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# The Diffusion of Development: Along Genetic or Geographic Lines?

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## *Abstract*

Why are some peoples still poor? Recent research suggests the possibility that some societies may be poor due to their genetic endowments, which are found to be a significant predictor of development even after controlling for an ostensibly exhaustive list of geographic and cultural variables. We find, by contrast, that the impact of genetics on living standards is not robust to the inclusion of basic controls for climatic similarity.

***JEL Classification:*** O10, O33, O49

***Keywords:*** Genetics, Economic Development, Geography, Climatic Similarity

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## 1. Introduction

Why are some peoples still poor? Recently, economic research has begun to investigate the role that genetics plays in the wealth of nations. One prominent example is Spolaore and Wacziarg (2009) — henceforth SW — who argue that the revolution in technological innovation which began in Lancashire cotton textiles circa 1760 spiraled outwards first to the immediate locale, then to the whole of Britain, soon to the entire English-speaking world, and finally to other culturally and *genetically* similar peoples of the world.<sup>1</sup> Today, with the United States at the forefront of the world technological hierarchy, SW find that various distances to the United States, measured geographically, culturally, and genetically, are determinants of a society's level of technology and development.

The authors are careful to point out that the significance of their genetic distance variable, a measure based on the time elapsed since two societies' last common ancestor developed by Cavalli-Sforza *et. al.* (1994), does not necessarily imply any direct influence of genetics on income, but could proxy cultural barriers to technological diffusion. However, SW report that genetic distance "has a statistically and economically significant effect on income differences across countries, even controlling for measures of geographical distance, climatic differences, transportation costs, and measures of historical, religious, and linguistic distance."<sup>2</sup> Were the impact of genetics on development robust to geographic and cultural controls, this would seemingly be evidence in favor of a direct impact of genetics on income, and would be an interesting and important result, in addition to being provocative and heavily-cited.<sup>3</sup> It would also be surprising given that the variable genetic distance from the US, the variable used in the paper (see Appendix Figure A.1), appears to be a simple function of geography.

While the authors deserve credit for introducing a politically incorrect variable into the development discourse, we find that the evidence offered in support of the theory that genetic distance predicts development is sensitive to the inclusion of two simple, intuitive geographic controls: latitude and an Africa dummy. Our findings are consistent with the theory that the technologies developed during the Industrial Revolution diffused first to other temperate regions of the world — where European agricultural technology could be deployed and where the disease environment was most favorable to European people, and thus to their human capital, institutions, technology, seeds, animals and germs. This is the theory developed by a long line of

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<sup>1</sup> Another example is Spolaore and Wacziarg (2011), who use the same genetic data and make a similar argument with technology adoption.

<sup>2</sup> Spolaore and Wacziarg (2009), p. 469.

<sup>3</sup> "The Diffusion of Development" was covered in the popular press in a David Warsh column, now is commonly featured on graduate reading lists, including at Harvard, MIT, Stanford, and Duke, among many others, and already has over 150 citations on google scholar.

scholars, including Crosby (1972), Kamarck (1976), Diamond (1992), Sachs (2001), and Gallup, Mellinger, and Sachs (1999), among others, who all stress the importance of climatic similarity for development. In a world with trade costs, where the stability of GDP per capita rankings across decades implies that history matters, and where Malthusian forces have certainly been a strong force historically and are debatably still at play in some developing countries (see Clark, 2008), the nature of agricultural technology diffusion and the historical disease environment will necessarily carry outsized importance for development. And regardless of the mechanism, it has long been known that countries near the equator tend to be less developed. SW themselves argue for the inclusion of latitude as a control, yet struggle with suitable implementation.

To our knowledge, no other paper has shown that simple geographic similarity controls can account for the puzzling apparent impact of genetics on development.<sup>4</sup>

## 2. Empirics

In columns (1) and (2) in Table 1, we have reproduced the baseline results from SW's Table 1, finding that "genetic distance to the US," measured as the amount of time elapsed since the populations in these countries separated, is a significant predictor of income per capita. Yet, while column (2) contains controls for geographic distance, it notably does not contain any "climatic similarity" variables. "Absolute difference in latitude" is included, but "absolute difference in absolute latitude"—distance from the equator—is not. The reason why the latter is the appropriate control should be clear: although the Southern Cone countries, South Africa, and Australasia all have very different latitudes than the US, they have similar climates owing to their similar *absolute latitudes* with Europe and the United States. (Appendix Figure A.2 shows the familiar nonlinear relationship between income and absolute difference in latitude with the US.) SW themselves argue for the inclusion of climatic similarity variables, writing that latitude could affect income directly, or via technology diffusion, yet climatic similarity variables are curiously omitted as controls from their primary results in Table 1.

It might be that "genetic distance" explains why it is that latitude is so highly correlated with development—that Europeans settled in areas with climates similar to Europe, and these places are now developed owing to their European institutional endowment, superior genes, or human capital. In column (4), however, when we include distance from the equator and a dummy for the 41 Sub-Saharan African nations in our sample—the very first specification we tried after

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<sup>4</sup> Giuliano, Spilimbergo, and Tonon (2006) have found that genetics does not explain economic outcomes after controlling for geography within Europe, and Luis Angeles (2011) shows that SW's genetic proxy is sensitive to the inclusion of 12 additional linguistic, religious, colonial, geographic *and another genetic control* (percentage of population with European ancestry, not counting mestizos).

coding up the dataset—the coefficient on genetic distance falls substantially, rendering the results insignificant. As distance from the equator could be an imperfect proxy for climate, when we include a more precise climatic variable, the percentage of each country's land area in the tropics or sub-tropics in column (5), the point estimate falls even further.

One might protest the inclusion of the dummy for Sub-Saharan African nations on the grounds that this is perfectly correlated with the genetic distance variable, but several East African nations, such as Ethiopia, are actually closer to the US genetically in the Cavalli-Sforza data than are some East Asian countries, such as Japan. Secondly, there is more genetic variation within Sub-Saharan Africa than there is in the entire rest of the world. Also, as seen in Table 1, latitude and the percentage of land area in the tropics or sub-tropics are still significant at 99.9% when an Africa dummy is included, even though Sub-Saharan African nations generally have a much higher proportion of land in tropical areas. Lastly, Africa is very different from other tropical areas in terms of its historical mortality rates, disease environment, pests, biodiversity, and geographic features. The entire region shares various geographic and cultural traits of which we are only controlling for a small subset, and so to "control for geography" one should naturally include dummies for large geographic regions, including Africa, as SW argue (and yet omit as a control from their Table 1). That the significance of the genetic distance variable simply reflects the impact of latitude and an Africa dummy renders the result substantially less newsworthy.

[Insert Table 1]

SW offer evidence (their Table IV) that relative genetic distance to the US is correlated with income differences generally. To show this, they take the difference in per capita GDP for each dyadic combination of 137 countries, manufacturing roughly 10,000 highly dependent data points, and use this as the dependent variable with the regressor of interest now being the relative genetic distance to the US. It should be noted that if genetic distance to the US is not a predictor of income, then it would be unlikely that relative genetic distance to the US between any two countries would be a predictor of income differences. We include our Table 2 in the interest of being thorough.

The first column in Table 2 benchmarks SW's results, and then in column (2) we show that the inclusion of continent dummies eliminates the result. While SW correctly stress the importance of including continent dummies in their analysis, their novel method of implementing these dummies oddly forces the income difference between North and South America to be the same as the difference between North America and Africa. If instead we allow a separate dummy for each continent pairing—*i.e.*, a dummy for North America paired with South America, and a separate dummy for North America paired with Africa—then the results

disappear. Including these dummies does not render the "Absolute difference in absolute latitude" variable insignificant in column (3).

[Insert Table 2]

### **3. Conclusion**

The results presented here show that genetic distance does not explain development after we control for geography. Our findings provide additional evidence for the importance of climatic similarity variables, if not the exact mechanism by which these variables impact development. Future research should continue in the spirit of Spolaore and Wacziarg (2009), which is to introduce creative new variables with the potential to explain why some peoples are poor, and why climatic similarity has been such a strong force historically—but the answer to this mystery does not lie in our genetic differences.

### **Acknowledgement**

We thank Gregory Clark and Giovanni Peri for their very helpful feedback, and Enrico Spolaore and Romain Wacziarg for making their data easily available on-line, easy to replicate, and for being both gracious and quick to respond to inquiries — the mark of true scholars. All errors remain our own.

### **References**

- Angeles, Luis, 2011. Is there a Role For Genetics in Economic Development? Working paper.
- Cavalli-Sforza, Luigi L., Paolo Menozzi, and Alberto Piazza, 1994. *The History and Geography of Human Genes*. Princeton, NJ: Princeton University Press.
- Clark, Gregory, 2007. *A Farewell to Alms. A Brief Economic History of the World*. Princeton, NJ: Princeton University Press.
- Crosby, Alfred, 1972. *The Columbian Exchange: Biological and Cultural Consequences of 1492*. Westport, CT: Greenwood Publishing Company.
- Diamond, Jared, 1992. *The Third Chimpanzee: The Evolution and Future of the Human Animal*. New York, NY: Harper Collins.
- Gallup, John L., Andrew D. Mellinger, and Jeffrey D. Sachs, 1999. Geography and Economic Development. *International Regional Science Review*, 22 2, pp. 179-222.

- Giuliano, Paola, Antonio Spilimbergo, and Giovanni Tonon, 2006. Genetic, Cultural and Geographical Distances. unpublished, International Monetary Fund.
- Kamarck, Andrew, 1976. *The Tropics and Economic Development: A Provocative Inquiry in the Poverty of Nations*. Baltimore, MD: The Johns Hopkins Press.
- Spolaore, Enrico and Romain Wacziarg, 2009. The Diffusion of Development, *Quarterly Journal of Economics*. 124, pp. 469-529.
- Spolaore, Enrico and Romain Wacziarg, 2011. Long Term Barriers to the International Diffusion of Innovations. Working Paper.

TABLE 1  
Income Level Regressed On Various Distances From the United States, 1995

	(1) Univariate	(2) SW's baseline controls	(3) Add Africa dummy	(4) Add distance from equator	(5) Add (%) of land area in tropics and sub-tropics
$F_{ST}$ genetic distance to the US, weighted	<b>-14.808***</b> (1.493)	<b>-14.315***</b> (1.958)	<b>-8.815***</b> (2.579)	<b>-3.782</b> (2.738)	<b>-1.617</b> (2.844)
Absolute difference in latitude from US		1.364** (0.589)	1.416** (0.542)	1.218** (0.489)	1.519*** (0.529)
Absolute difference in longitude from US		0.801* (0.434)	0.705* (0.382)	-0.024 (0.393)	0.339 (0.359)
Geodesic distance from the US (1000s of km)		-0.159* (0.086)	-0.147* (0.077)	-0.038 (0.075)	-0.117* (0.068)
=1 for contiguity with the US		1.002*** (0.173)	0.856*** (0.187)	0.695*** (0.168)	0.395 (0.255)
=1 if the country is an island		0.464 (0.298)	0.263 (0.289)	0.391 (0.287)	0.448* (0.254)
=1 if the country is landlocked		-0.234 (0.227)	-0.259 (0.222)	-0.465** (0.200)	-0.469** (0.213)
Sub-Saharan Africa dummy			-0.907*** (0.255)	-0.838*** (0.234)	-1.269*** (0.248)
% of land area in tropics and sub-tropics					-1.164*** (0.219)
Distance from the Equator				0.031*** (0.010)	
Observations	144	144	144	144	144
$R^2$	0.38	0.436	0.472	0.538	0.551

Robust standard errors in parentheses; \*significant at 10%; \*\*significant at 5%; \*\*\* significant at 1%. Constant suppressed.



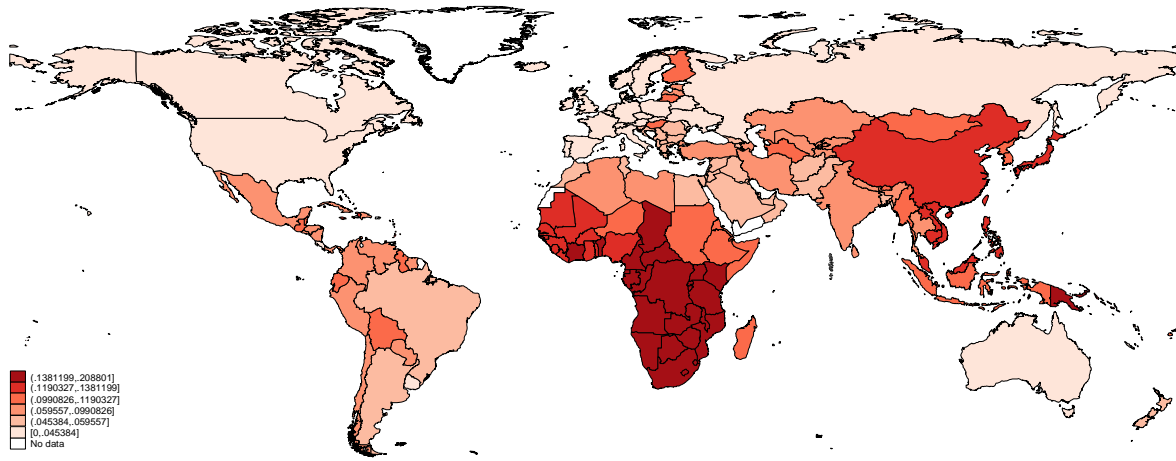
TABLE 2  
Paired World Income Difference Regression (Two-way Clustering)

	(1) SW's column (5) in Table IV	(2) Baseline	(3) Adding abs. diff. in abs. latitude
	SW's Continent Dummy	Region by Region fixed effects	
$F_{ST}$ Genetic Distance Relative to the US, Weighted	4.414*** (1.229)	0.35 (1.161)	0.026 (1.158)
Absolute Diff. in Latitude	-0.23 (0.228)	-0.107 (0.201)	-0.479** (0.238)
Absolute Diff. in Longitude	0.163 (0.140)	0.466** (0.178)	0.259 (0.161)
Distance	-0.015 (0.020)	-0.029 (0.024)	-0.002 (0.022)
=1 for two countries are contiguous	-0.341*** (0.073)	-0.300*** (0.065)	-0.250*** (0.060)
=1 for either country is landlocked (0 for both are landlocked)	0.133* (0.070)	0.157*** (0.060)	0.166*** (0.059)
=1 for either country is island (0 for both are islands)	0.149* (0.084)	0.077 (0.092)	0.069 (0.089)
Absolute Difference in Absolute Latitude			0.009*** (0.004)
Observations	10296	10296	10296

Two-way clustered standard errors in parentheses; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

APPENDIX

Figure A.1. Choropleth Map: Weighted Genetic Fst Distance from the US



(Darker countries are genetically relatively more distant.)

Figure A.2.

