operationalize the testable implications of the theory by building geospatial datasets to recreate as closely as we can the ecological conditions of largest city hinterlands conditional on 18th century technologies

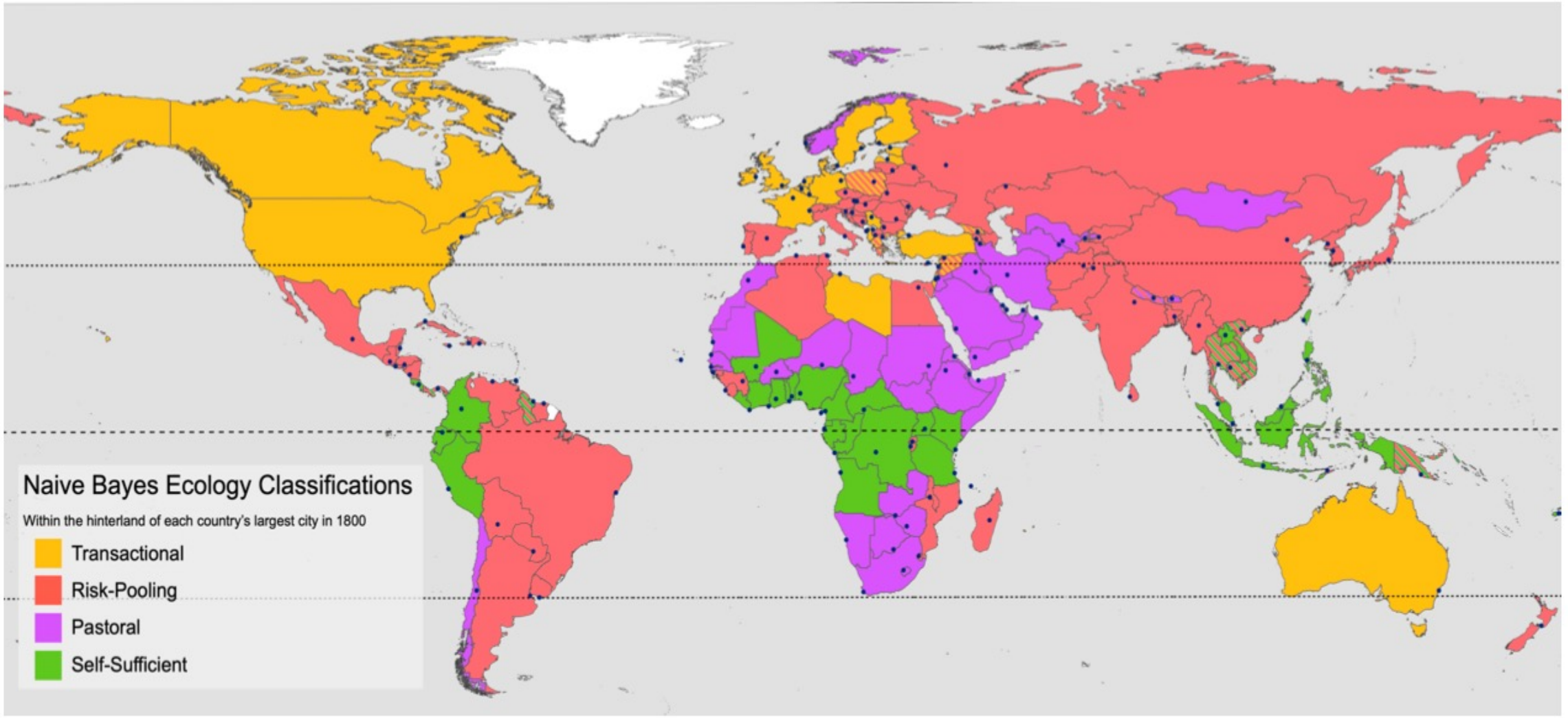




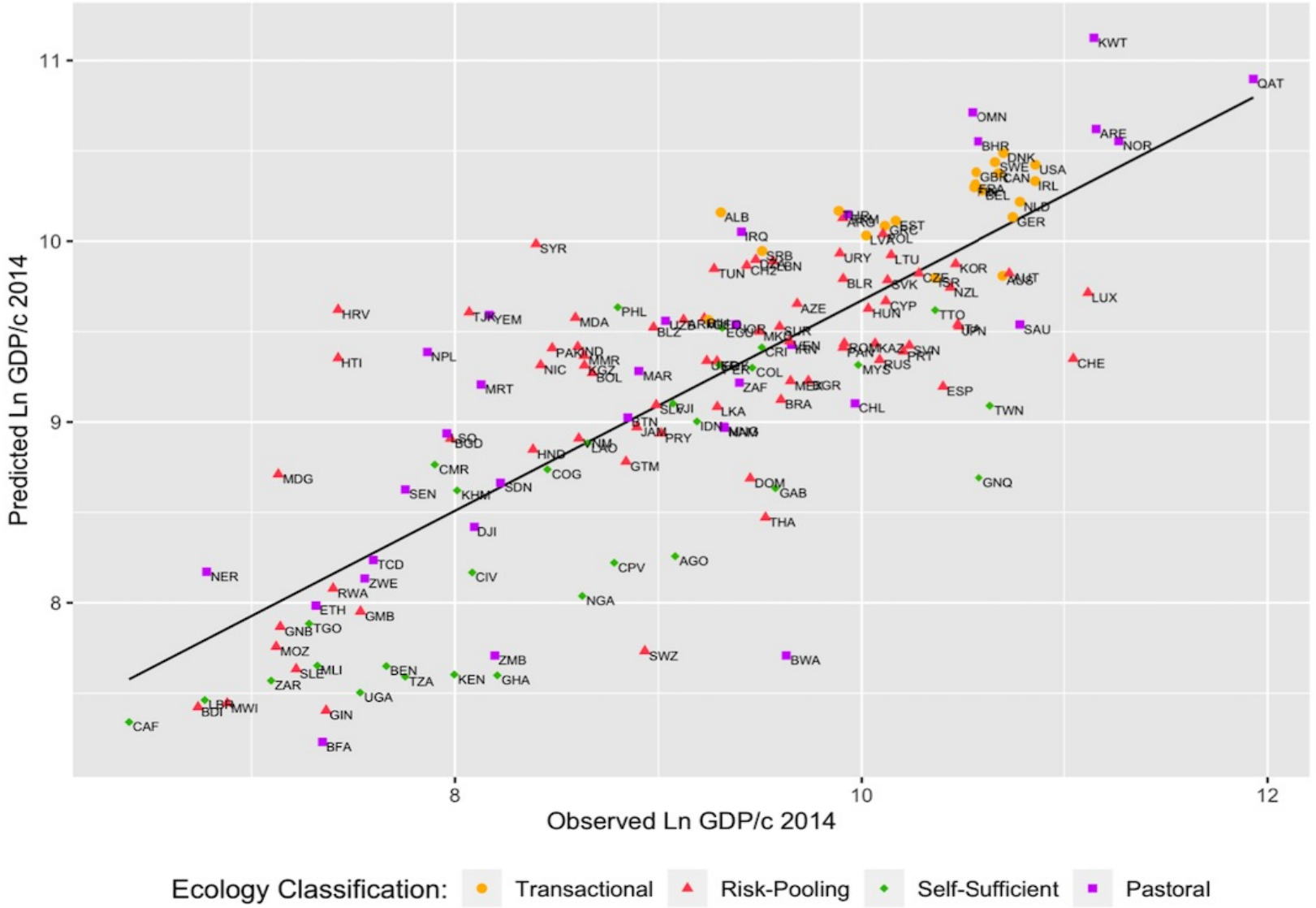
What we discover: exogenous ecological factors about largest city hinterlands in 1800 yield four distinct ecologies (in which an ecology is understood to mean the physical environment, the living organisms, and the social adaptations made by human beings to survive)



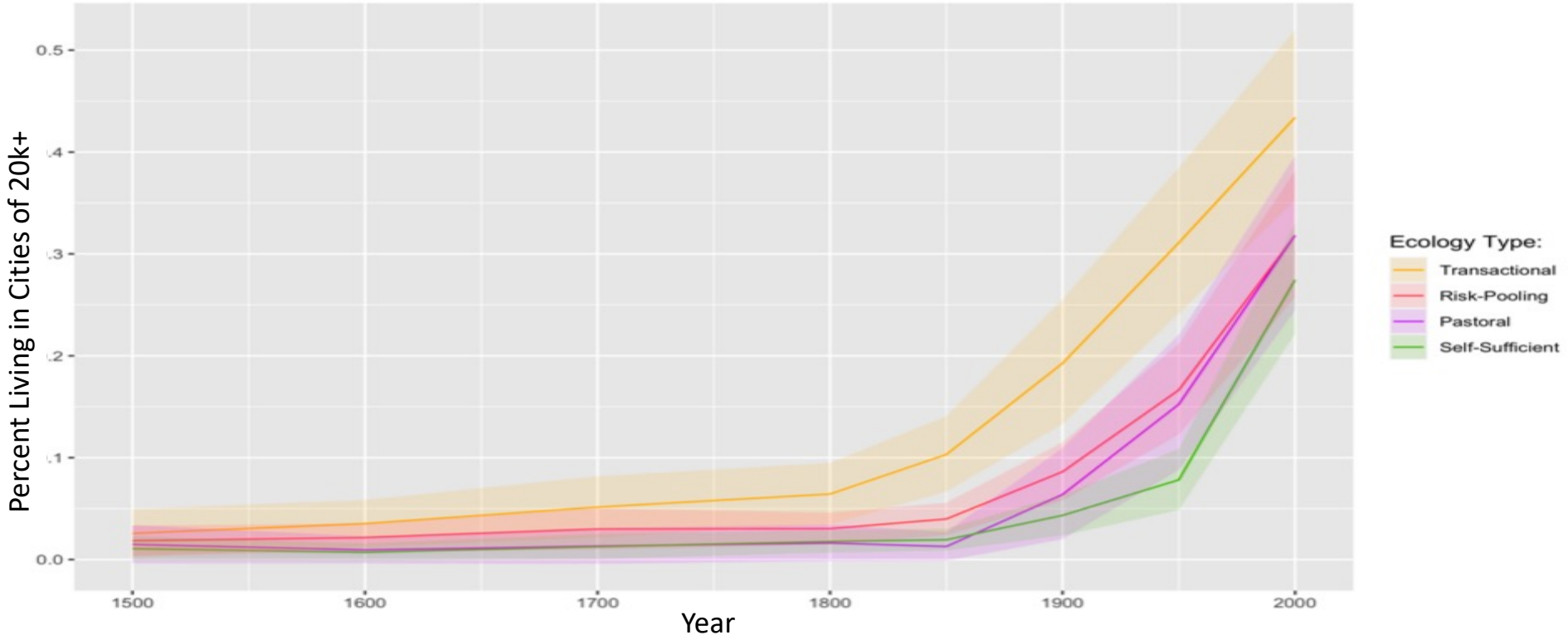
What we discover: the ecological factors are outcomes of climatic forces that operate at planetary scale



What we discover: ecological variables for largest city hinterlands in 1800 account for 2/3rds of the variance in current GDP/c; ecology types behave as predicted



What we discover: the ecological factors for progressively less of the variance in levels of economic development (as measured by urbanization ratios) going back in time



Percent Urban in:	2000	2000	1950	1950	1900	1900	1850	1800	1700	1600	1500
Pseudo-R^2	0.327	0.279	0.434	0.426	0.252	0.263	0.34	0.097	0.011	0.059	0.071
Out-of-Bag Mean Squared Error	0.028	0.03	0.017	0.017	0.01	0.01	0.002	0.002	0.004	0.002	0.001
N	163	163	163	163	163	163	156	160	147	148	145
Oil Used as Control:	✓	–	✓	–	✓	–	–	–	–	–	–

What we discover: the mechanics work as the theory predicts

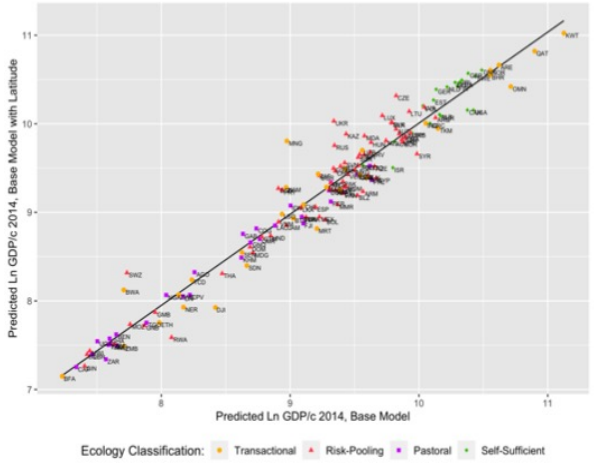
Table 5: Ecology Classifications Predict Differences in 19th Century Markers of Human Capital & Technological Absorption

	Year 250km of railroad surpassed	**Percent enrolled in primary school, 1820**	**Numeracy in 1820 (Whipple Index)**	**Number of New Cities 1500-1800**	**Pop. Growth in Cities 1500-1800***
Mean of Trans. Coefs.	−41.444	21.695	−37.632	2.525	101269
Mean of Trans. Std. Err.	(10.116)	(7.136)	(41.287)	(0.748)	(33325.6)
Mean of Risk-Pooling Coefs.	−15.655	1.134	32.193	0.261	10386.2
Mean of Risk-Pooling Std. Err.	(7.983)	(3.281)	(39.902)	(0.192)	(9260.3)
Mean of Self-Suff. Coefs.	3.263	−4.401	–	0.041	−3197.1
Mean of Self-Suff. Std. Err.	(8.85)	(2.525)	–	(0.202)	(7280.7)
Mean of Intercept Coefs.	1911.322	4.922	198.45	0.233	7343.2
Mean of Intercept Std. Err.	(6.89)	(2.649)	(35.55)	(0.125)	(4708.9)
Avg. Adjusted R^2	0.148	0.204	0.053	0.204	0.155
Avg. N	132	104	47	163	163
Models Run	10,000	10,000	10,000	10,000	10,000

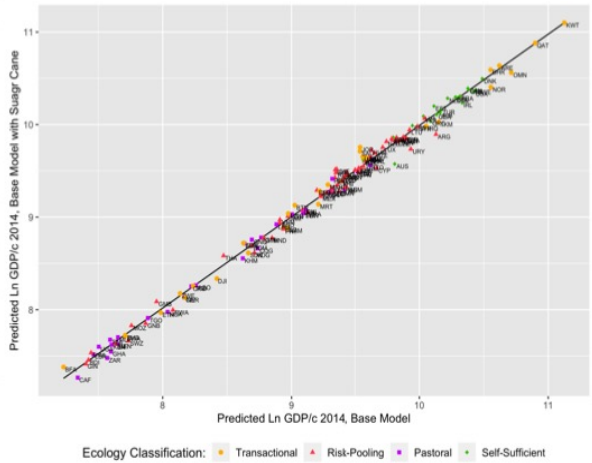
*Excluding centroid city

A powerful test of a theory is whether it can accommodate the fact patterns that support alternative theories

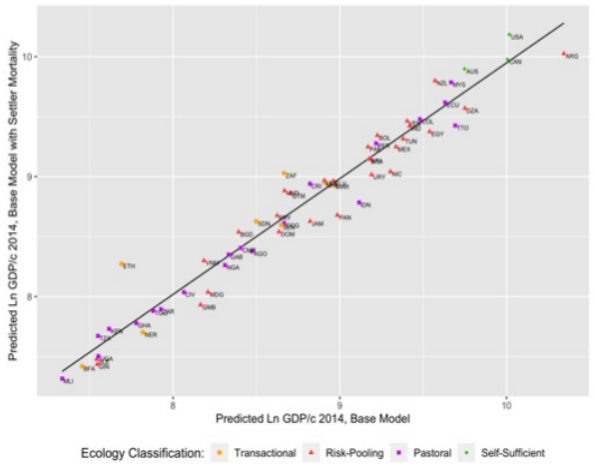
(a) Random Forest Predicted Values Adding Latitude



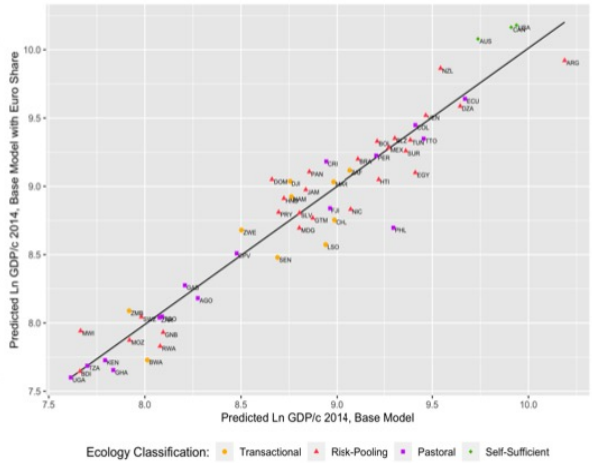
(b) Random Forest Predicted Values Adding Potential Sugar Cane Production



(c) Random Forest Predicted Values Adding Settler Mortality



(d) Random Forest Predicted Values Adding European Share of the Population



Robustness tests

- We drop African slave trade countries
- We drop New World colonizers
- We repeat all of the measurements done above, but also include data for second largest city hinterlands.

Implications

- First nature variables worked on economic development by conditioning the forms of social organization that emerged prior to modernity
- Those forms of social organization then conditioned how rapidly countries could absorb the technologies that propelled economic growth and democratic consolidation in the modern period
- No one chose these forms of social organization in any meaningful sense of the word
- Geography may not be destiny….but….