The Out of Africa Hypothesis of Comparative Development

Oded Galor

June 18, 2024

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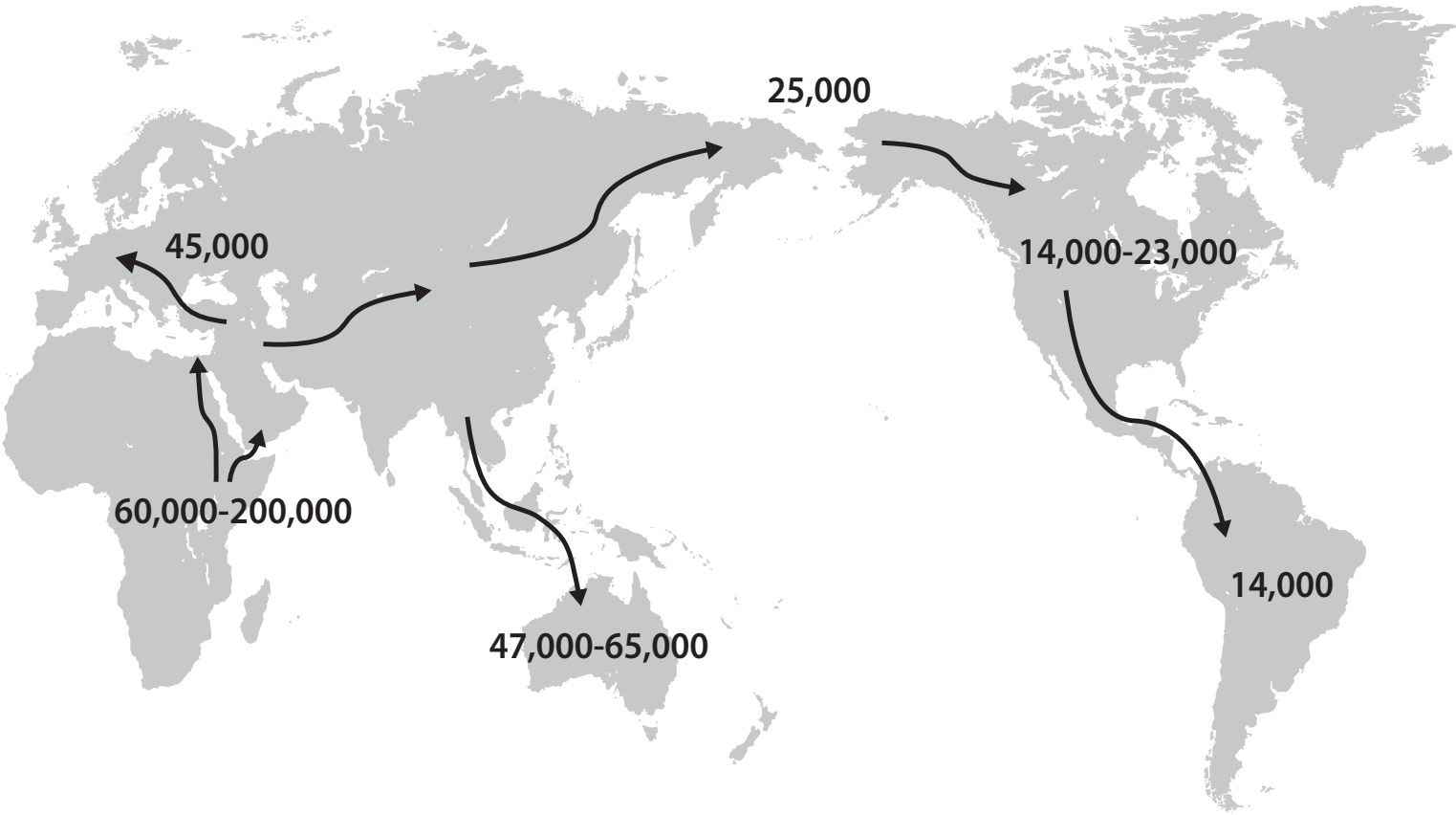
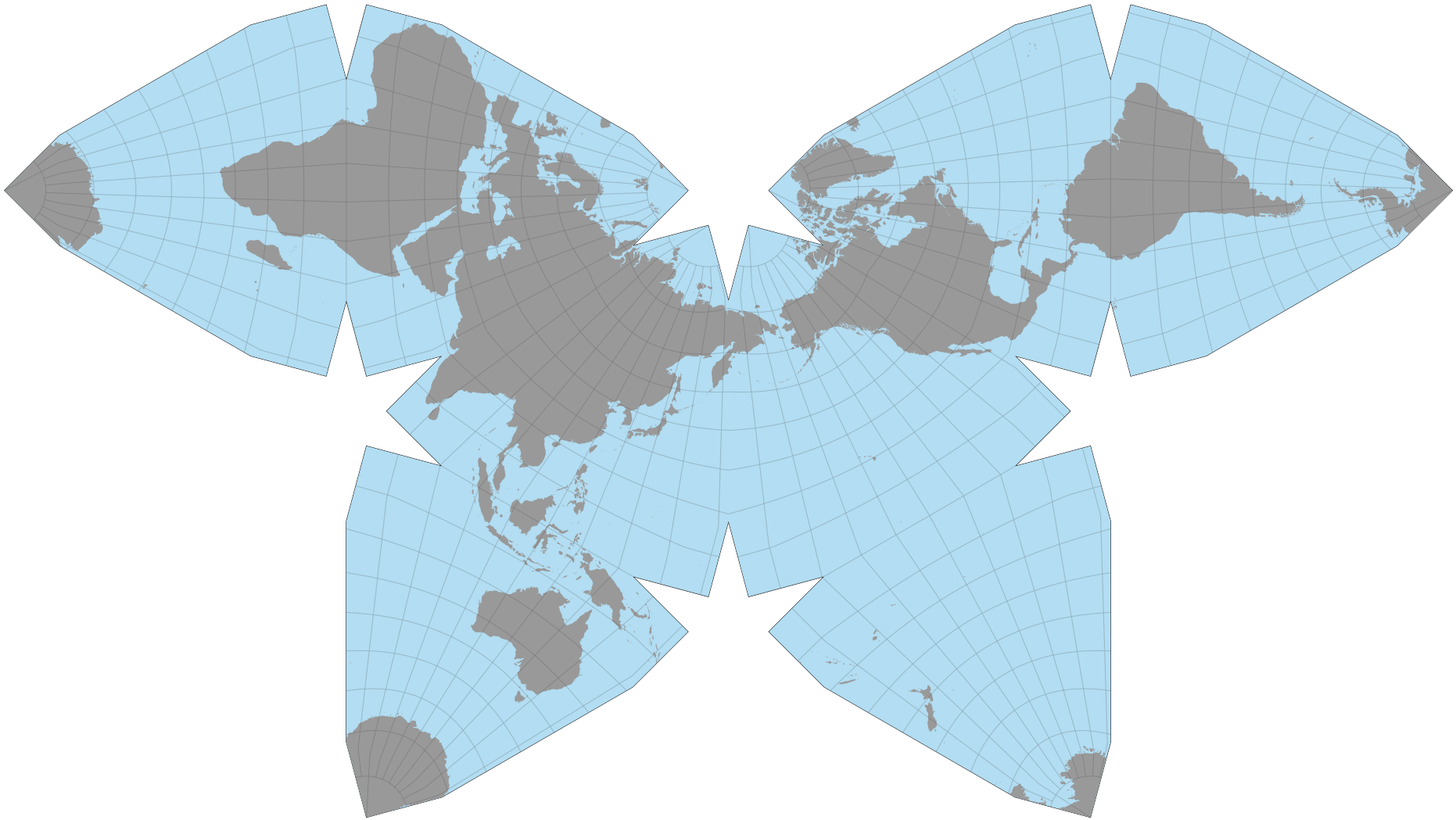
The Exodus of Homo sapiens from Africa 60,000-90,000 BP



Migration out of Africa and Human Diversity



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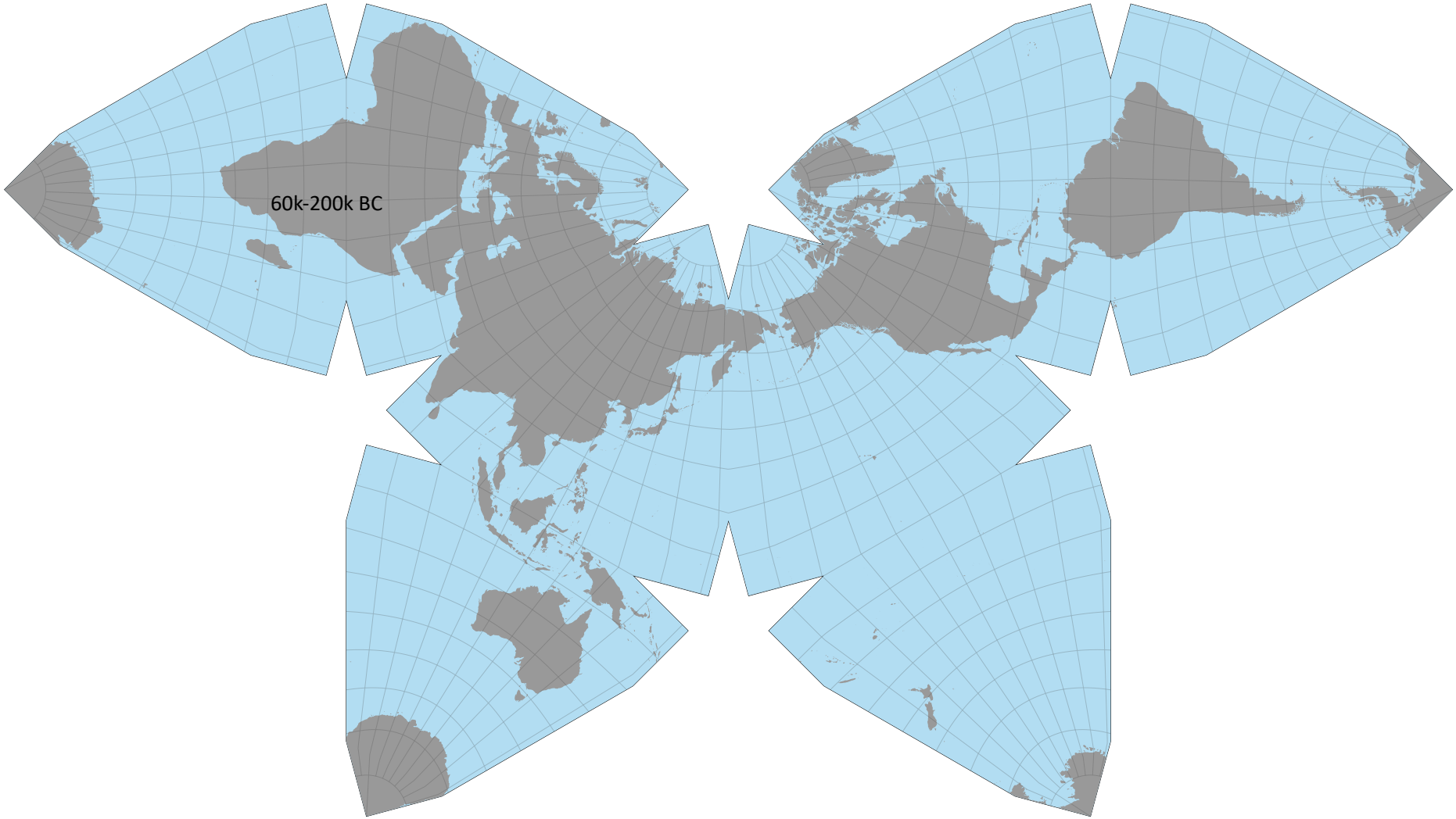

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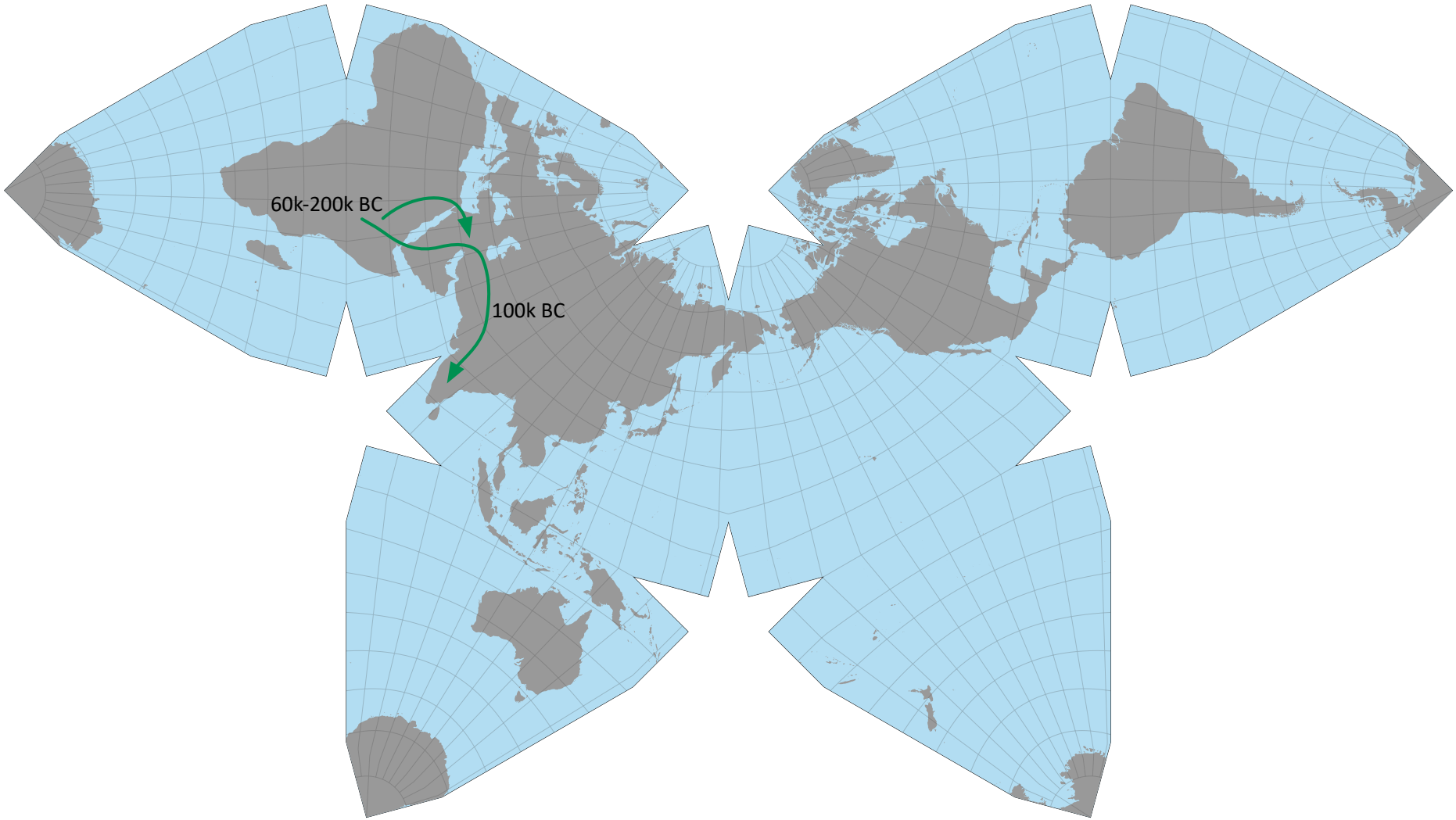

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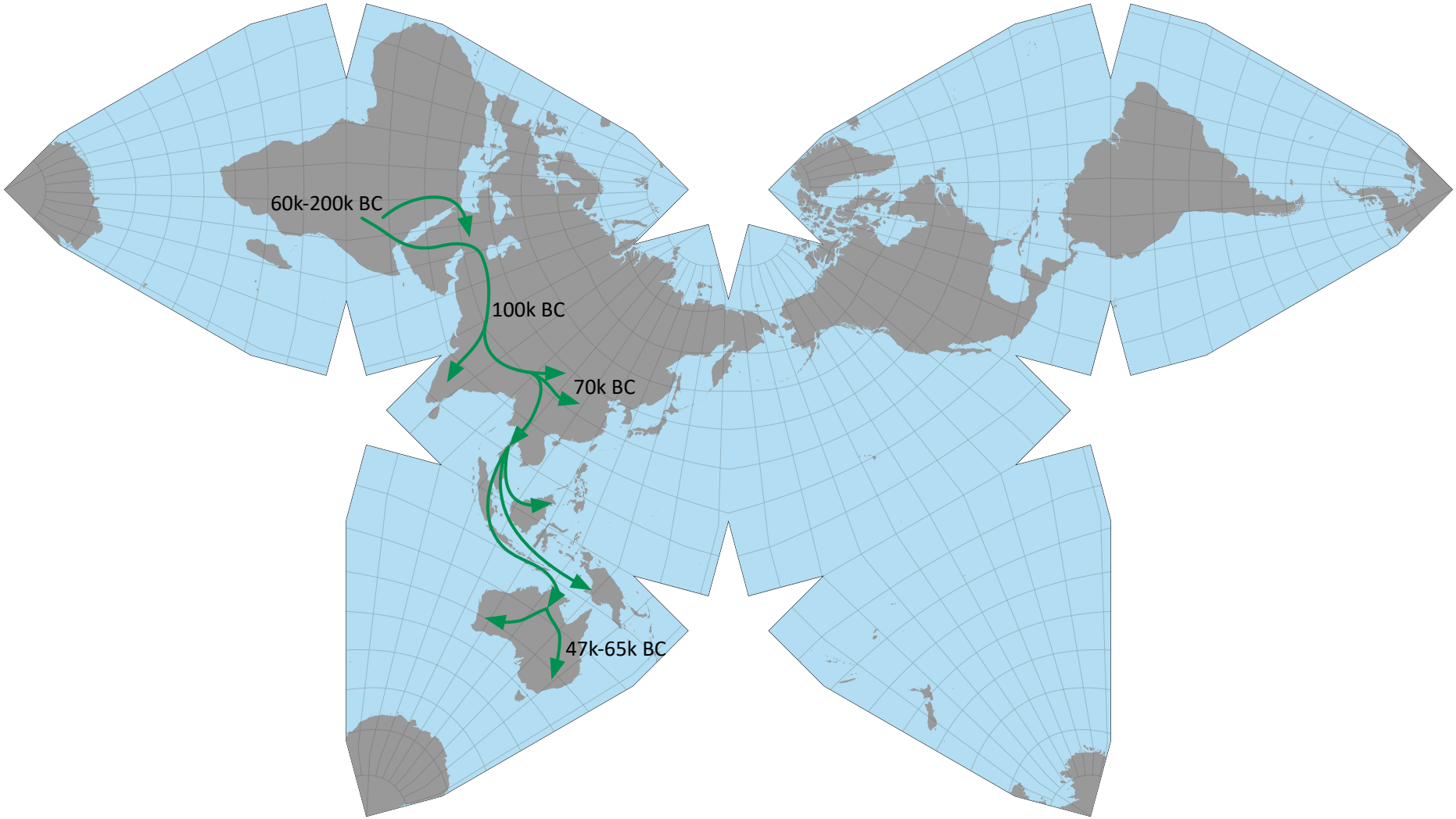

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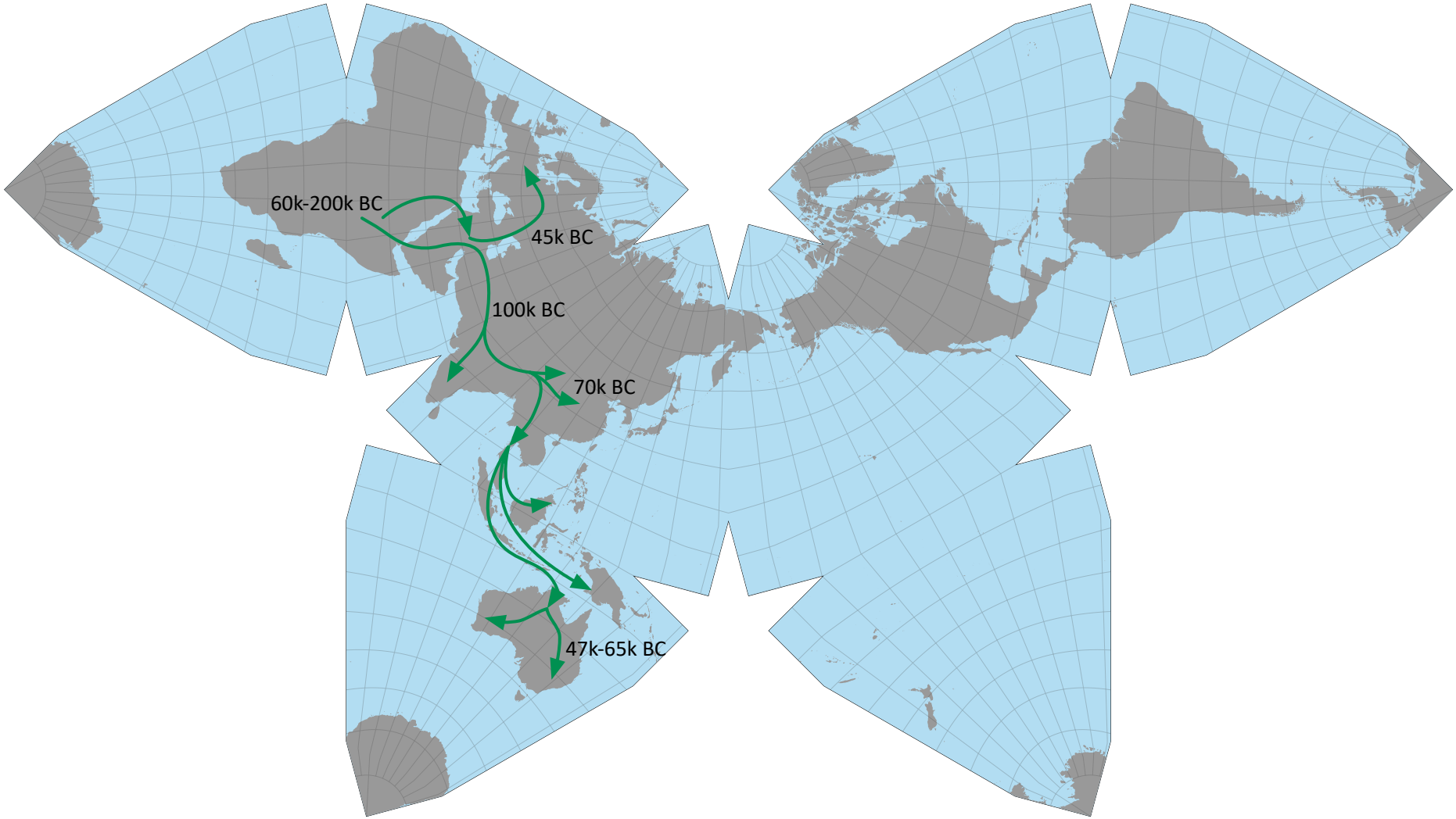

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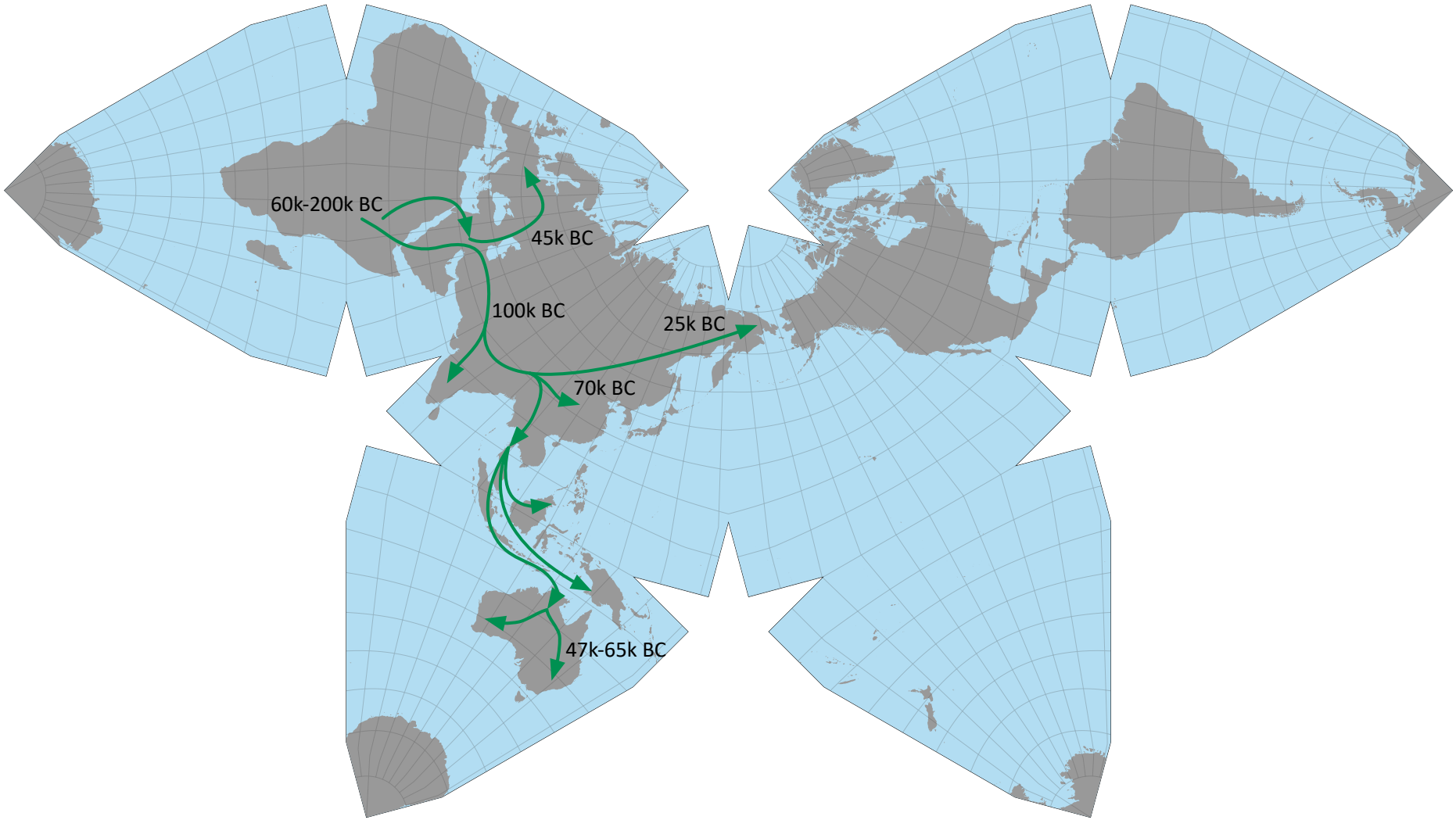

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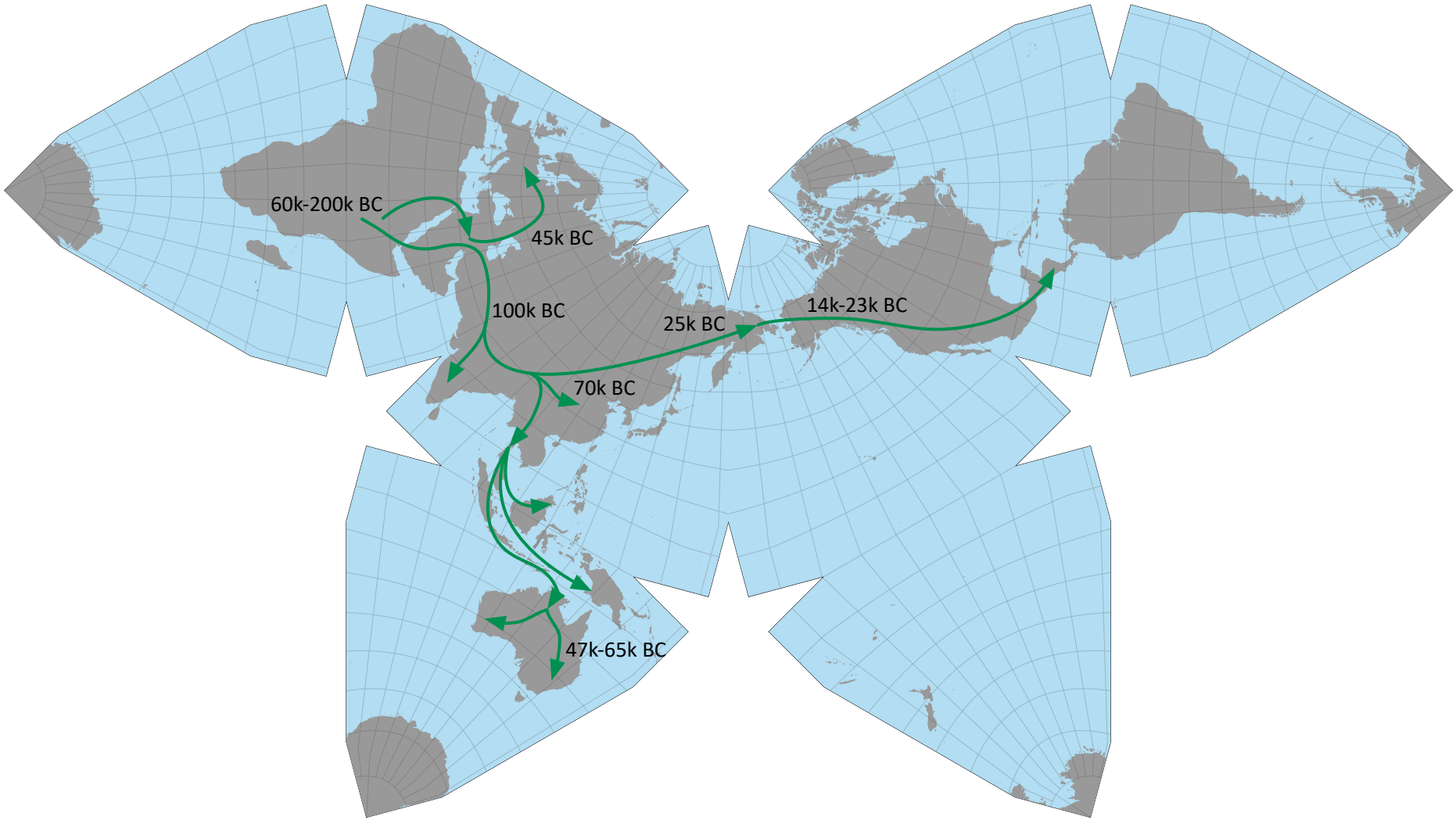

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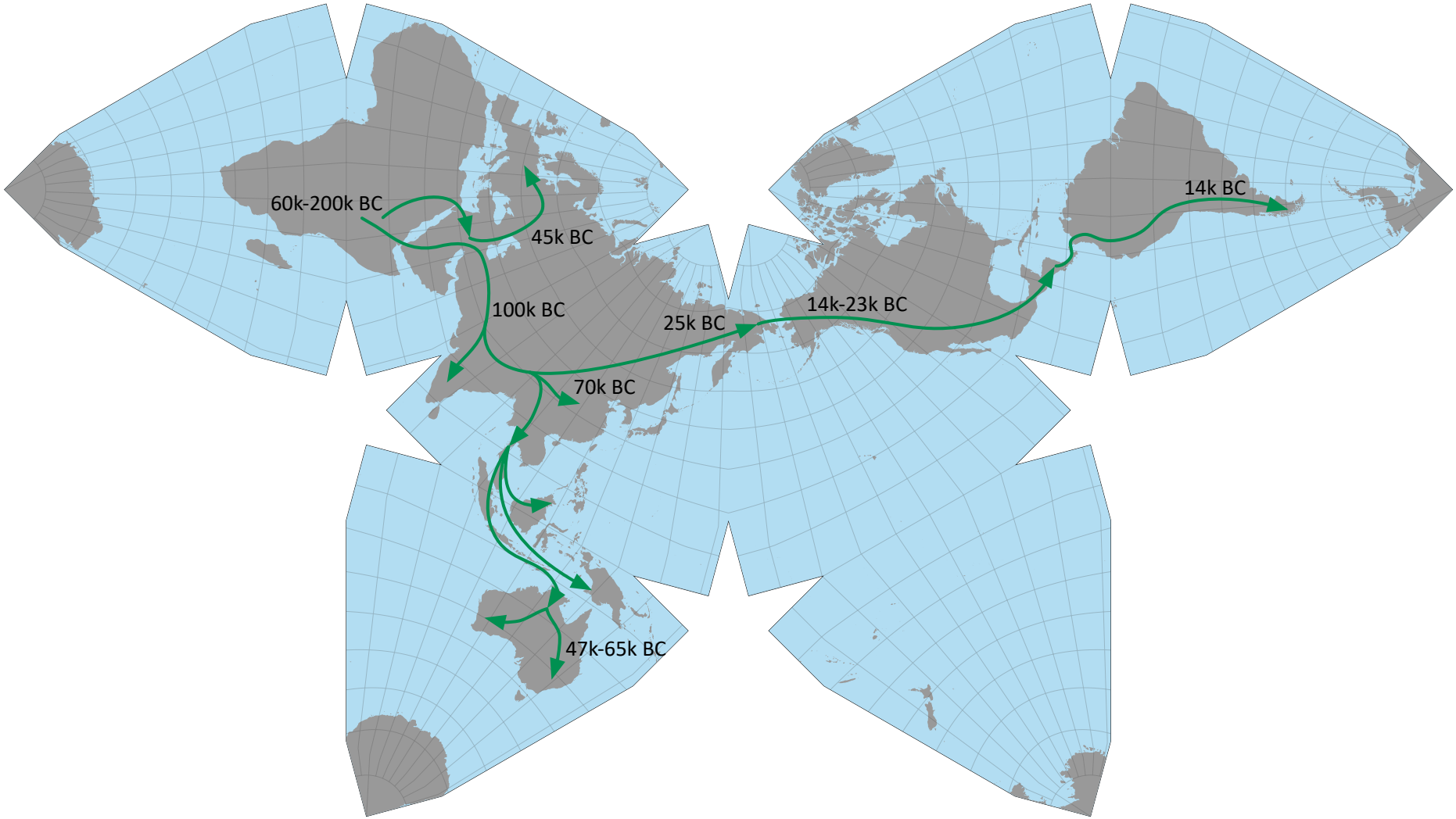

The Serial Founder Effect

During the exodus of modern humans from Africa

- Departing populations:

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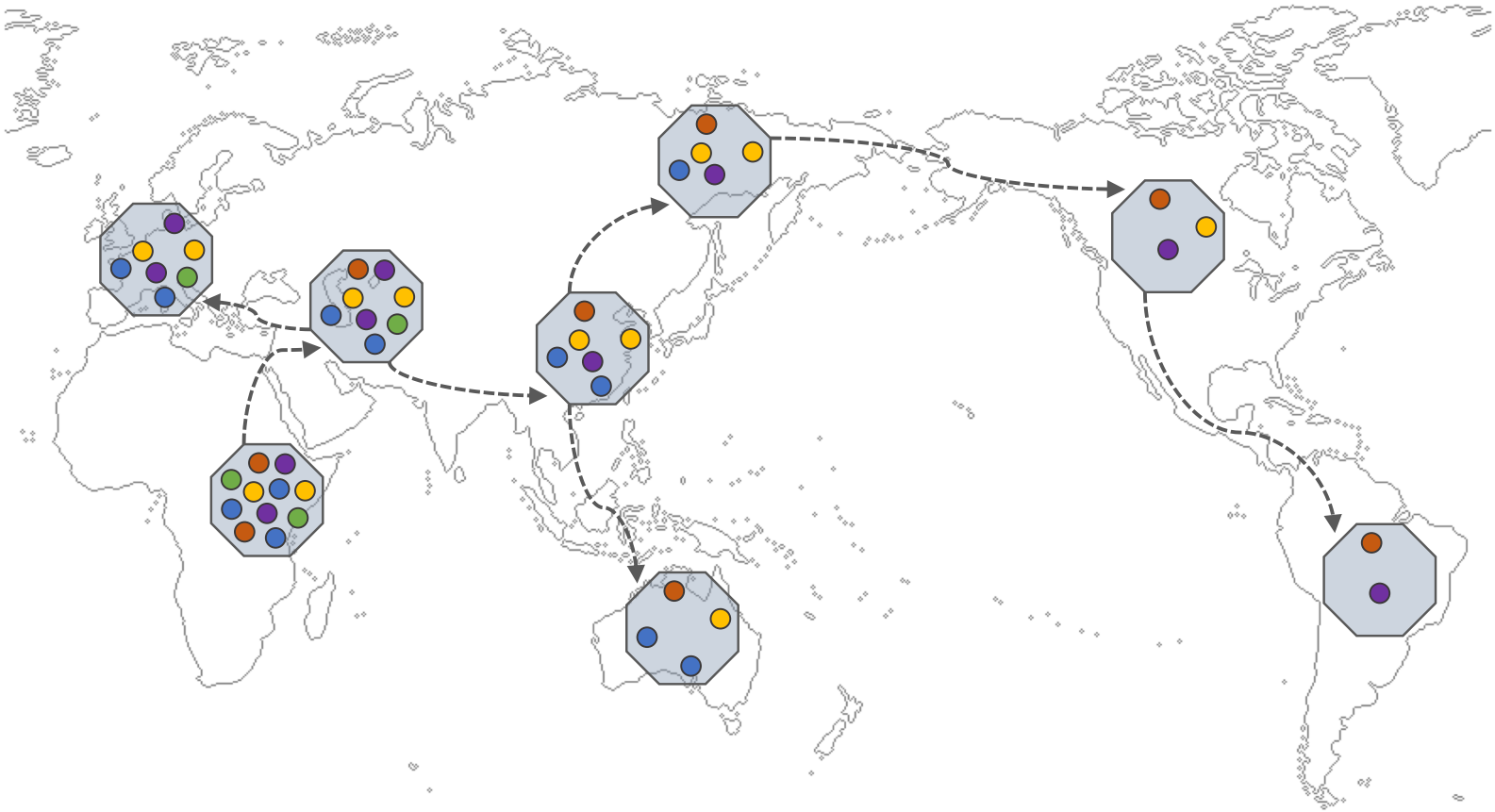
An Illustration of the Serial Founder Effect



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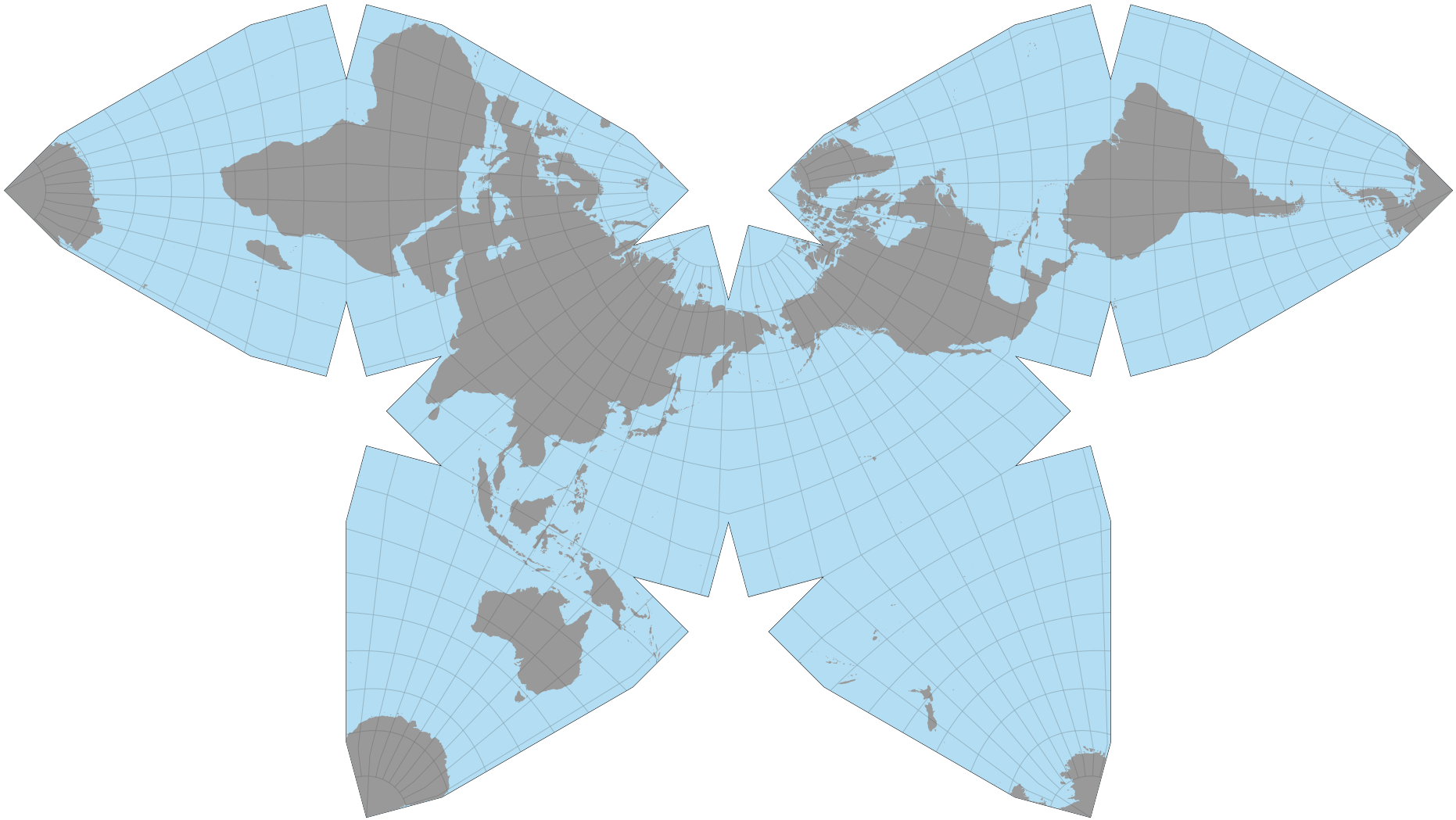

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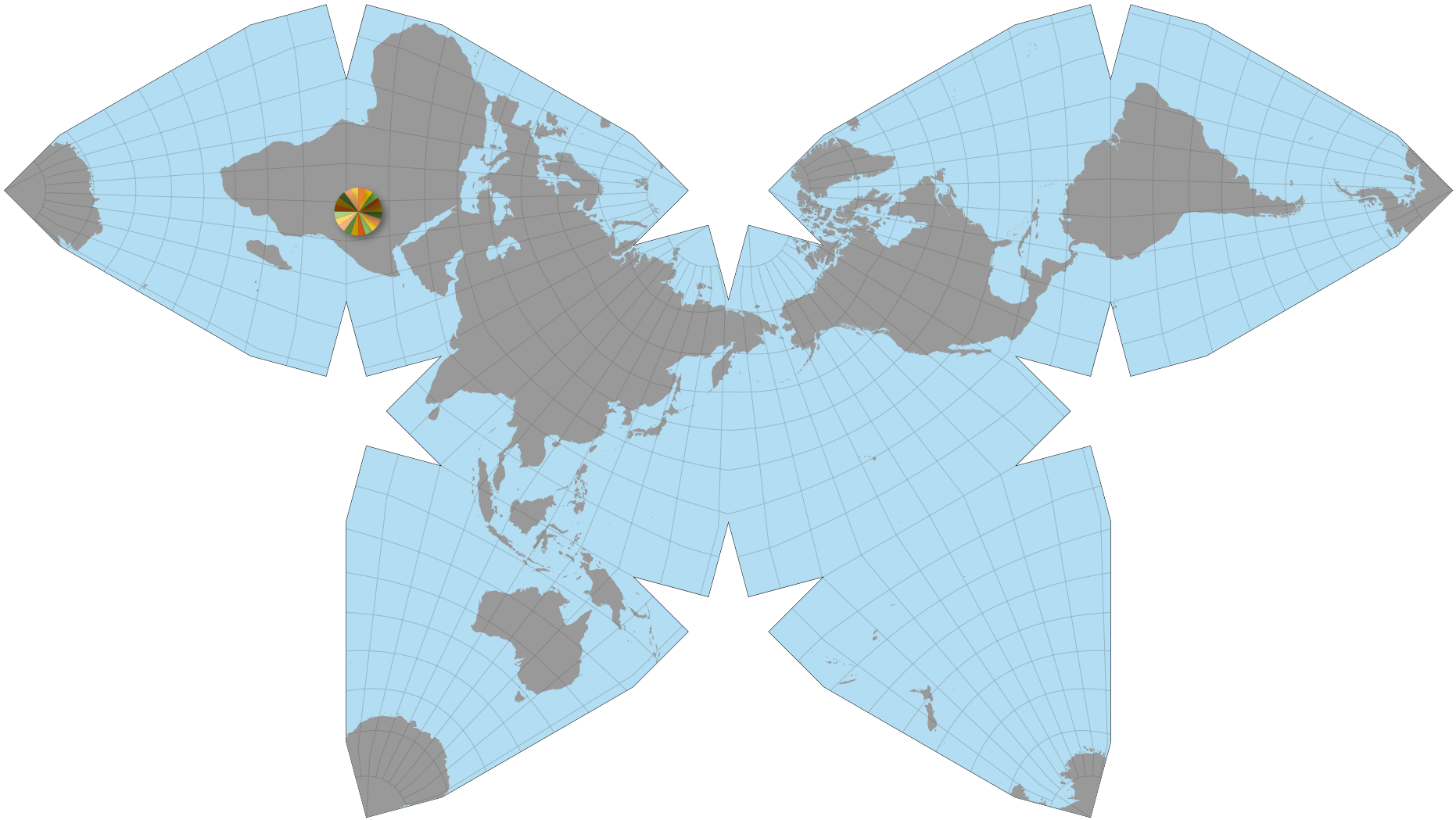

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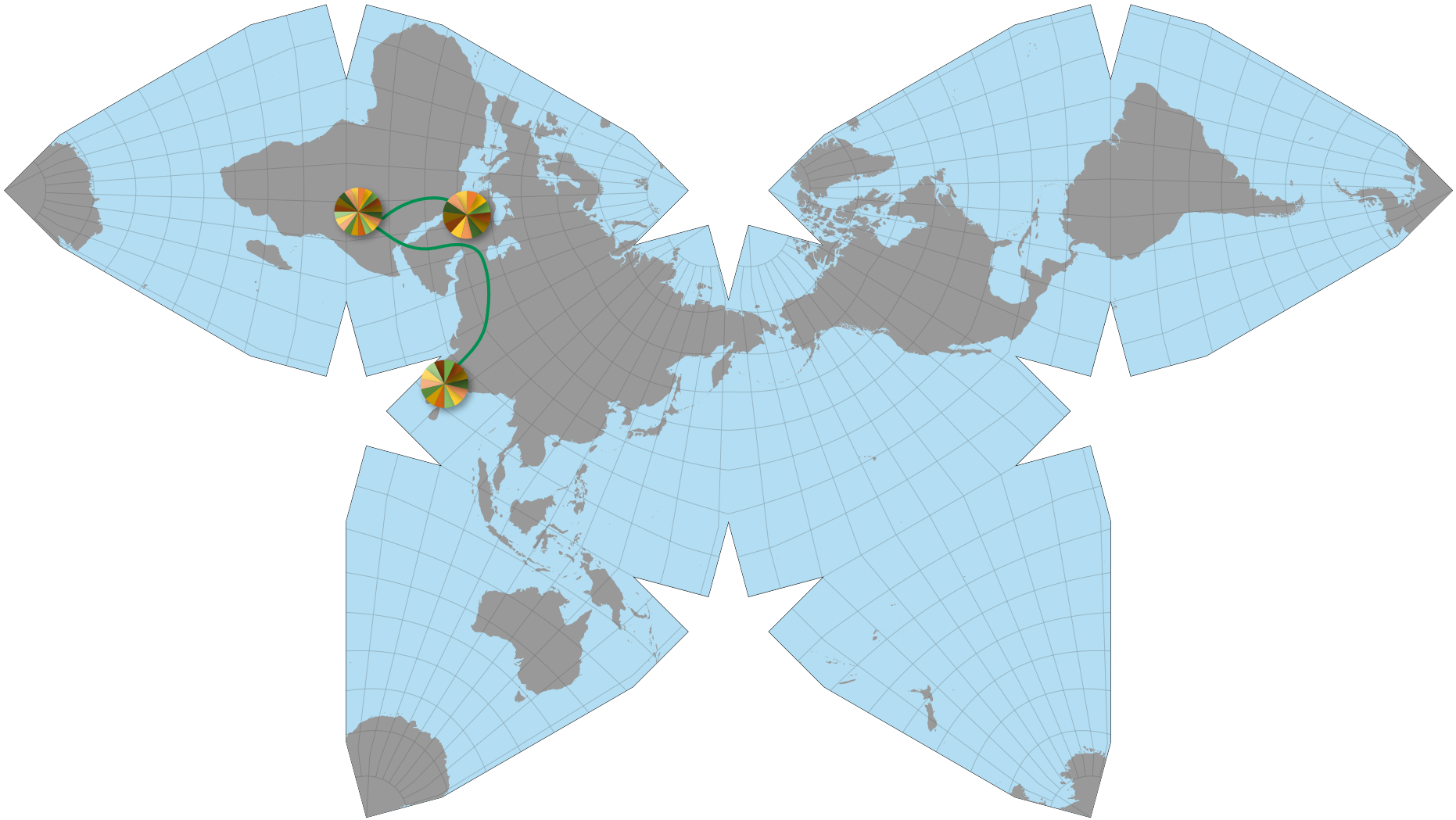

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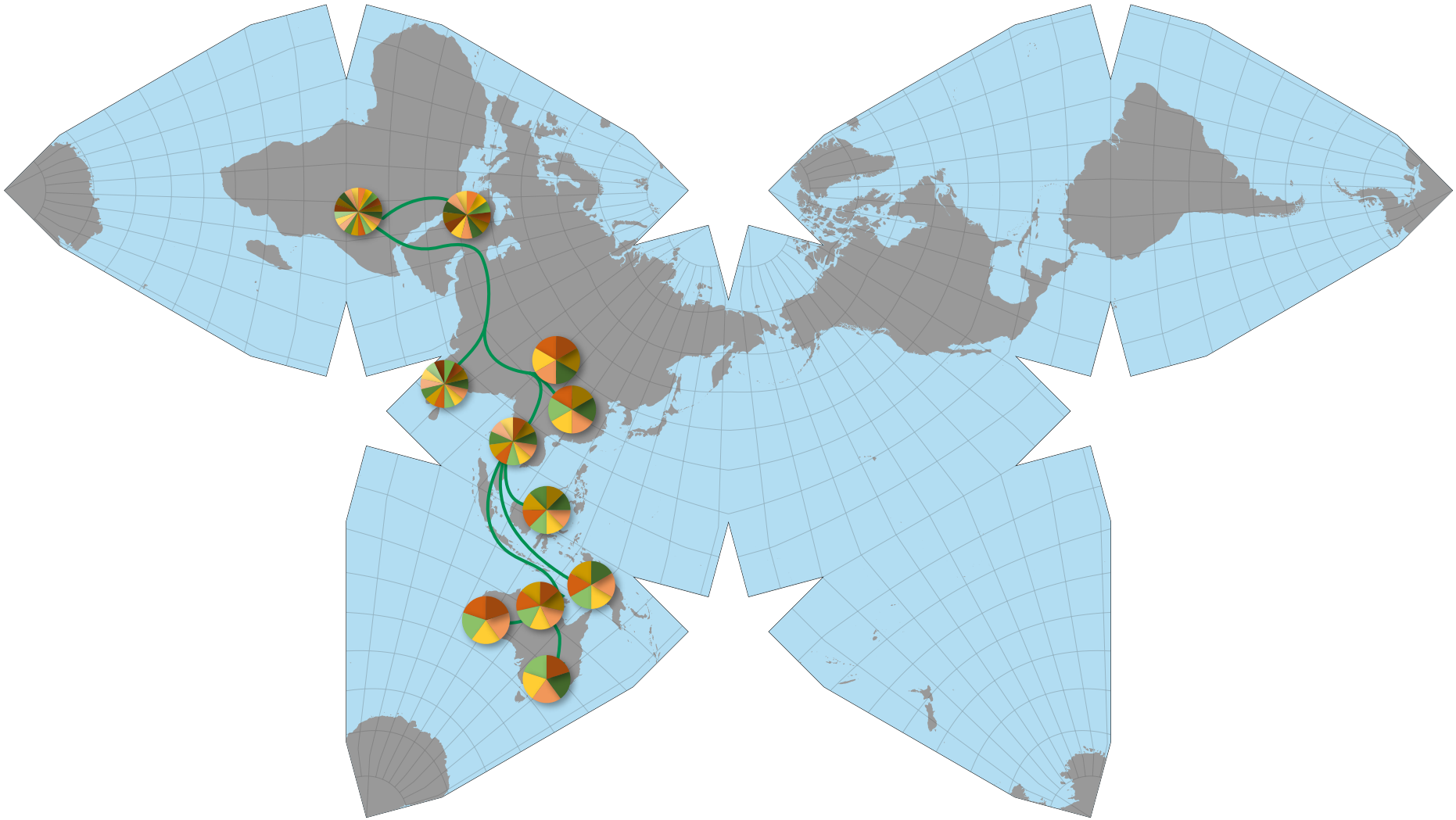

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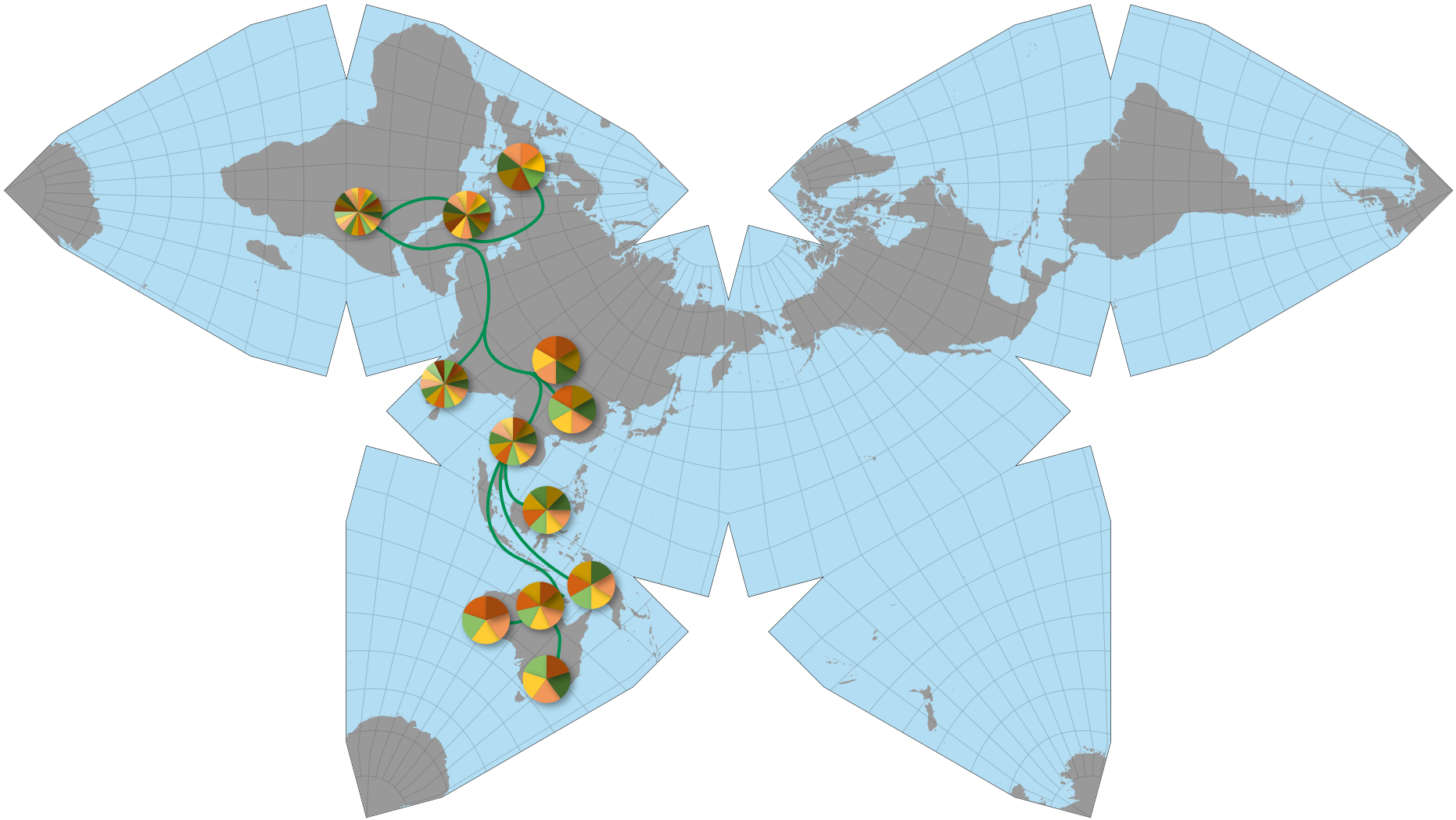

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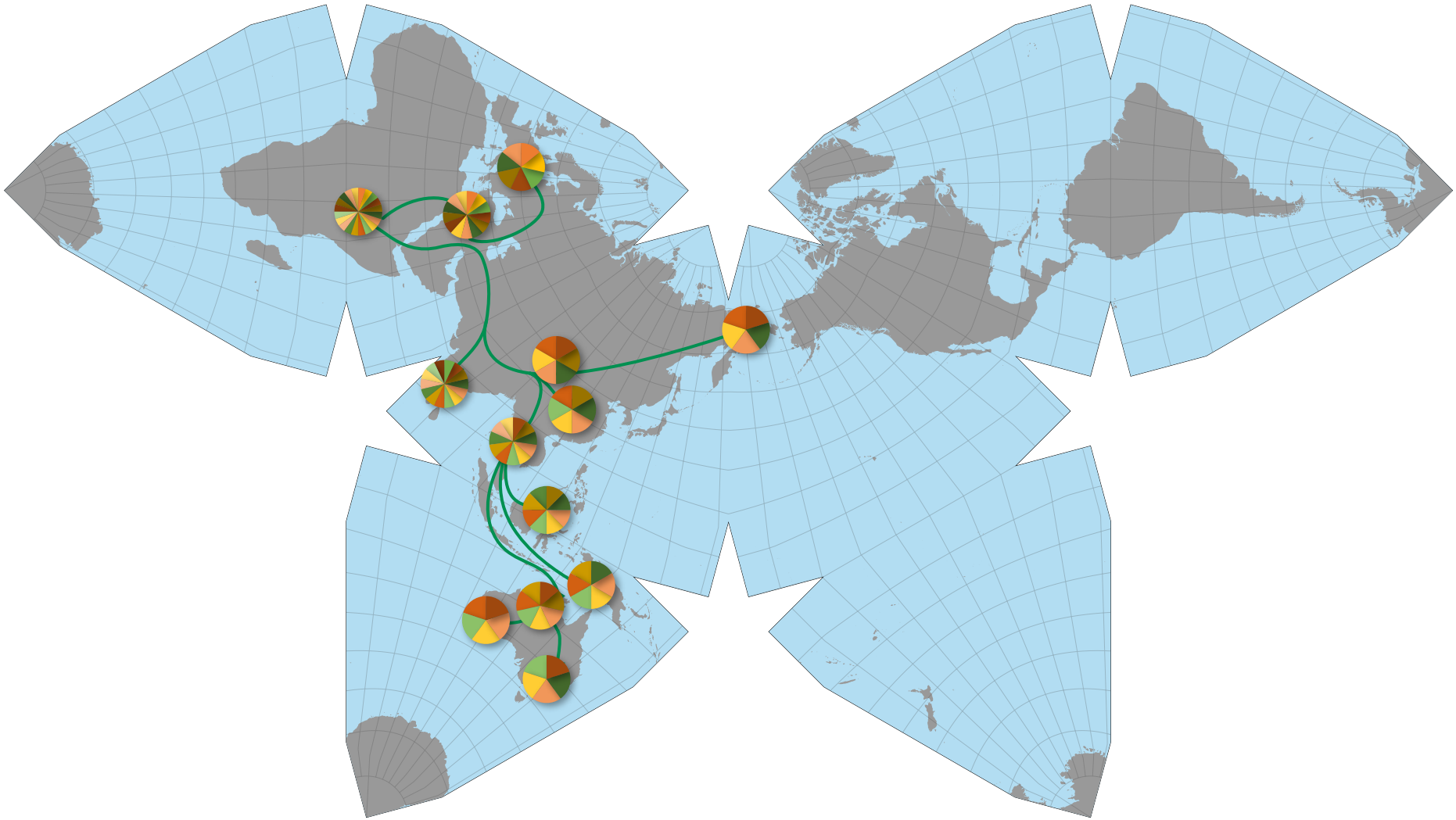

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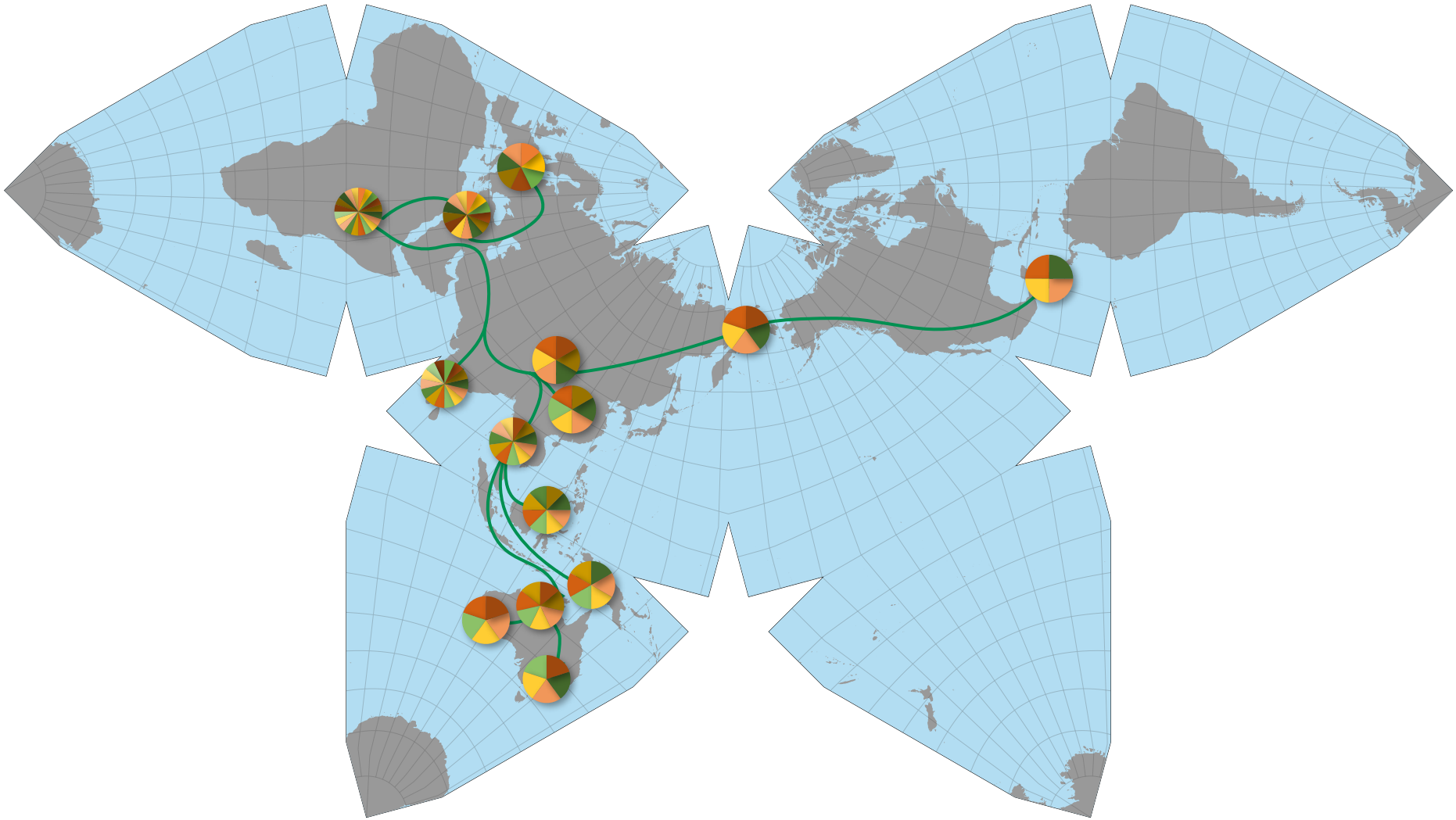

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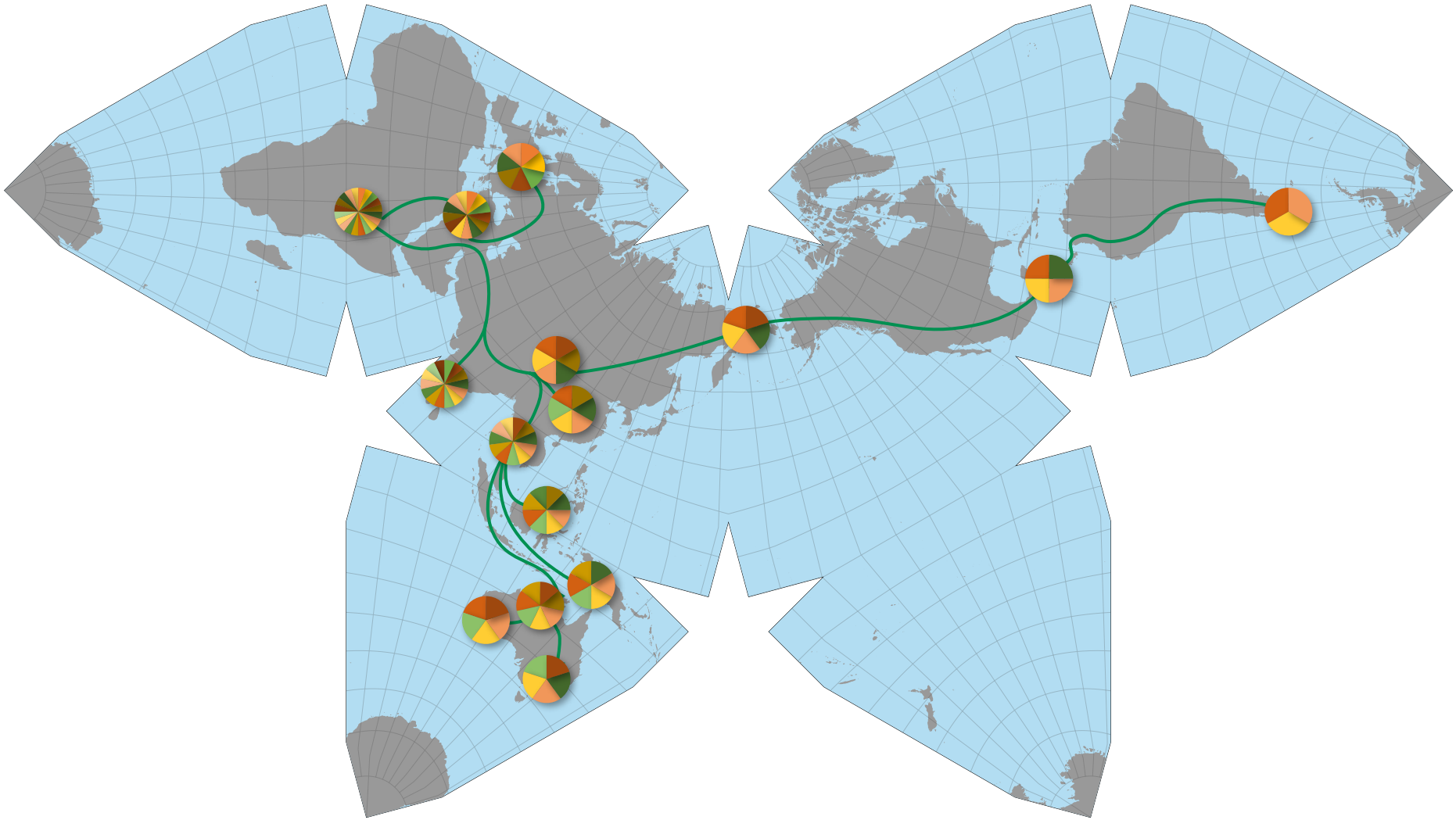
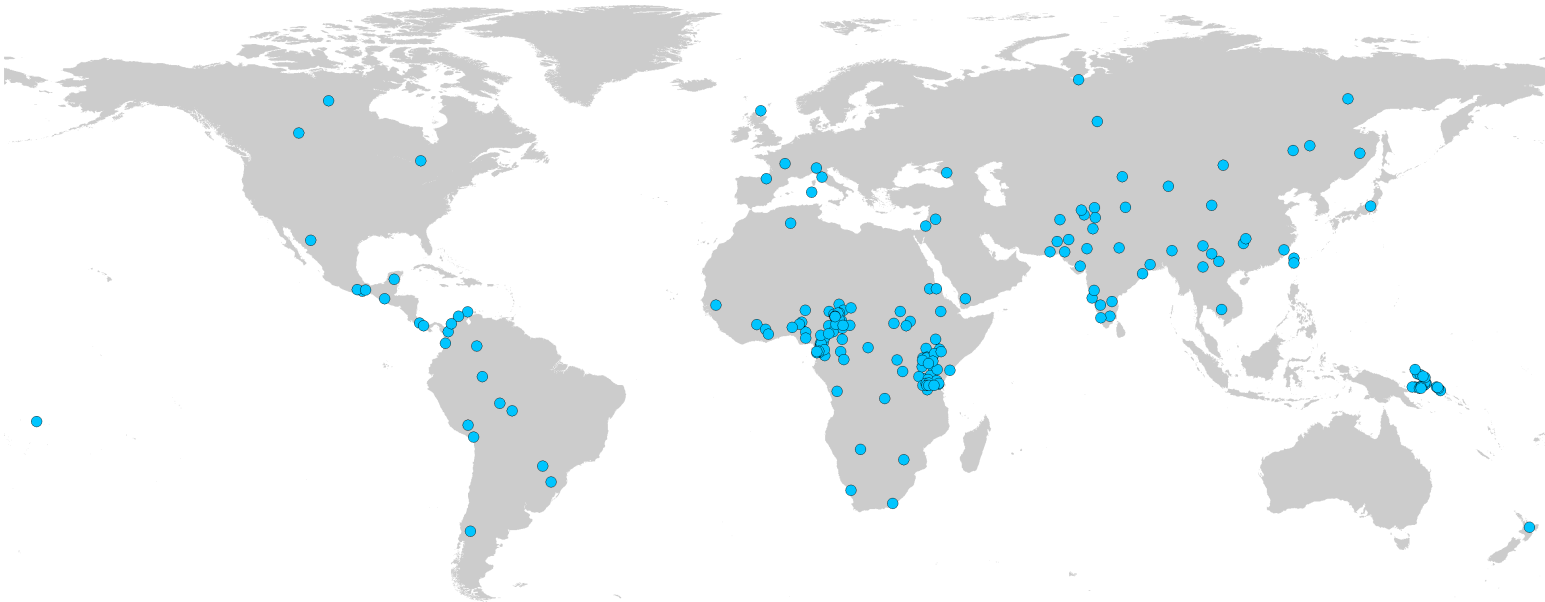
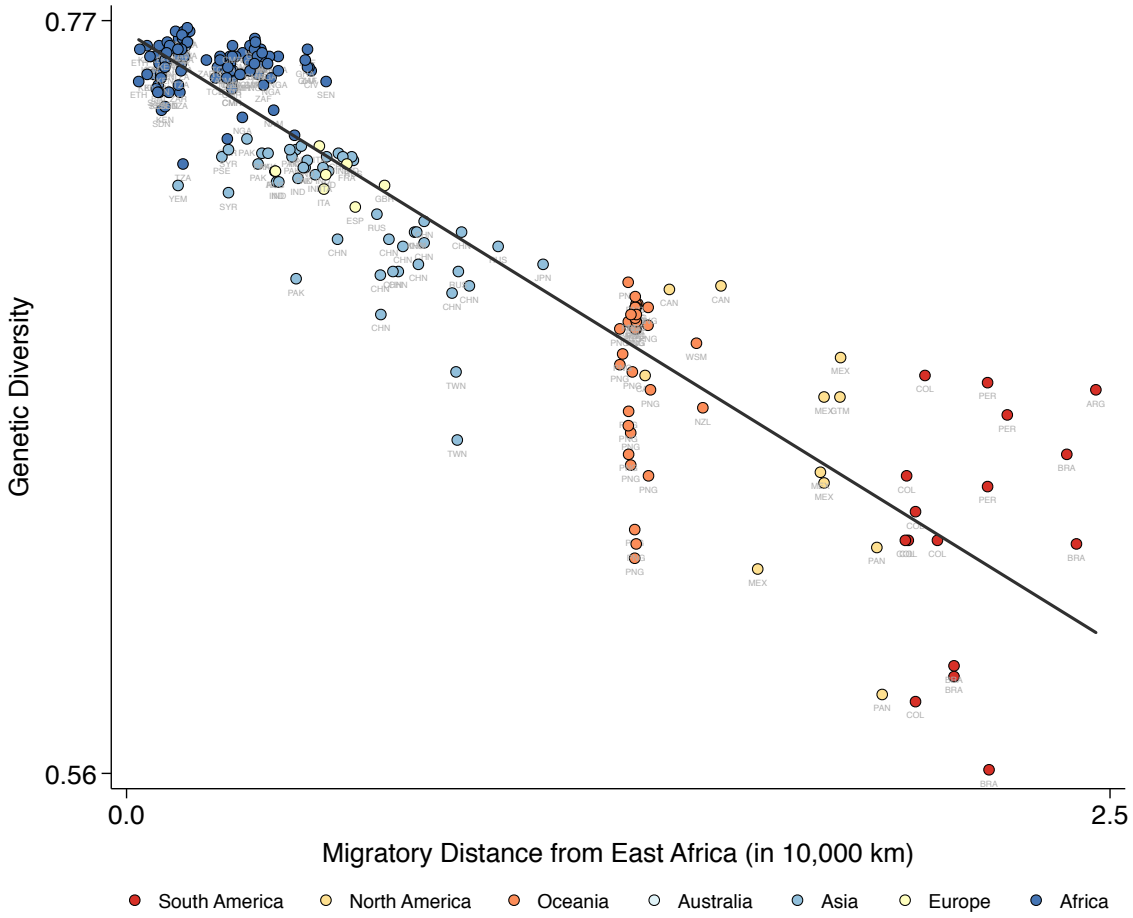


Observed Diversity - 207 Ethnic Groups

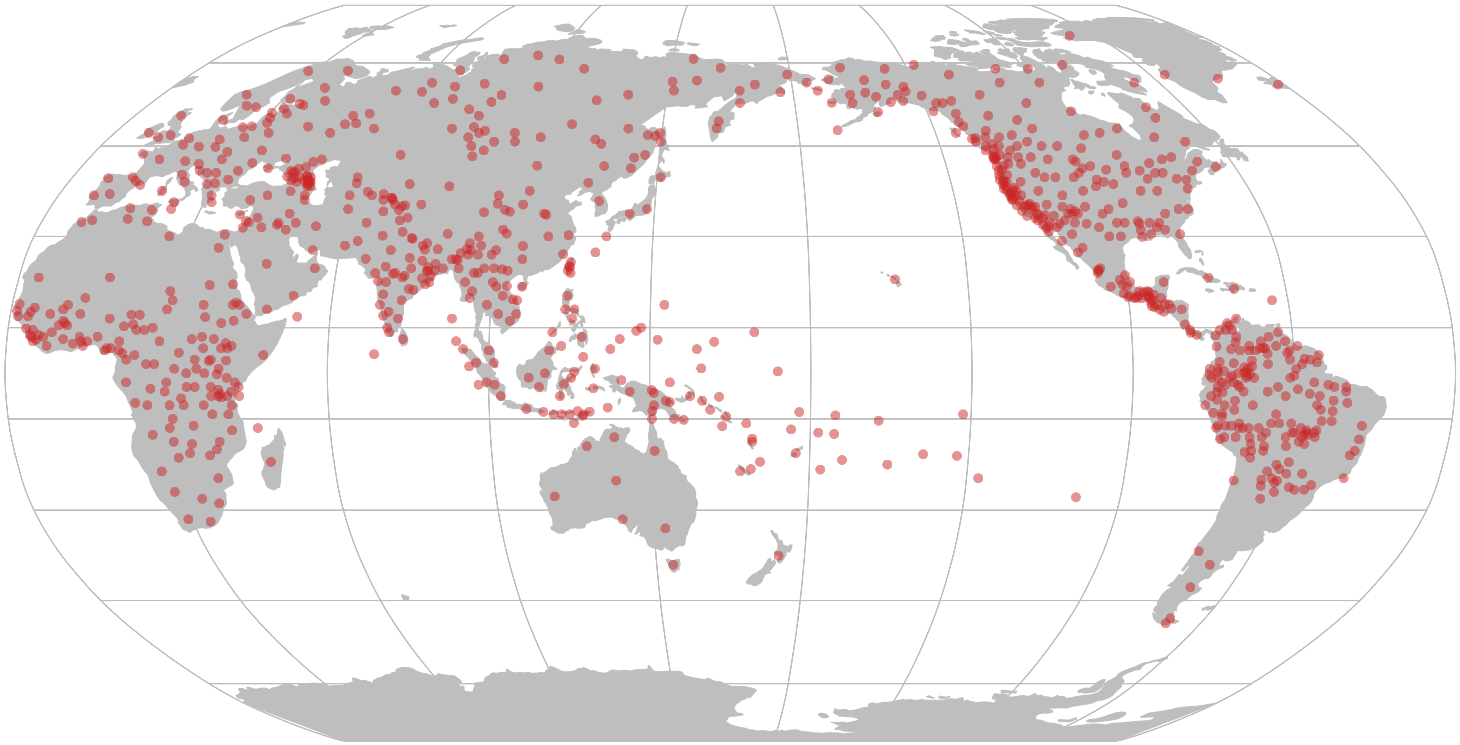


Migratory Distance from Africa and Population Diversity

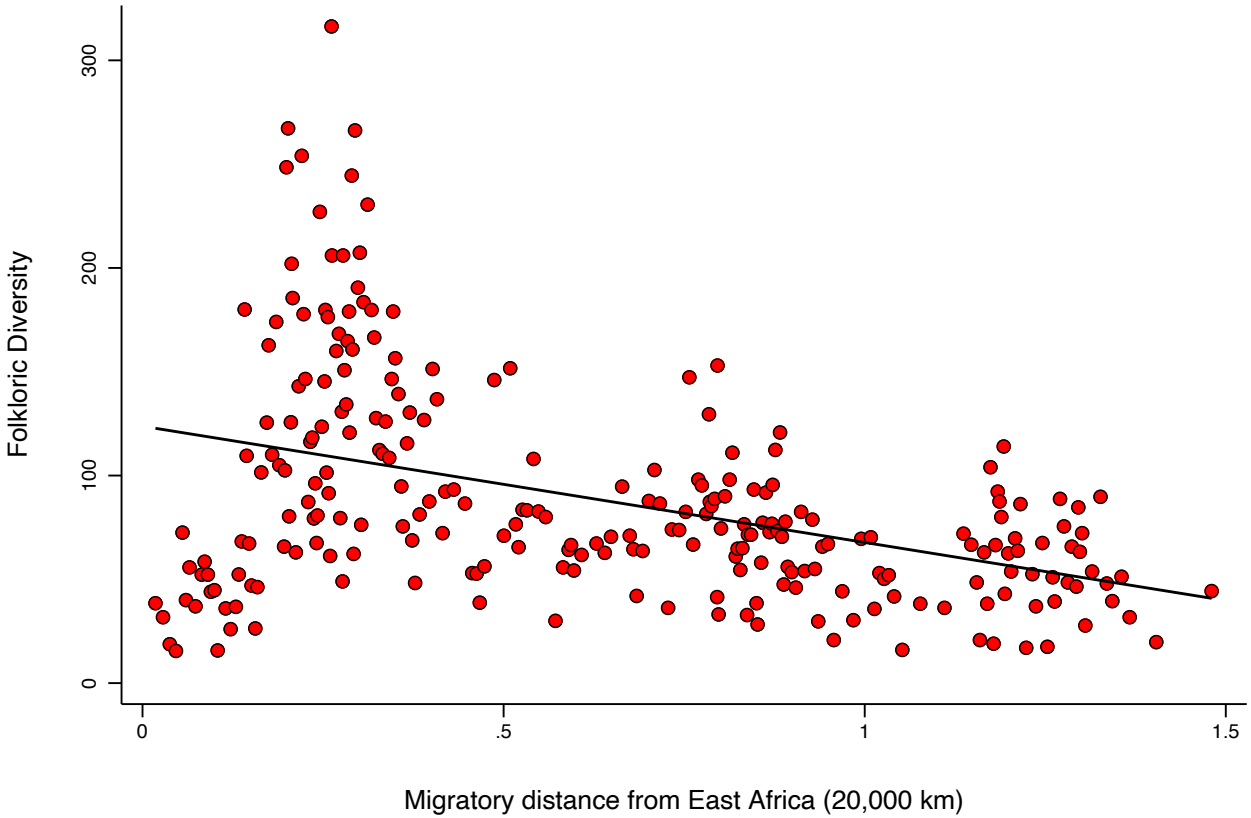


Source: Ashraf-Galor, AER 2013, Arbatli-Ashraf-Galor-Klemp, ECMA, 2020

Folkloric Diversity – 958 Ethnic Groups (Berezkin's Folklore & Mythology Catalogue)



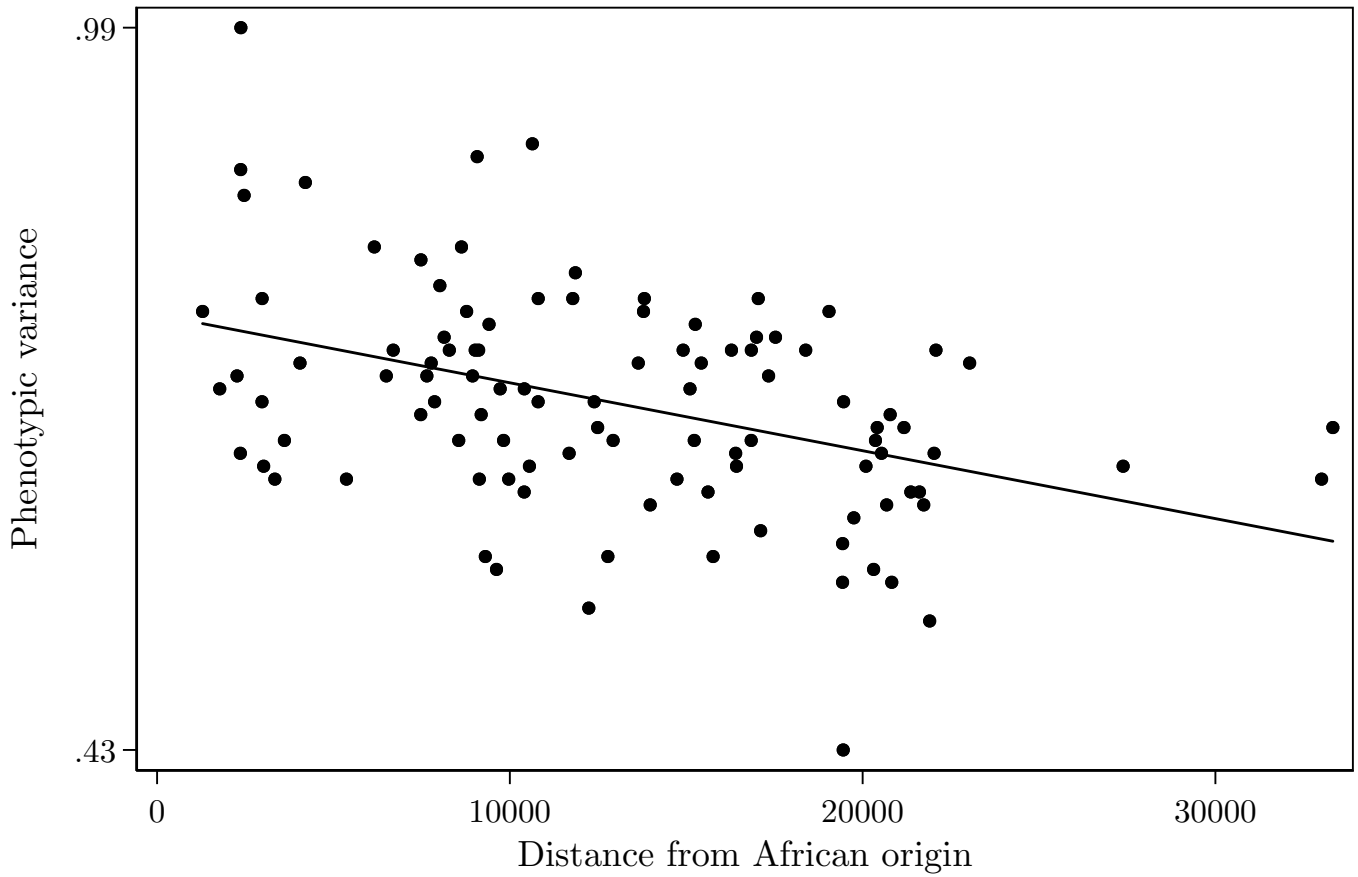
Migratory Distance from Africa and Folkloric Diversity



Slope coefficient = -55.572; (robust) standard error = 6.822; t-statistic = -8.146; observations = 958

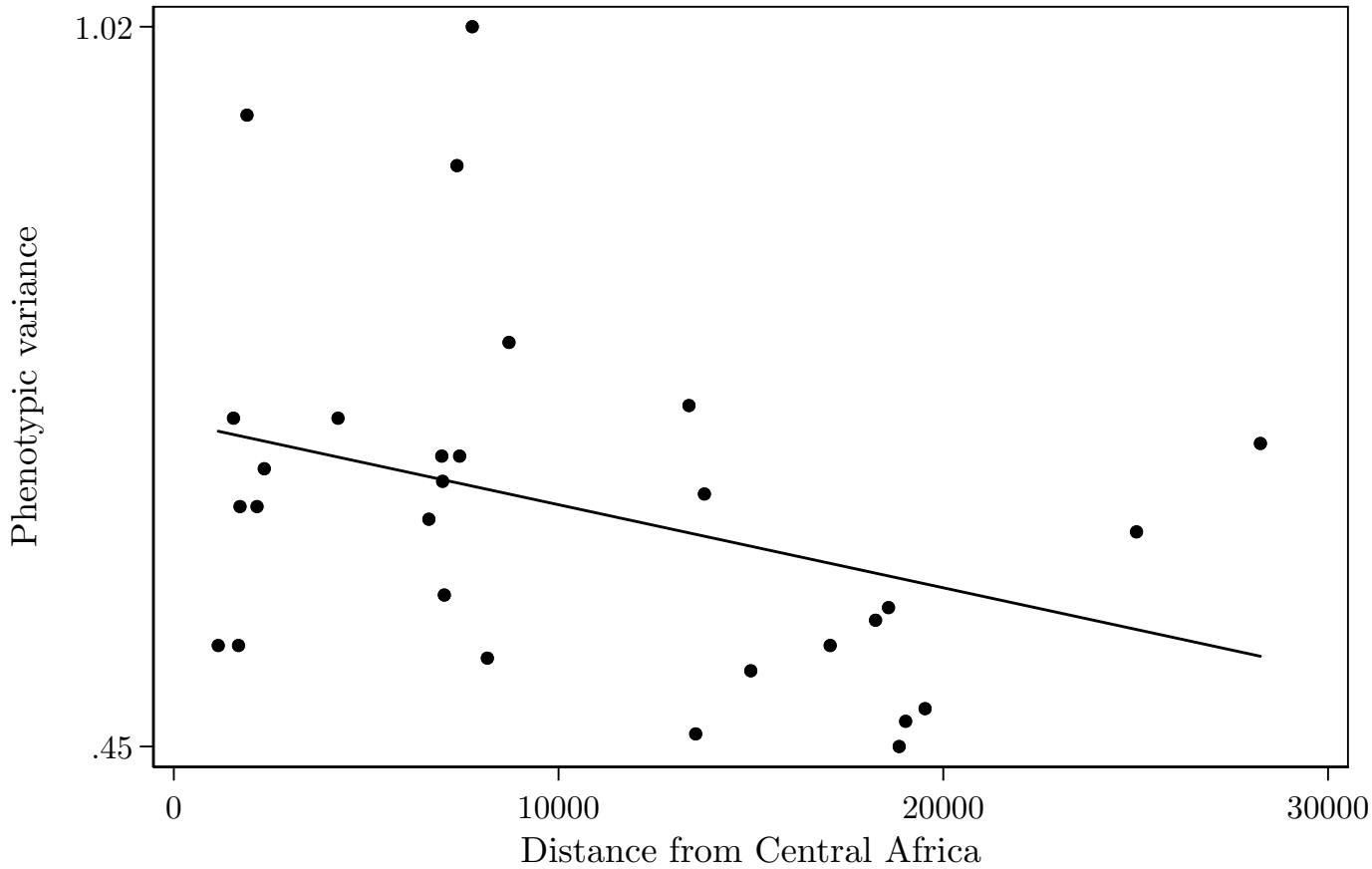
Source: Galor-Klemp-Wainstock, 2023

Migratory Distance from Africa and Craniometric Diversity



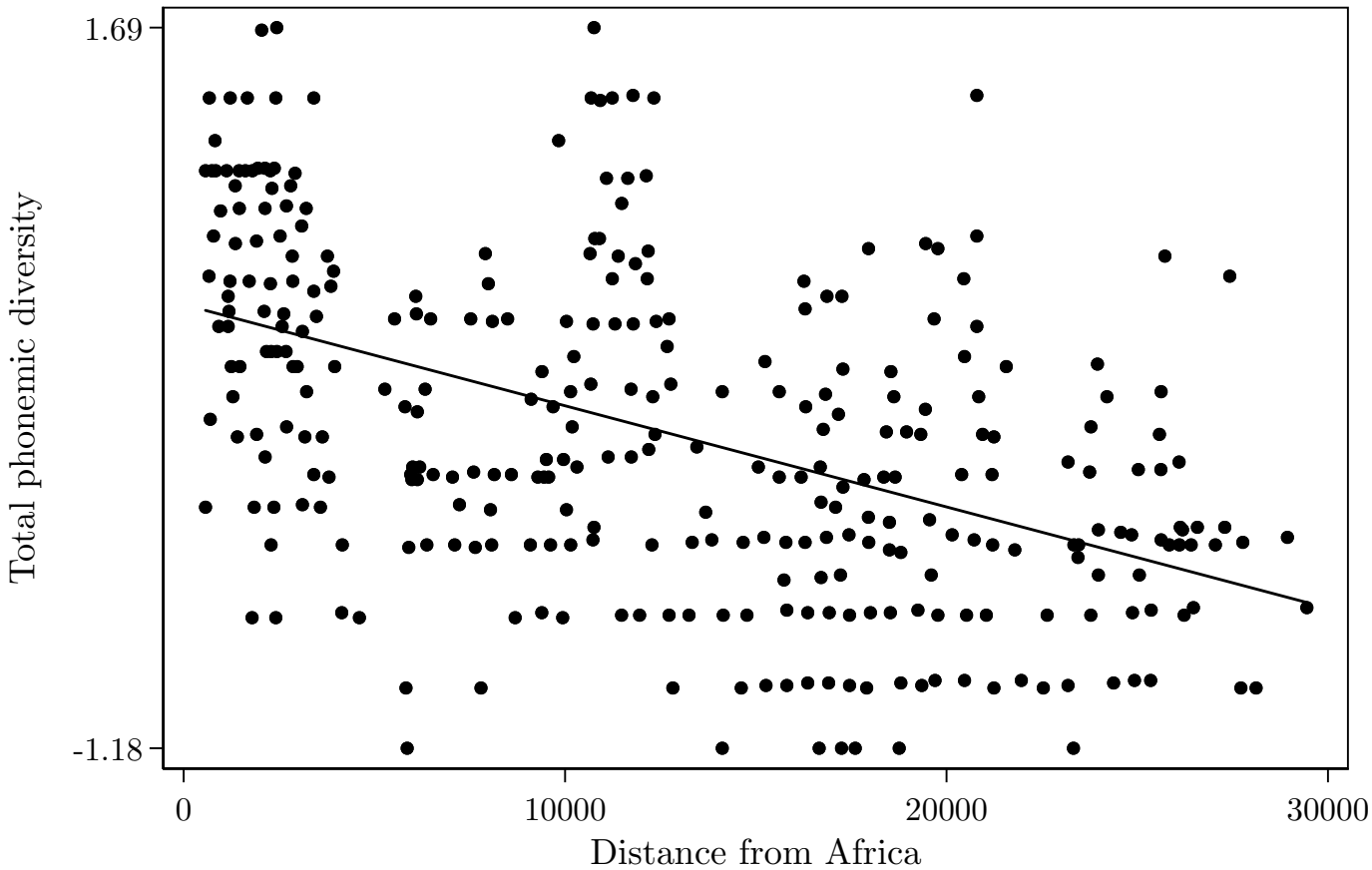
Source: Manica et al., *Nature* 2007

Migratory Distance from Africa and Pelvic Bone Diversity



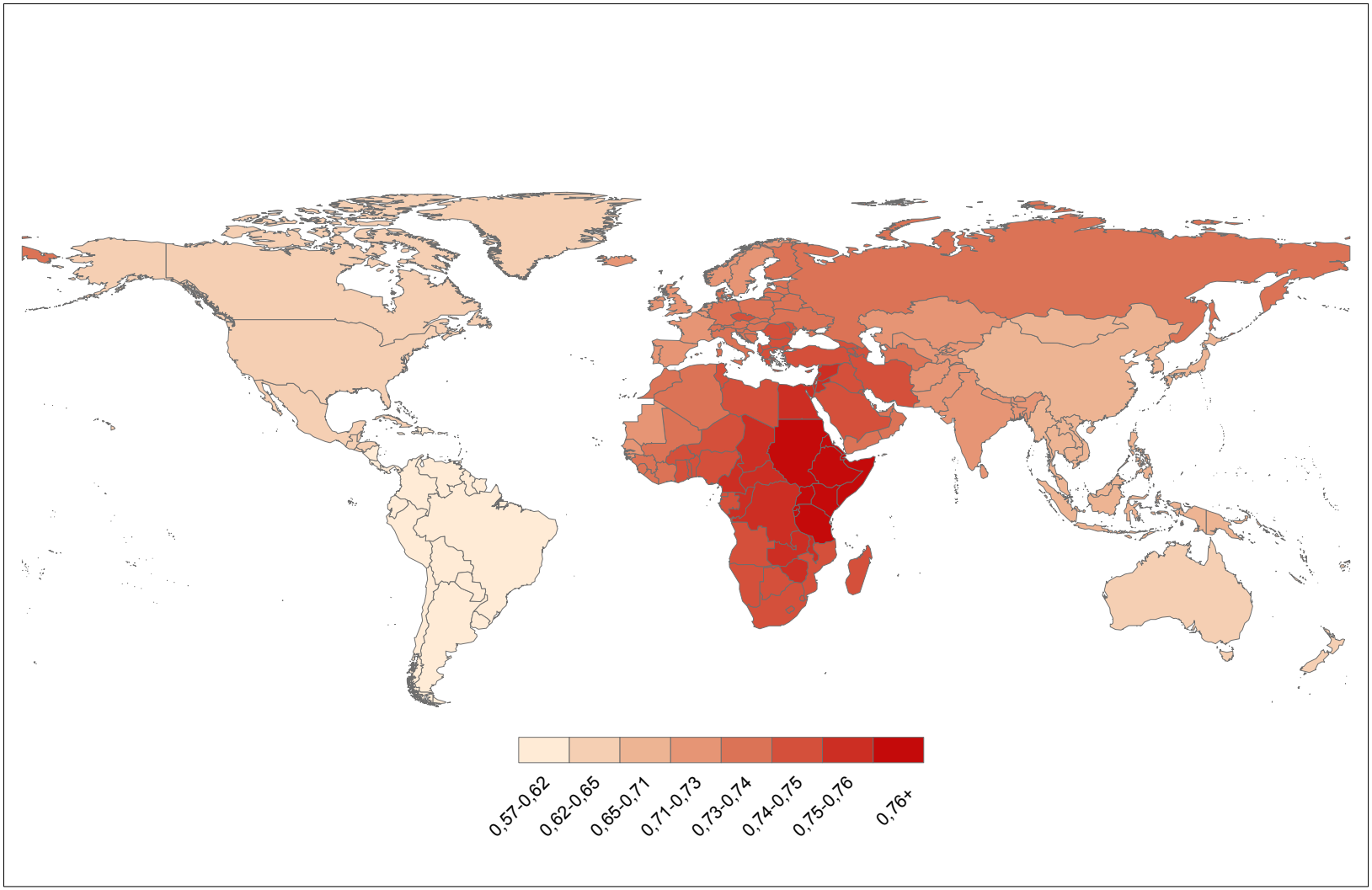
Source: Betti et al., *Proceedings of the Royal Society* 2018

Migratory Distance from Africa and Phonemic Diversity

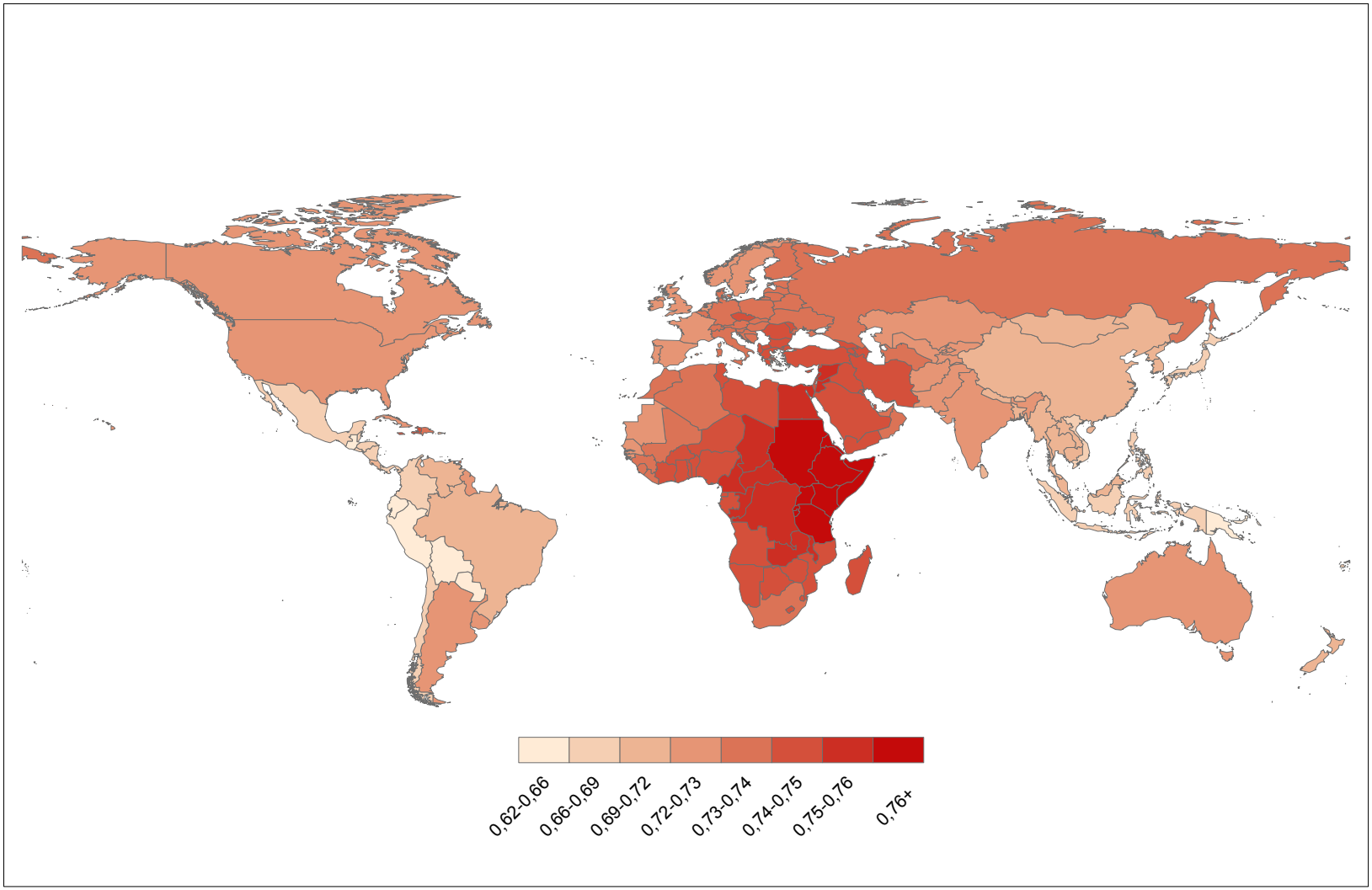


Source: Atkinson, *Science* 2011

Migratory Distance from Africa & Population Diversity (pre-1500)



Migratory Distance from Africa & Population Diversity (post-1500)



Trade-offs: Human Diversity and Productivity

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  - Productivity maximizing diversity increases in the development process

Adverse Effects of Diversity

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    - $\Longrightarrow$ Inefficient productivity relative to the PPF

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  - Upper tail of the distribution that matters for innovations
    - $\Longrightarrow$ Diversity fosters innovations & expands the PPF

Productivity Maximizing Level of Diversity

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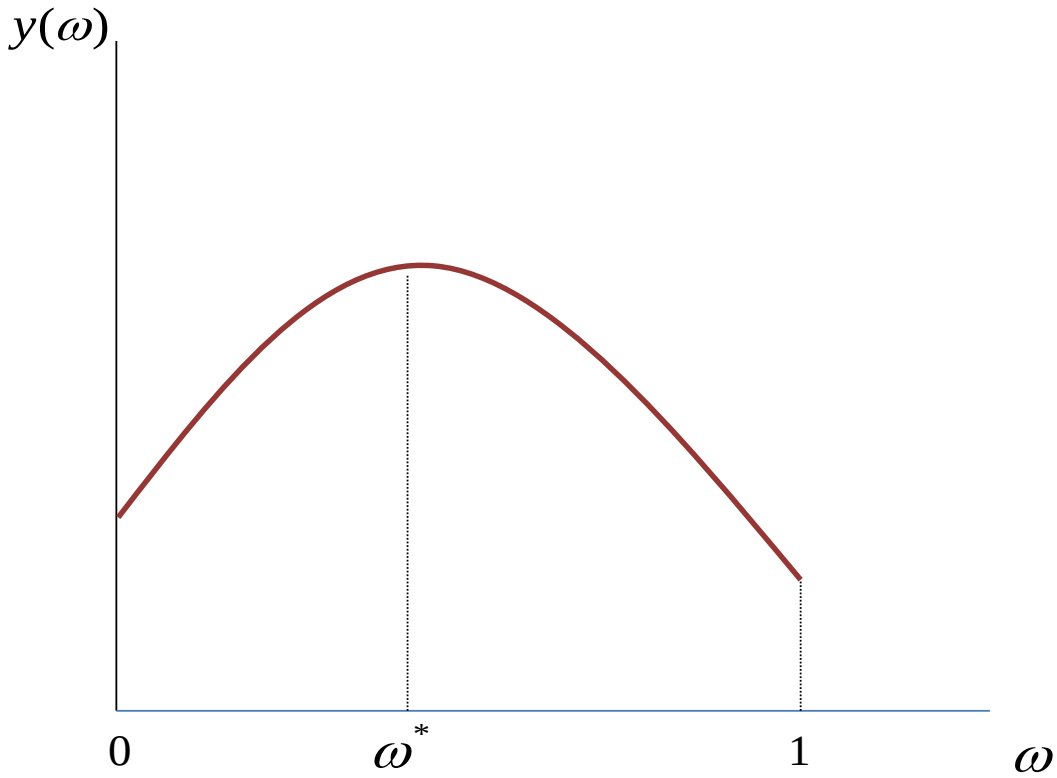
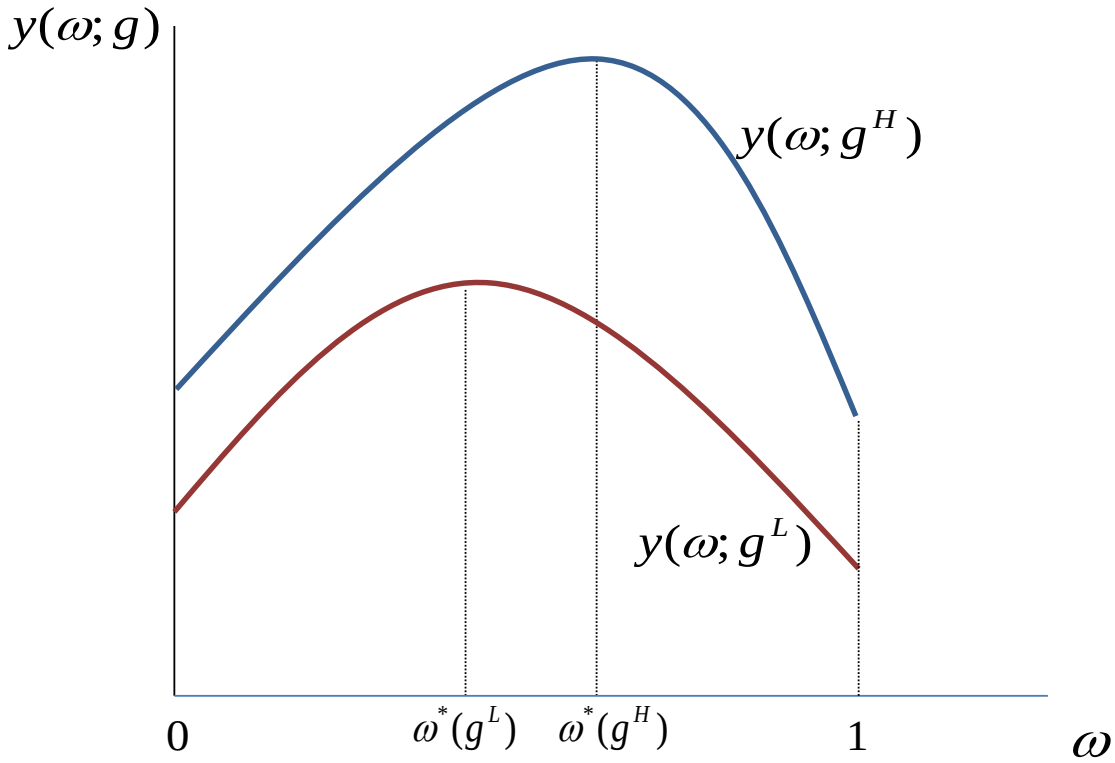
    - $\Longrightarrow$ Optimal level of diversity (for each stage of development)

The Level of Population Diversity that Maximizes Productivity



Growth Enhancing Diversity in a Changing Technological Progress



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  - Adjustment of population diversity for migration in post-1500 period

Empirical Strategy

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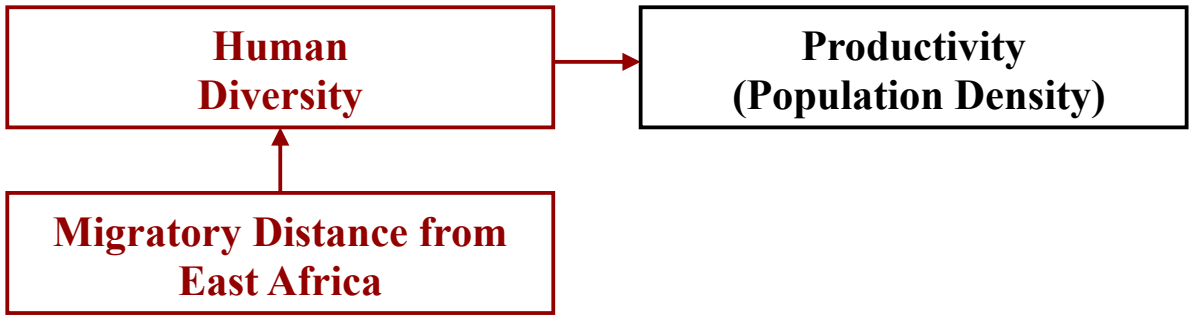
  - Geographic Factors: Land productivity, Absolute latitude
  - Time elapsed since the Neolithic Revolution

Determinants of Productivity: Channels

Productivity
(Population Density)

Determinants of Productivity: Channels



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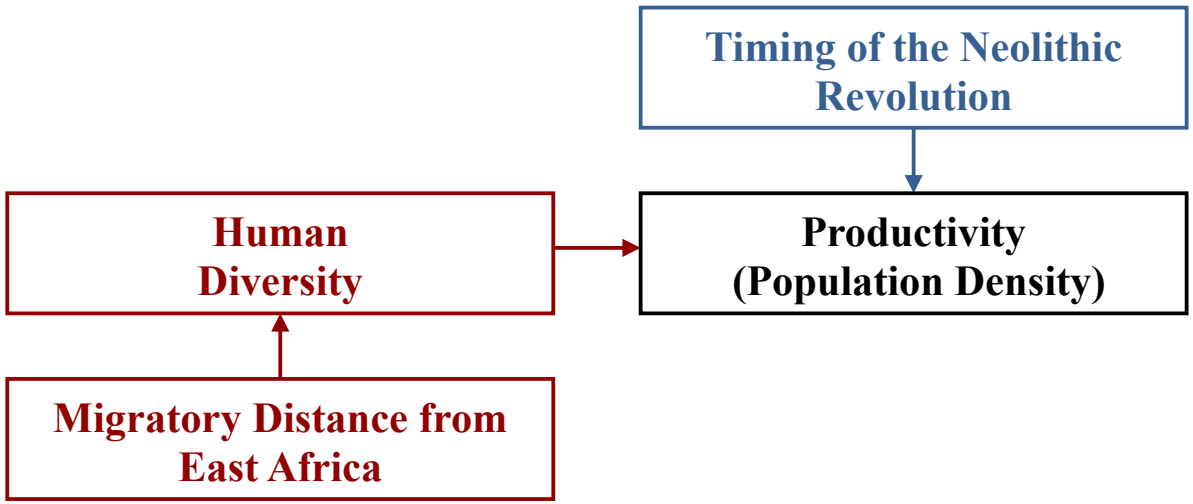
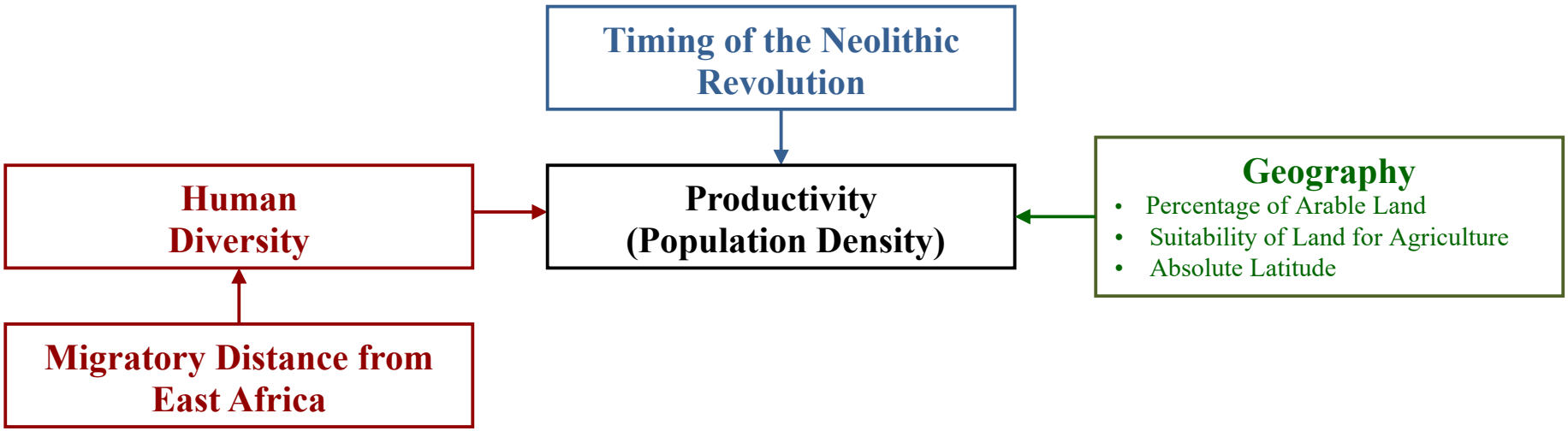
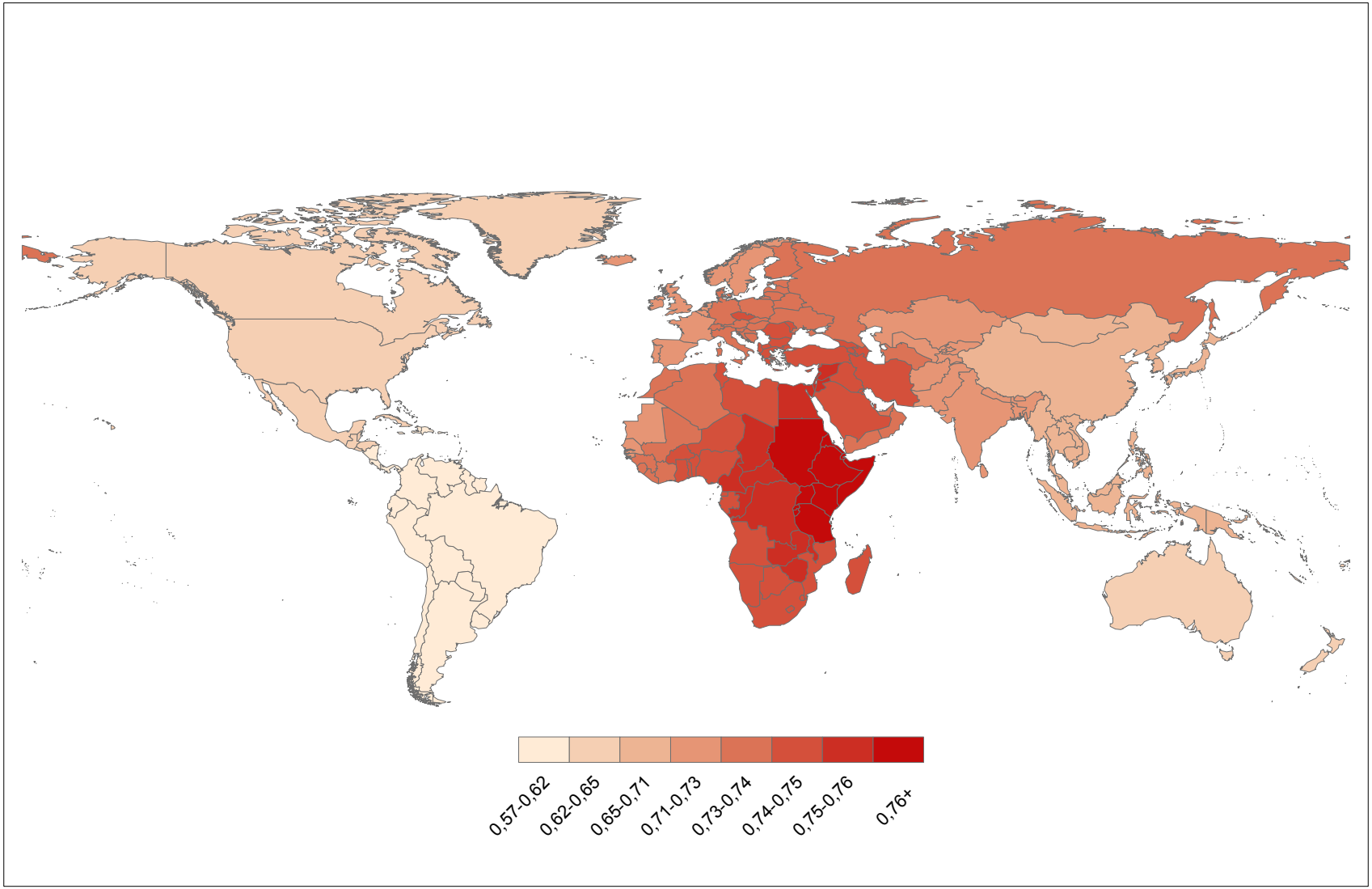


Determinants of Productivity: Channels



Predicted Population Diversity across Countries in the Pre-Colonial Era

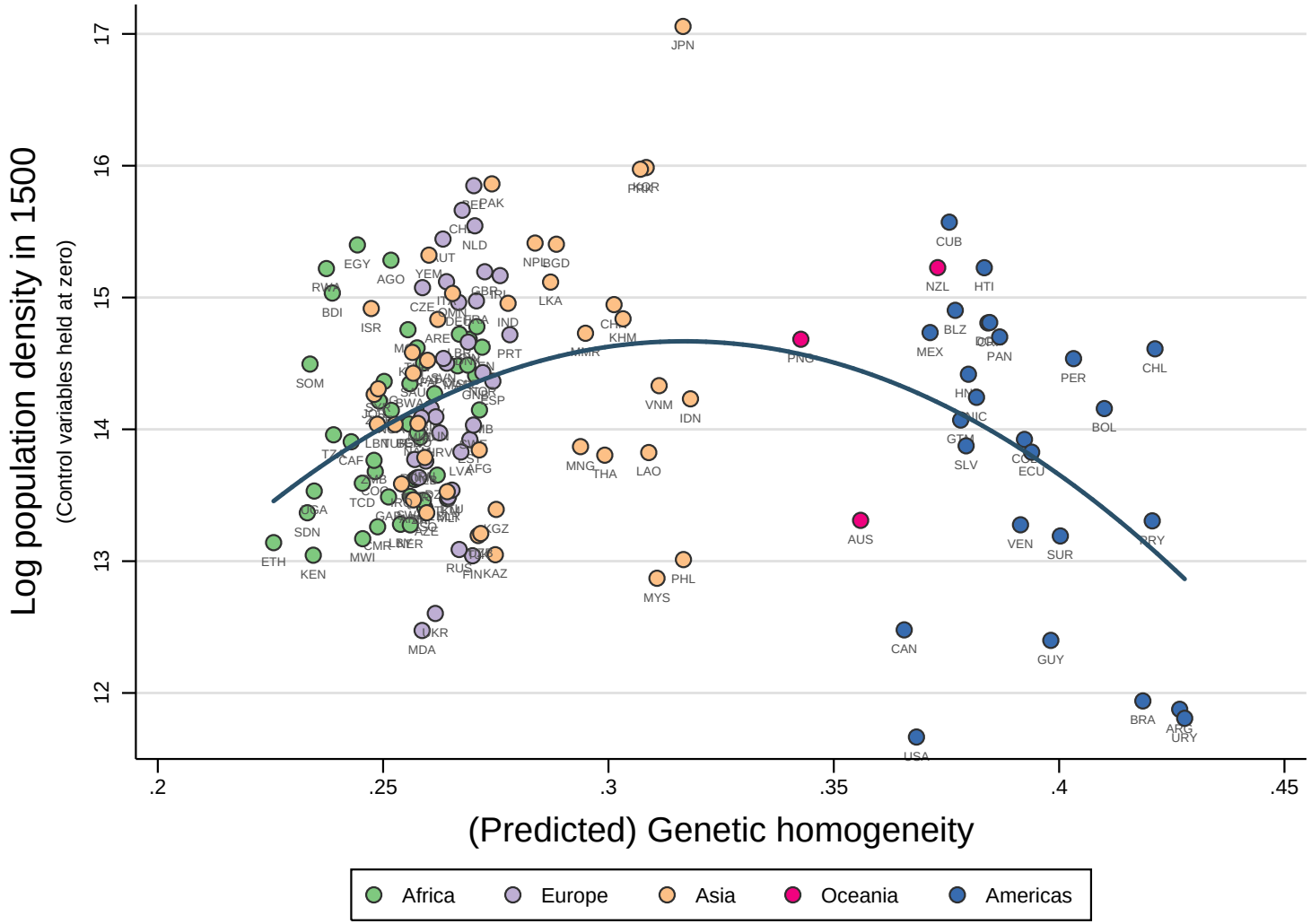


Predicted Diversity and Comparative Development in 1500

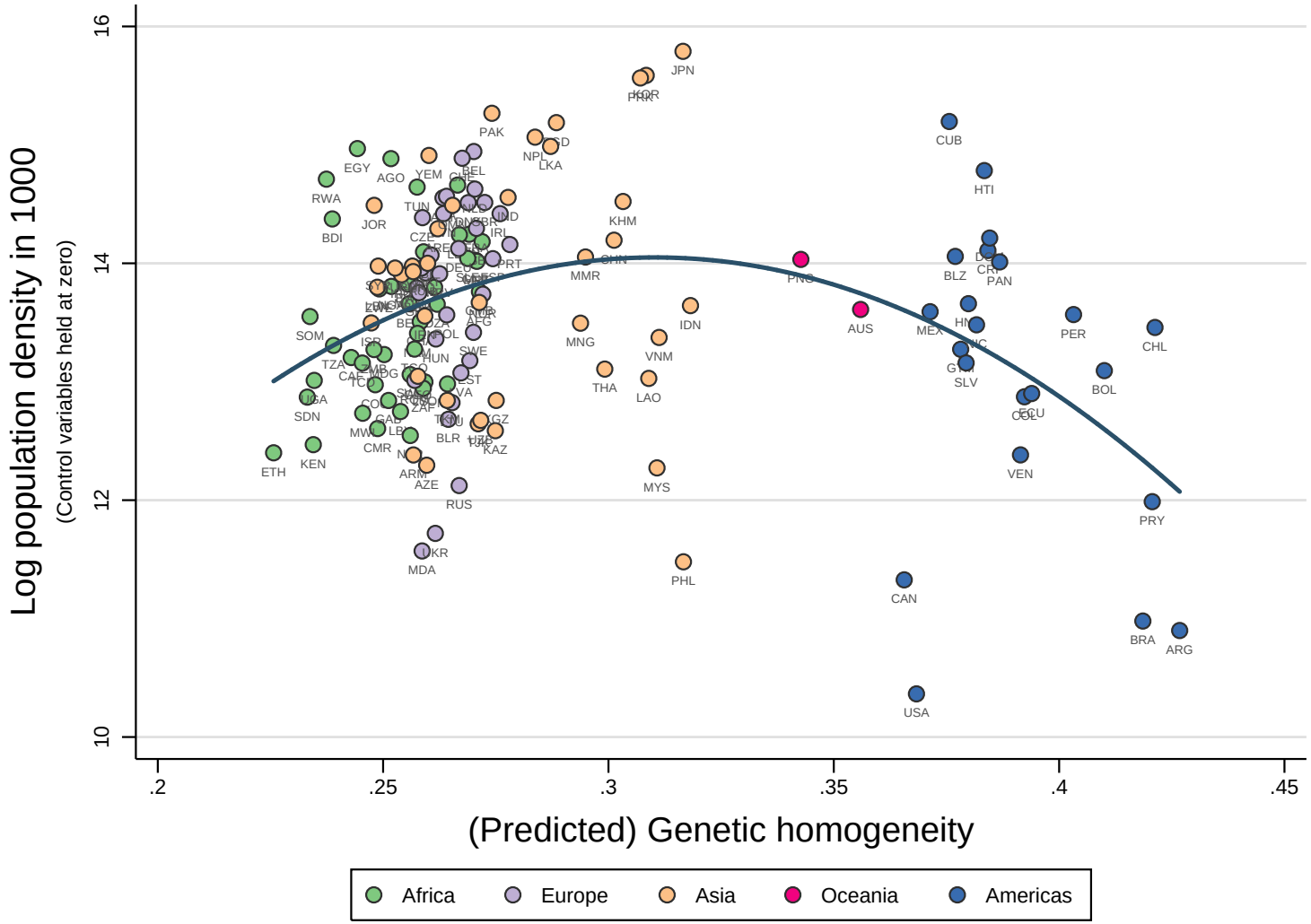
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable is Log Population Density in 1500					
Predicted Diversity	251.0***		213.5***	203.0***	195.4***	199.7**
	(68.26)		(63.50)	(61.05)	(56.09)	(80.51)
Predicted Diversity Sqr.	-177.4***		-152.1***	-142.0***	-138.0***	-146.2***
	(50.22)		(46.65)	(44.83)	(40.84)	(56.26)
Log Years since NR		1.29***	1.05***		1.16***	1.24***
		(0.18)	(0.19)		(0.15)	(0.24)
Log % of Arable Land				0.52***	0.40***	0.39***
				(0.12)	(0.09)	(0.10)
Log Absolute Latitude				-0.17*	-0.34***	-0.42***
				(0.09)	(0.09)	(0.12)
Log Agri. Suitability				0.19	0.31***	0.26***
				(0.12)	(0.10)	(0.10)
Optimal Diversity	0.707		0.702	0.715	0.708	0.683
	(0.021)		(0.025)	(0.110)	(0.051)	(0.110)
Continent Dummies	No	No	No	No	No	Yes
Observations	145	145	145	145	145	145
R-squared	0.22	0.26	0.38	0.50	0.67	0.69

Bootstrap standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

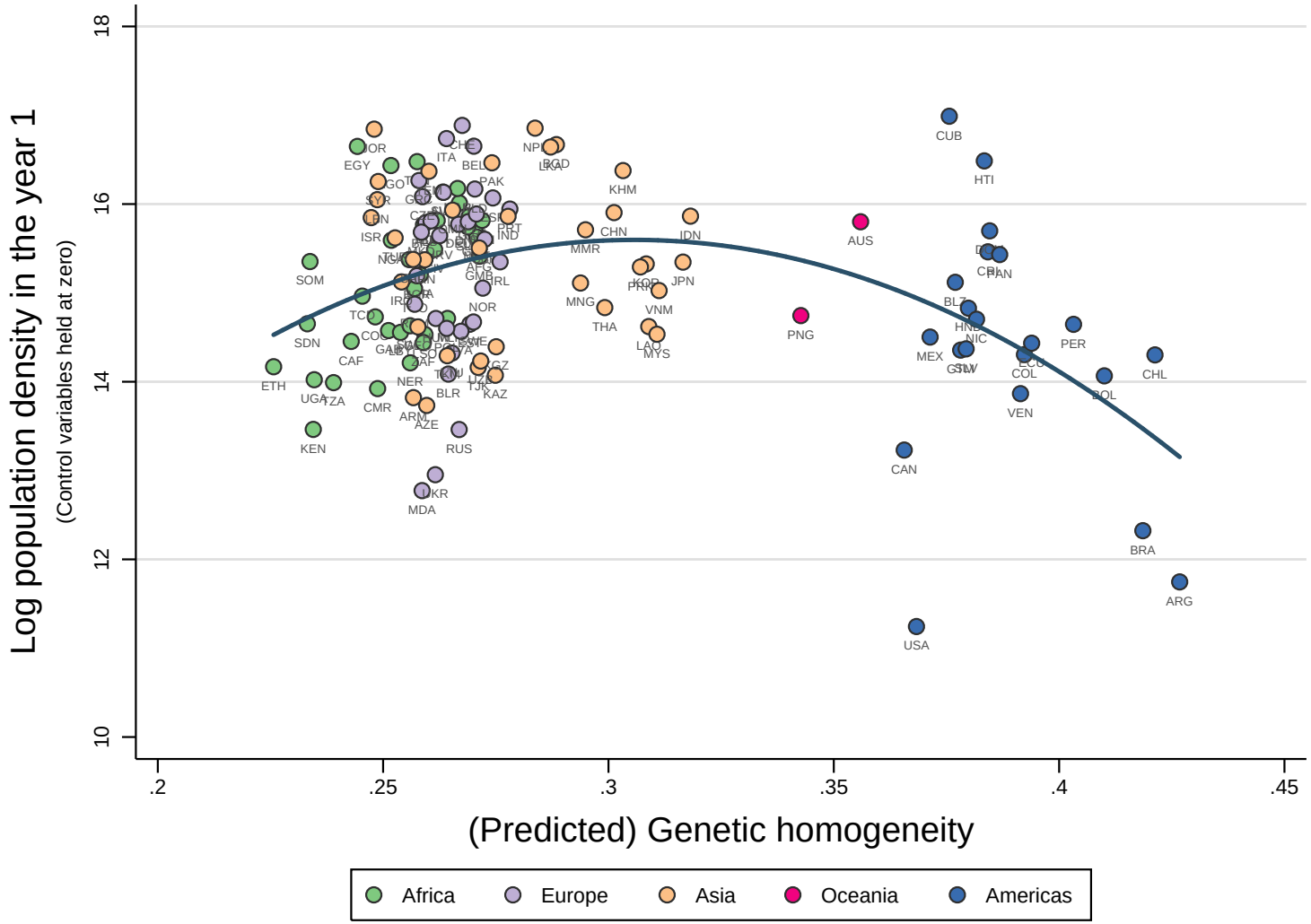
Predicted Diversity and Comparative Development in 1500



Predicted Diversity and Comparative Development in 1000 CE



Predicted Diversity and Comparative Development in 1 CE



Robustness: Distances from Placebo Origins

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Log Population Density in 1500				
Distance calculated from:	Addis Ababa	Addis Ababa	London	Tokyo	Mexico City
Migratory Distance	0.138**		-0.040	0.052	-0.063
	(0.061)		(0.063)	(0.145)	(0.099)
Migratory Distance Sqr.	-0.008***		-0.002	-0.006	0.005
	(0.002)		(0.002)	(0.007)	(0.004)
Aerial Distance		-0.008			
		(0.106)			
Aerial Distance Sqr.		-0.005			
		(0.006)			
Log Years since NR	1.160***	1.158***	1.003***	1.047***	1.619***
	(0.144)	(0.138)	(0.164)	(0.225)	(0.277)
Log % of Arable Land	0.401***	0.488***	0.357***	0.532***	0.493***
	(0.091)	(0.102)	(0.092)	(0.089)	(0.094)
Log Absolute Latitude	-0.342***	-0.263***	-0.358***	-0.334***	-0.239***
	(0.091)	(0.097)	(0.112)	(0.099)	(0.083)
Log Agri. Suitability	0.305***	0.254**	0.344***	0.178**	0.261***
	(0.091)	(0.102)	(0.092)	(0.080)	(0.092)
Observations	145	145	145	145	145
R-squared	0.67	0.59	0.67	0.59	0.63

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Regional Technological Frontiers

City & Modern Location	Continent	Sociopolitical Entity	Period
Cairo, Egypt	Africa	Mamluk Sultanate	1500 CE
Fez, Morocco	Africa	Marinid Kingdom of Fez	1500 CE
London, UK	Europe	Tudor Dynasty	1500 CE
Paris, France	Europe	Valois-Orléans Dynasty	1500 CE
Constantinople, Turkey	Asia	Ottoman Empire	1500 CE
Peking, China	Asia	Ming Dynasty	1500 CE
Tenochtitlan, Mexico	Americas	Aztec Civilization	1500 CE
Cuzco, Peru	Americas	Inca Civilization	1500 CE
Cairo, Egypt	Africa	Fatimid Caliphate	1000 CE
Kairwan, Tunisia	Africa	Berber Zirite Dynasty	1000 CE
Constantinople, Turkey	Europe	Byzantine Empire	1000 CE
Cordoba, Spain	Europe	Caliphate of Cordoba	1000 CE
Baghdad, Iraq	Asia	Abbasid Caliphate	1000 CE
Kaifeng, China	Asia	Song Dynasty	1000 CE
Tollan, Mexico	Americas	Classic Maya Civilization	1000 CE
Huari, Peru	Americas	Huari Culture	1000 CE
Alexandria, Egypt	Africa	Roman Empire	1 CE
Carthage, Tunisia	Africa	Roman Empire	1 CE
Athens, Greece	Europe	Roman Empire	1 CE
Rome, Italy	Europe	Roman Empire	1 CE
Luoyang, China	Asia	Han Dynasty	1 CE
Seleucia, Iraq	Asia	Seleucid Dynasty	1 CE
Teotihuacán, Mexico	Americas	Pre-classic Maya Civilization	1 CE
Cahuachi, Peru	Americas	Nazca Culture	1 CE

Robustness to Distance from Regional Technological Frontiers

	(1)	(2)	(3)
	Log Population Density 1500 CE	Log Population Density 1000 CE	Log Population Density 1 CE
Predicted Diversity	156.7**	183.8**	215.86**
	(77.98)	(91.20)	(106.5)
Predicted Diversity Sqr.	-114.6**	-134.6**	-157.7**
	(54.67)	(63.65)	(74.82)
Log Years since NR	Yes	Yes	Yes
Land Prod. Controls	Yes	Yes	Yes
Log Distance to Frontier in 1500 CE	-0.19***		
	(0.07)		
Log Distance to Frontier in 1000 CE		-0.23**	
		(0.11)	
Log Distance to Frontier in 1 CE			-0.30***
			(0.10)
Optimal Diversity	0.684	0.683	0.684
	(0.169)	(0.218)	(0.266)
Continent Dummies	Yes	Yes	Yes
Observations	145	140	126
R-squared	0.72	0.64	0.66

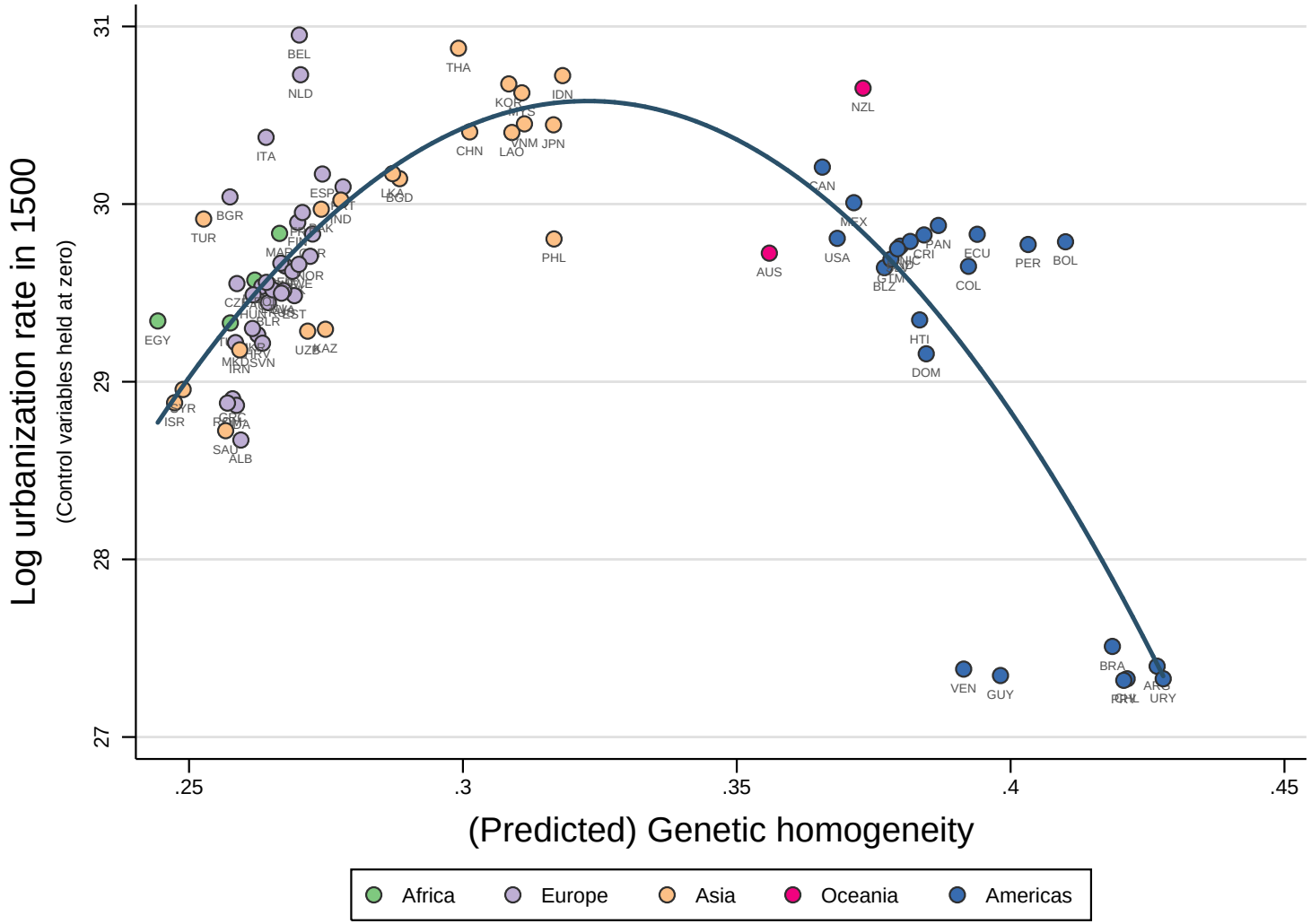
Bootstrap standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Robustness to the Use of Urbanization Rates in 1500

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Log Urbanization Rate in 1500				
Predicted Diversity	120.6**	165.2***	93.46*	148.8***	234.4***
	(51.62)	(50.08)	(48.77)	(48.37)	(67.32)
Predicted Diversity Square	-84.76**	-120.1***	-62.41*	-106.2***	-166.8***
	(38.42)	(37.21)	(36.65)	(36.51)	(48.78)
Log Years since NR		0.457**		0.402**	0.752***
		(0.224)		(0.202)	(0.257)
Log % of Arable Land			-0.097**	-0.116***	-0.119**
			(0.043)	(0.044)	(0.052)
Log Absolute Latitude			-0.334**	-0.236	-0.151
			(0.151)	(0.155)	(0.170)
Log Agri. Suitability			0.002	-0.036	0.031
			(0.057)	(0.058)	(0.059)
Continent Dummies	No	No	No	No	Yes
Observations	80	80	80	80	80
R-squared	0.30	0.35	0.40	0.44	0.51

Bootstrap standard errors in parentheses; *** p ¡ 0.01, ** p ¡ 0.05, * p ¡ 0.1.

Population Diversity and Urbanization Rates in 1500



Measure of Contemporary Population Diversity

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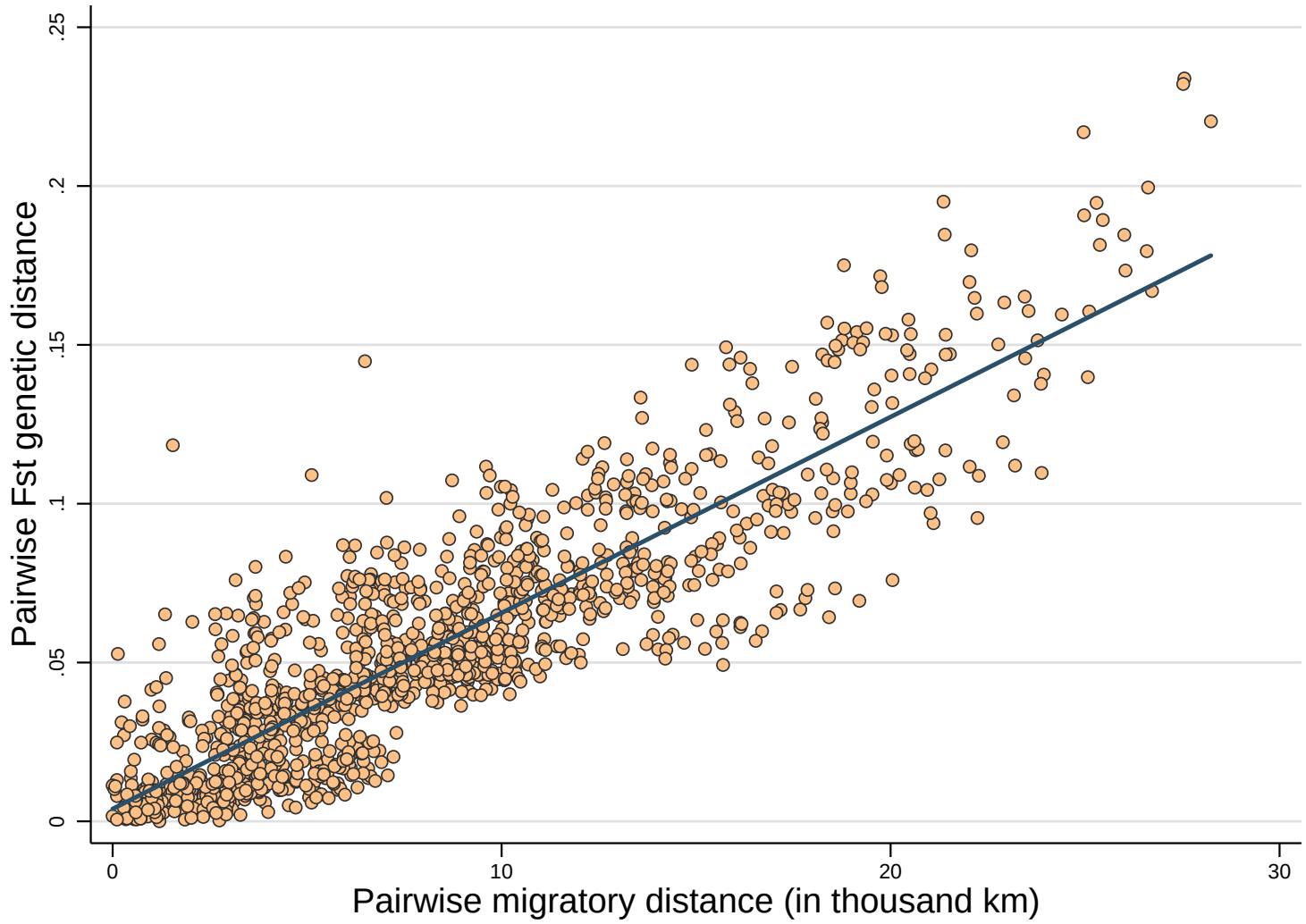
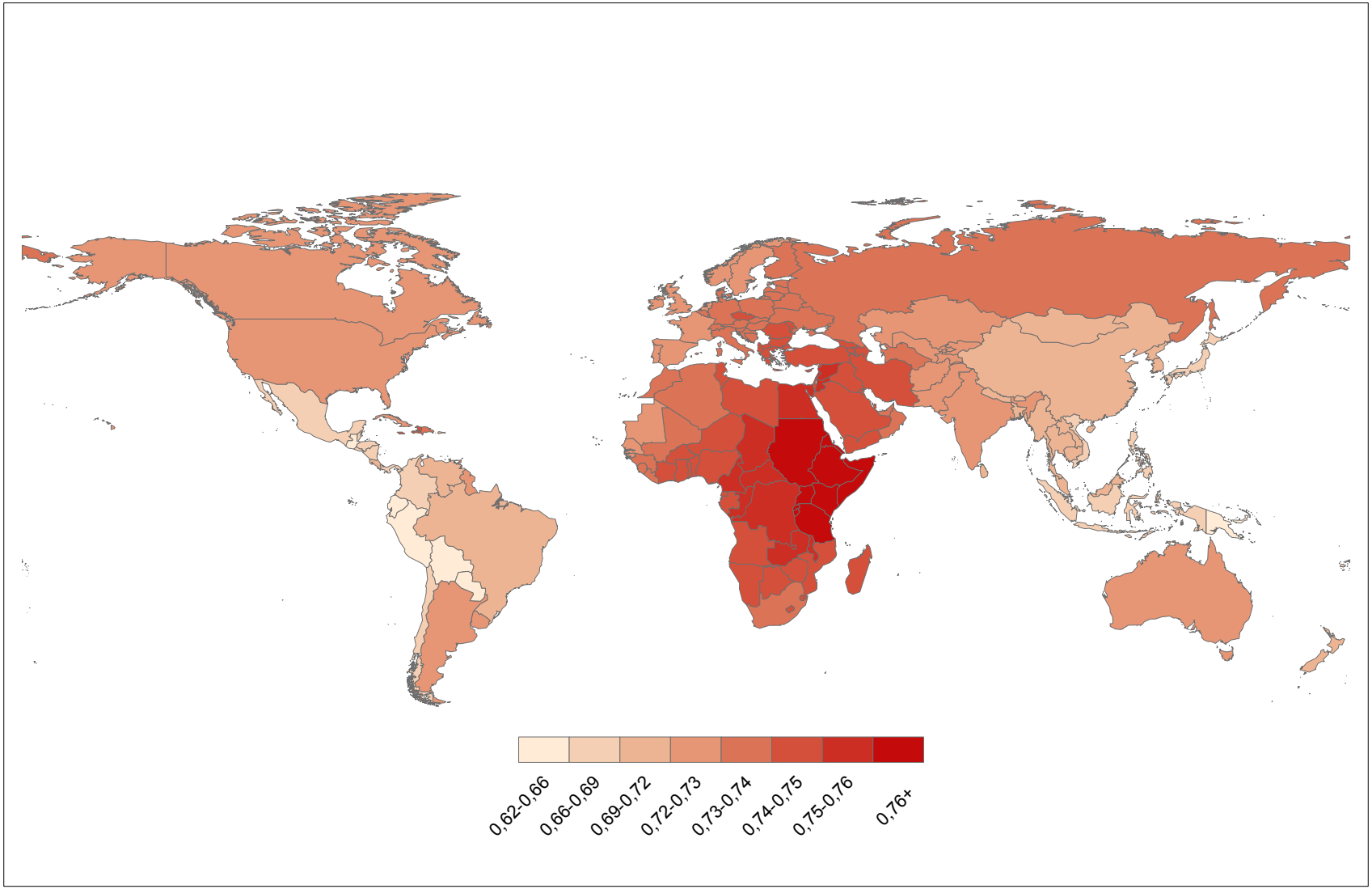
  - Predicted distance between all pairs of these ancestral populations
    - Based on pairwise migratory distance between these ancestral populations

Pairwise Population Distances



Population Diversity across Countries in 2000



Predicted Diversity and Economic Development in 2000 and 1500

	(1)	(2)	(3)	(4)
	Log Income per Capita in 2000			Log Population Density in 1500
Adjusted Diversity	204.6**	237.2***	245.0***	
	(88.47)	(86.23)	(85.45)	
Adjusted Diversity Sqr.	-143.5**	-166.5***	-171.4***	
	(62.5)	(61.36)	(60.84)	
Unadjusted. Diversity				198.6**
				(79.11)
Unadjusted. Diversity Sqr.				-145.3***
				(55.472)
Log Adj. Years since NR		0.061	0.002	
		(0.262)	(0.305)	
Log Years since NR	-0.151			1.238***
	(0.186)			(0.230)
Log % of Arable Land	-0.110	-0.119	-0.137	0.378***
	(0.100)	(0.107)	(0.111)	(0.100)
Log Absolute Latitude	0.164	0.172	0.192	-0.423***
	(0.125)	(0.119)	(0.143)	(0.124)
Log Agri. Suitability	-0.193**	-0.177*	-0.189*	0.264***
	(0.095)	(0.102)	(0.102)	(0.096)
Log Population Density in 1500			0.047	
			(0.097)	
Optimal Diversity	0.713	0.712	0.715	0.683
	(0.100)	(0.036)	(0.118)	(0.095)
Continent Dummies	Yes	Yes	Yes	Yes
Observations	143	143	143	143
R-squared	0.57	0.57	0.57	0.68

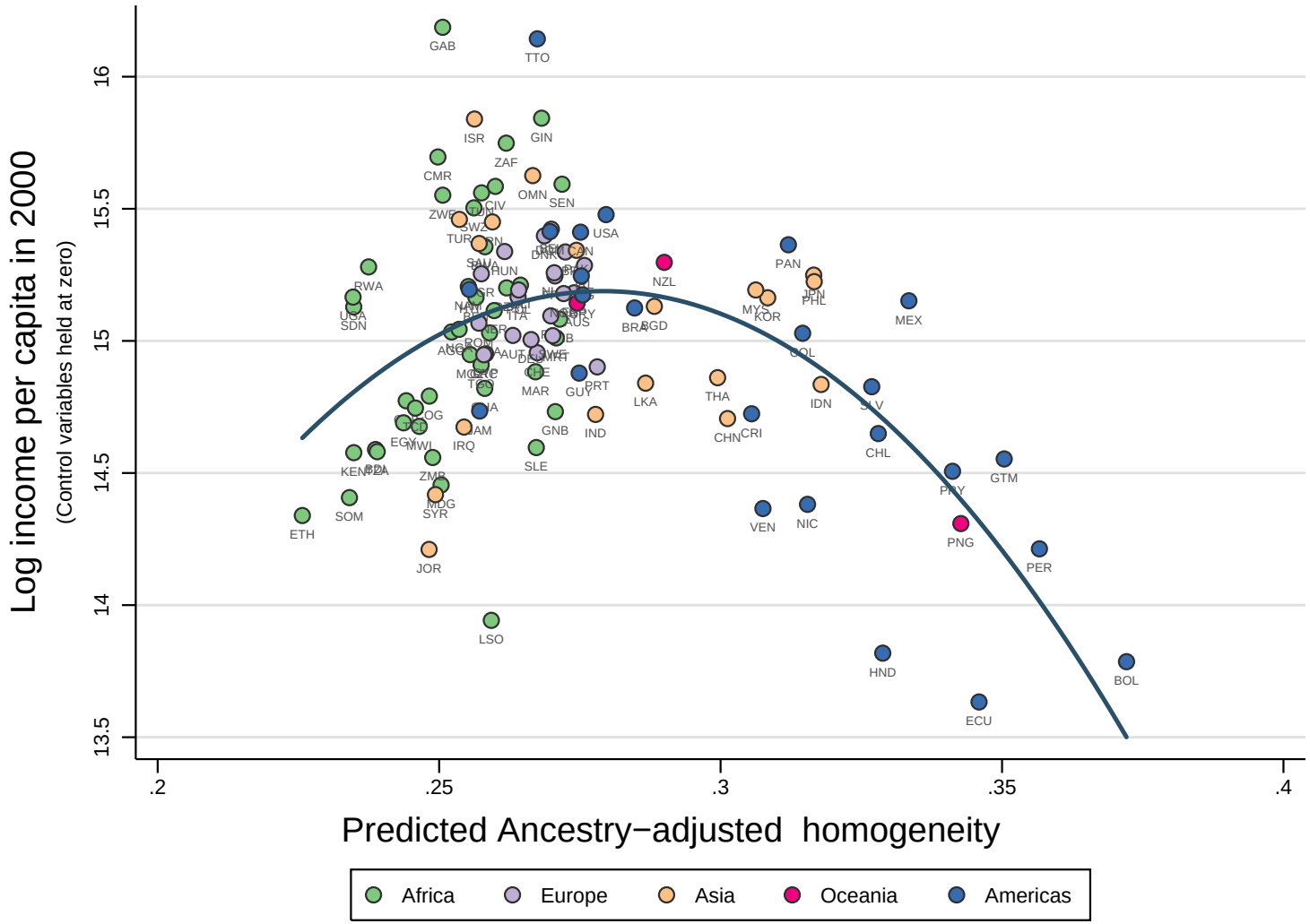
Bootstrap standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Population Diversity and Comparative Development in 2000

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Log Income per Capita in 2000				
Adjusted Diversity	315.3***	225.9***	204.1***	277.3***	215.7***
	(84.22)	(67.67)	(66.97)	(70.23)	(63.95)
Adjusted Diversity Sqr.	-221.0***	-155.8***	-140.9***	-192.4***	-150.9***
	(59.56)	(47.96)	(47.39)	(49.68)	(45.55)
Log Adj. Time from NR	-0.273	-0.092	-0.062	0.396*	-0.046
	(0.269)	(0.200)	(0.203)	(0.233)	(0.208)
Log % of Arable Land	-0.218***	-0.159***	-0.163***	-0.183***	-0.084
	(0.061)	(0.049)	(0.050)	(0.051)	(0.056)
Log Absolute Latitude	0.123	0.083	0.080	0.009	-0.006
	(0.122)	(0.100)	(0.101)	(0.108)	(0.087)
Social Infrastructure		2.359***	2.069***	1.826***	0.880**
		(0.269)	(0.377)	(0.417)	(0.418)
Democracy			0.036		
			(0.029)		
Ethnic Fractionalization				-0.333	-0.122
				(0.280)	(0.265)
% Population at Risk of Contracting Malaria				-0.502	-0.723**
				(0.351)	(0.353)
Avg. Schooling					0.134***
					(0.042)
Optimal Diversity	0.713	0.725	0.725	0.721	0.715
	(0.014)	(0.032)	(0.045)	(0.008)	(0.073)
Continent Dummies	Yes	Yes	Yes	Yes	Yes
Legal Origin Dummies	No	No	No	Yes	Yes
Major Religion Shares	No	No	No	Yes	Yes
Observations	109	109	109	109	94
R-squared	0.74	0.84	0.85	0.90	0.93

Bootstrap standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Predicted Diversity and Comparative Development in 2000



Interpretations – Diversity and Comparative Development in 2000

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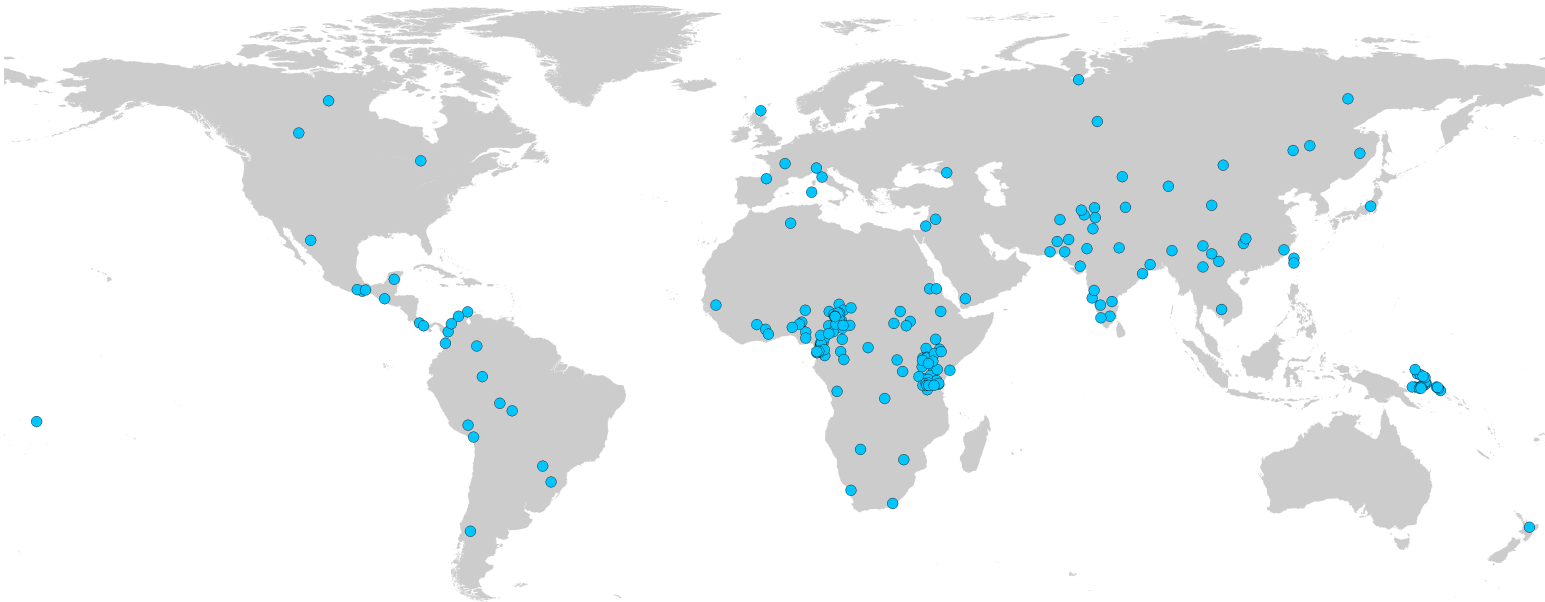
- Decreasing GD of Ethiopia (0.77), the most heterogeneous country, by:
  - 0.05 $\implies$ 1.7-fold increase in income per capita in 2000
    - From 2% to 4% of that of the US

Addressing Endogenous Post-1500 Migrations

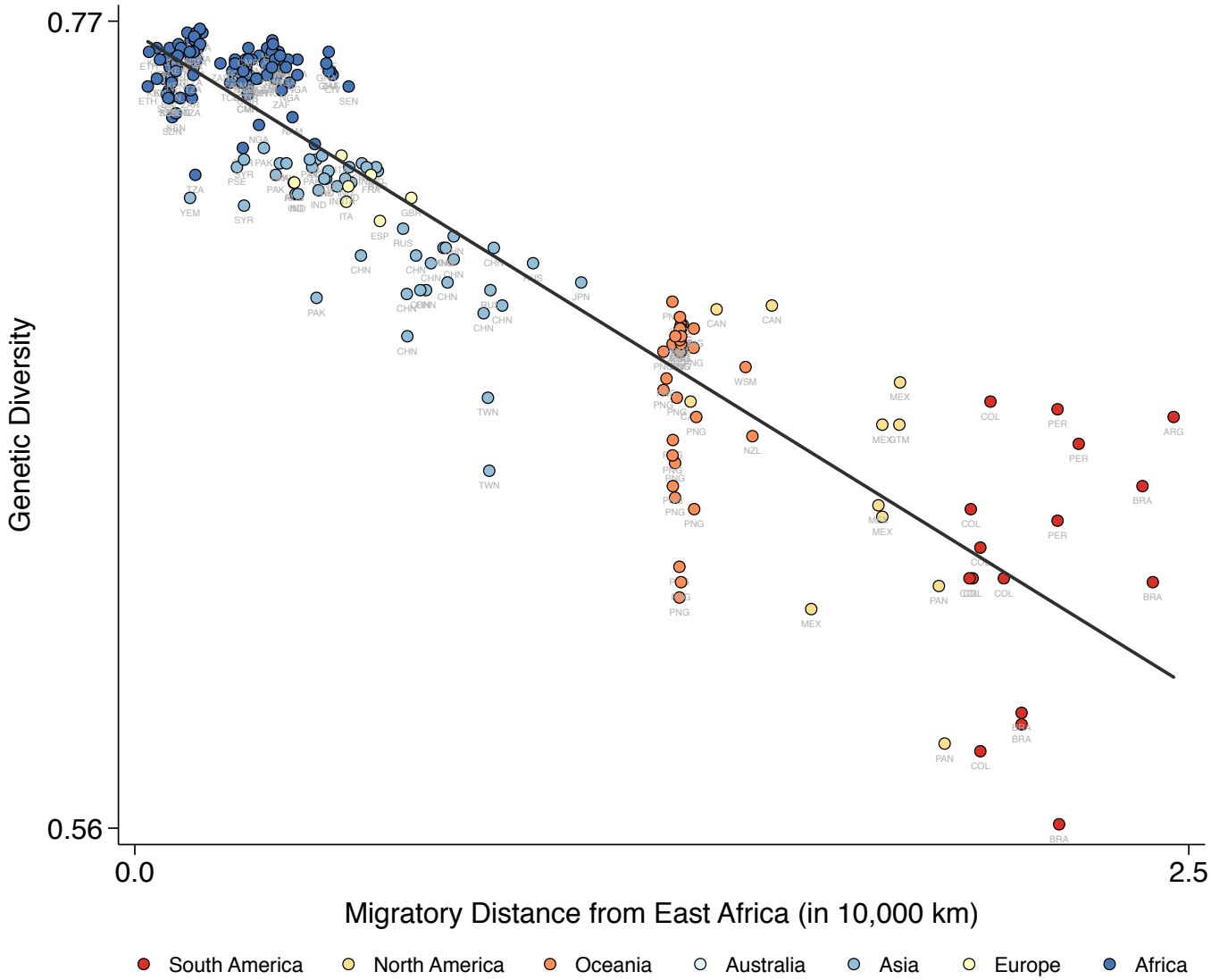
	(1) Full Sample	(2) Non OECD	(3) w/o Neo Europes	(4) w/o Latin America	(5) w/o Sub Sahara	(6) >0.97 Indigenous
	Dependent Variable is Log Income per Capita in 2000					
Adjusted Diversity	277.3***	222.0***	261.4***	412.2***	264.8**	304.7**
	(70.2)	(88.48)	(70.53)	(148.6)	(111.4)	(111.6)
Adjusted Diversity Sqr.	-192.4***	-189.0***	-181.8***	-287.1***	-183.9**	-213.4**
	(49.68)	(62.10)	(49.67)	(101.9)	(80.40)	(77.26)
Log Adj. Time of NR	0.396*	0.390	0.355	0.518*	0.068	0.448*
	(0.233)	(0.281)	(0.231)	(0.298)	(0.442)	(0.254)
Log % of Arable Land	-0.183***	-0.236***	-0.201***	-0.189***	-0.211**	-0.104
	(0.051)	(0.060)	(0.055)	(0.050)	(0.097)	(0.061)
Log Absolute Latitude	0.009	-0.021	-0.025	-0.139	0.218	-0.074
	(0.108)	(0.119)	(0.111)	(0.126)	(0.242)	(0.130)
Social Infrastructure	1.826***	1.313**	1.416***	2.044***	1.585***	1.311*
	(0.417)	(0.579)	(0.507)	(0.545)	(0.486)	(0.716)
Ethnic Frac.	-0.333	-0.437	-0.390	-0.752**	0.104	-0.044
	(0.280)	(0.375)	(0.300)	(0.348)	(0.408)	(0.412)
% Population at Risk of Malaria	-0.502	-0.605	-0.591	-0.308	-0.425	-0.153
	(0.351)	(0.381)	(0.370)	(0.486)	(0.581)	(0.434)
% Population Living in Tropical Zones	-0.319	-0.196	-0.302	-0.520**	-0.528	-0.339
	(0.204)	(0.239)	(0.219)	(0.252)	(0.341)	(0.312)
Optimal Diversity	0.721	0.720	0.719	0.718	0.720	0.714
	(0.083)	(0.085)	(0.015)	(0.023)	(0.180)	(0.012)
Observations	109	83	105	87	71	37
R-squared	0.90	0.82	0.89	0.93	0.86	0.98

Bootstrap standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

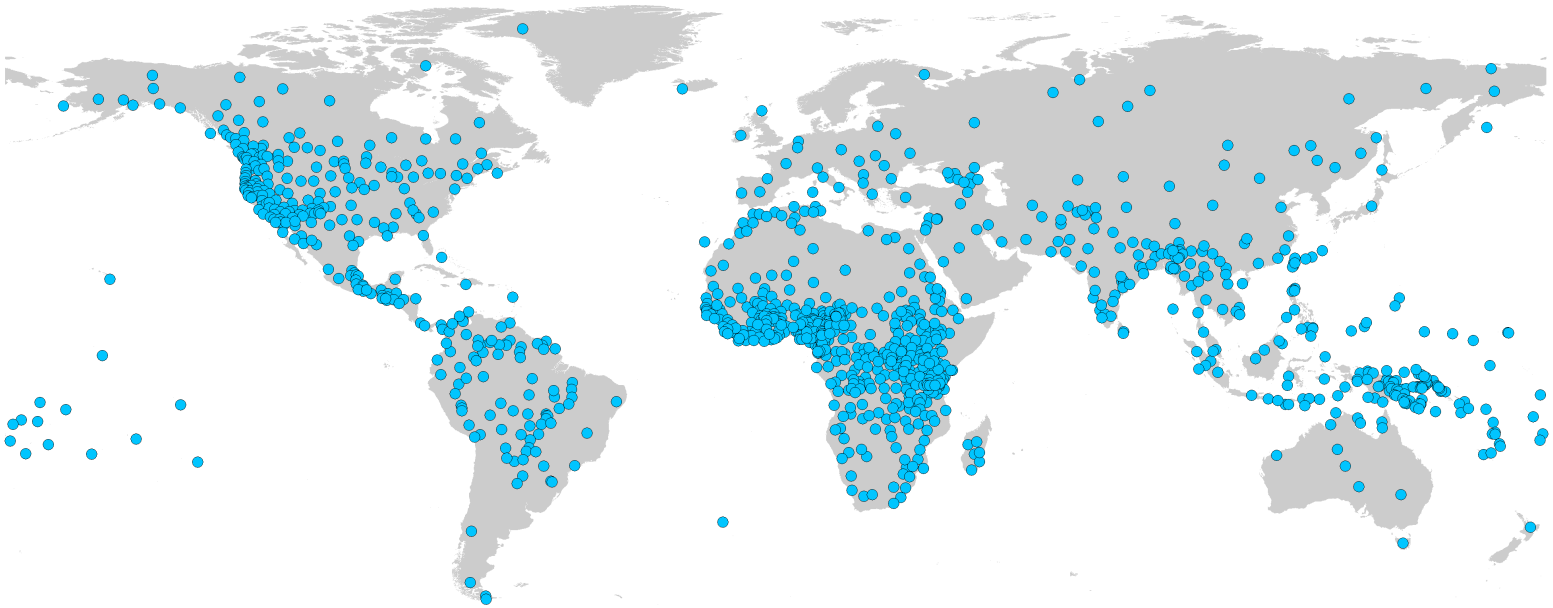
Observed Population Diversity - 207 Ethnic Groups



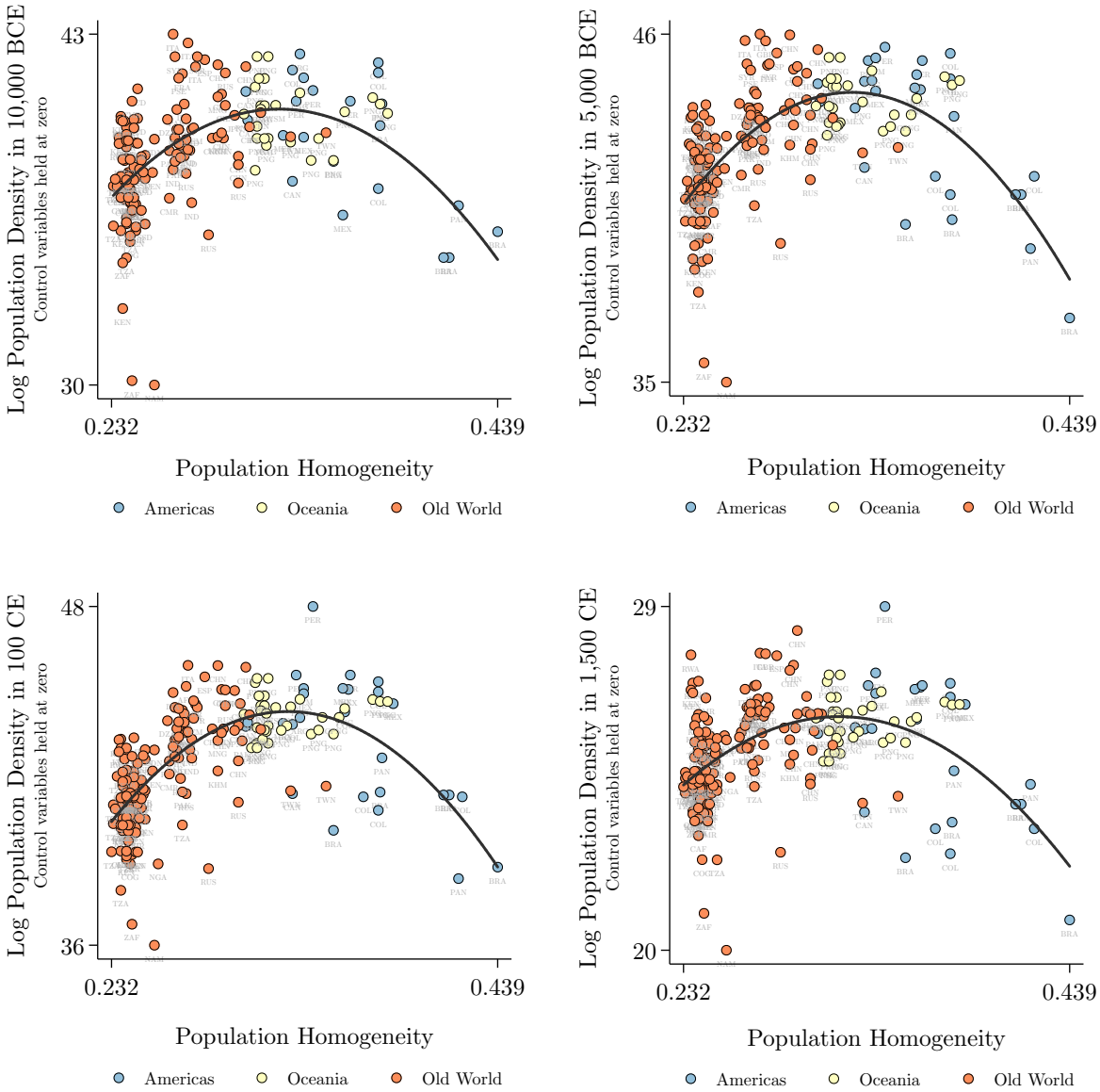
Migratory Distance from Africa and Population Diversity



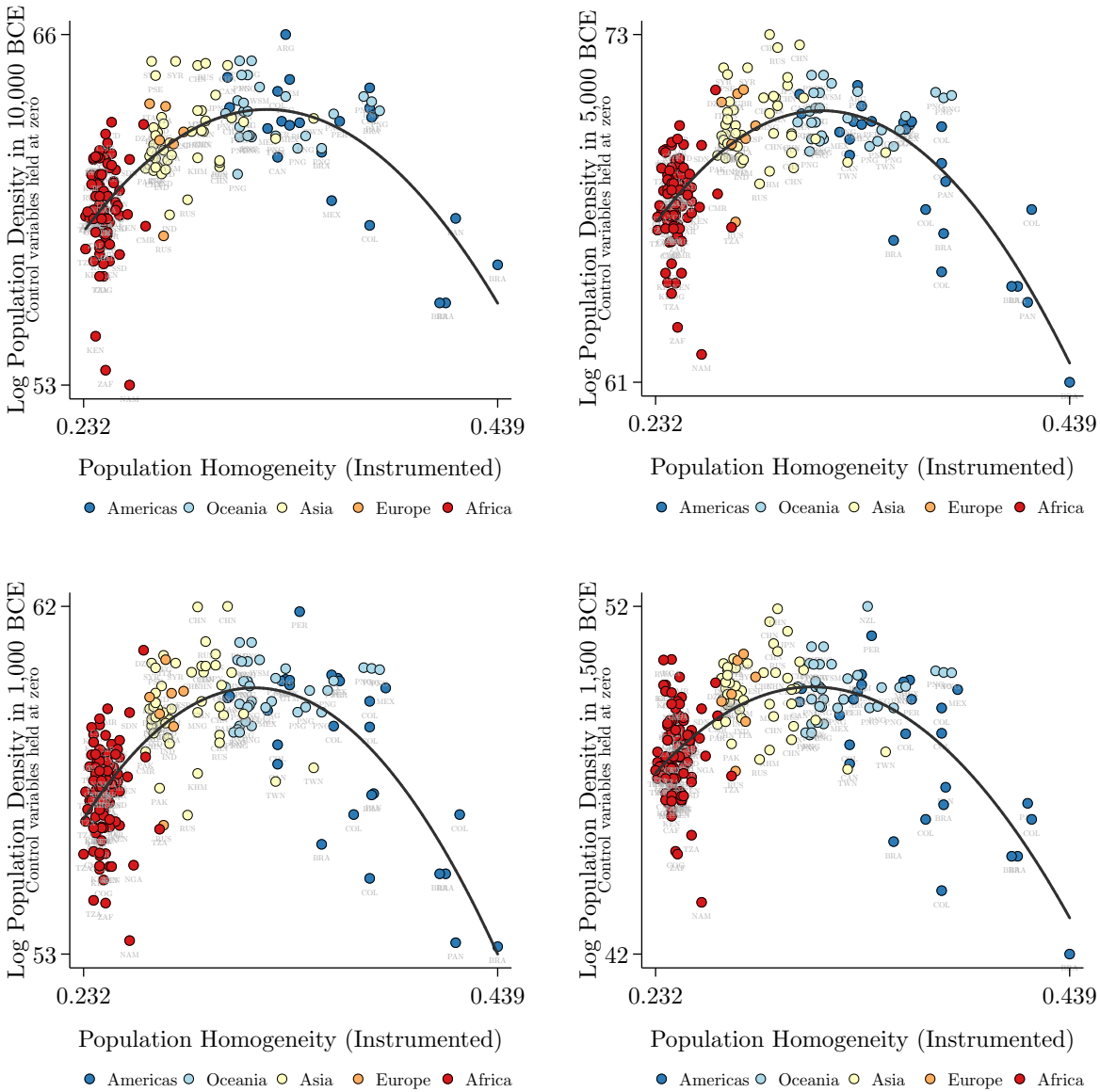
Predicted Diversity - 1265 Ethnic Groups



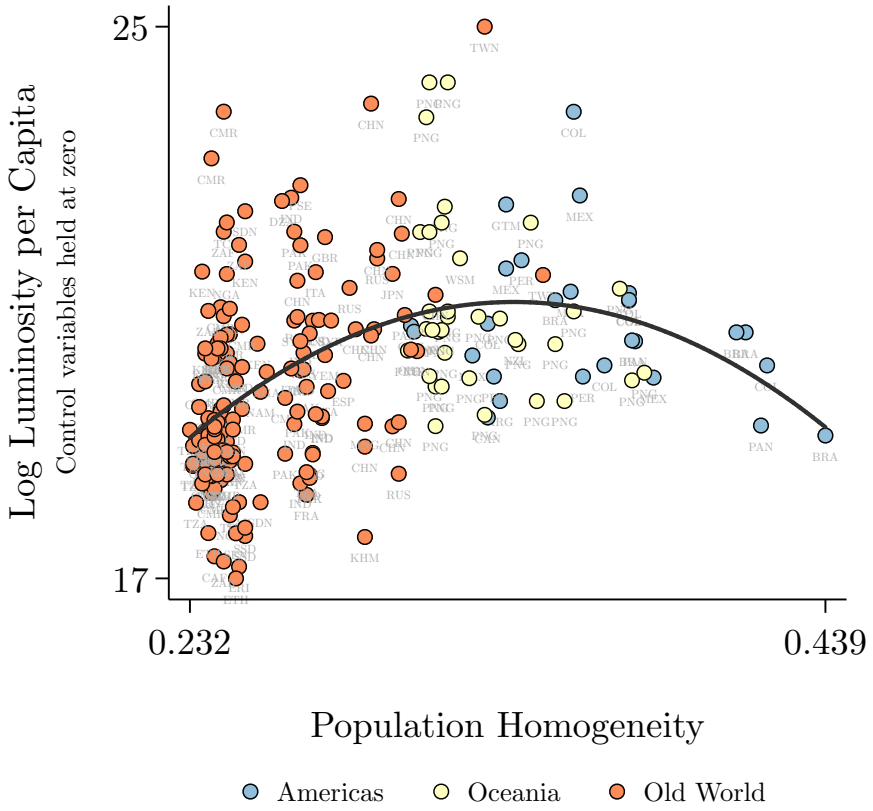
Observed Population Diversity & Population Density 10,000 BCE - 1500 CE

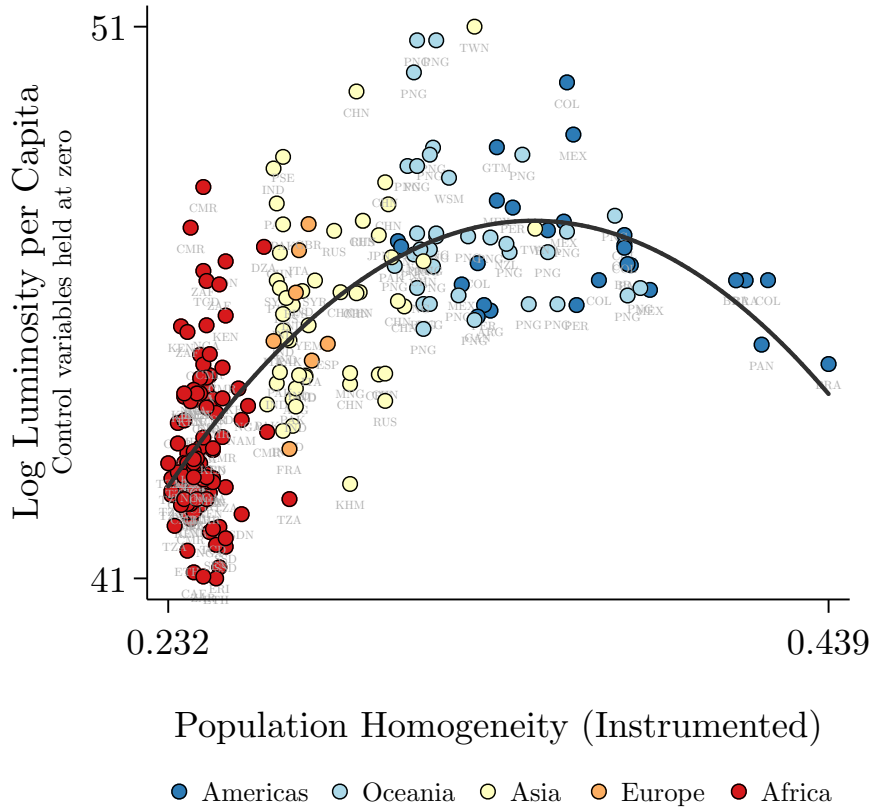


Observed Diversity and Population Density 10,000 BCE - 1500 CE - IV



Population Diversity and Luminosity across Ethnic Groups





The Conflicting Effects of Diversity

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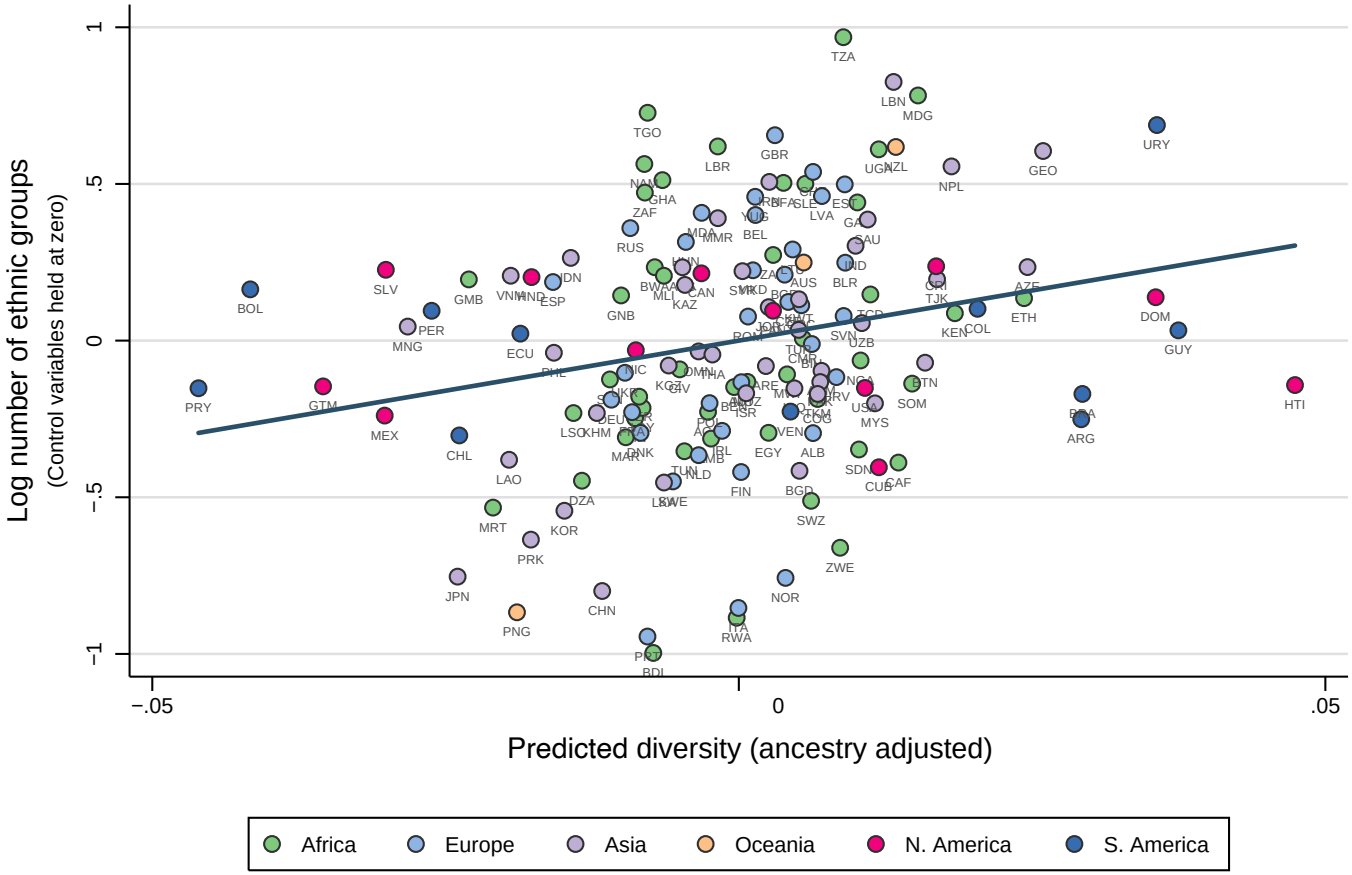
Cost of Diversity – Diversity & Cultural Fragmentation

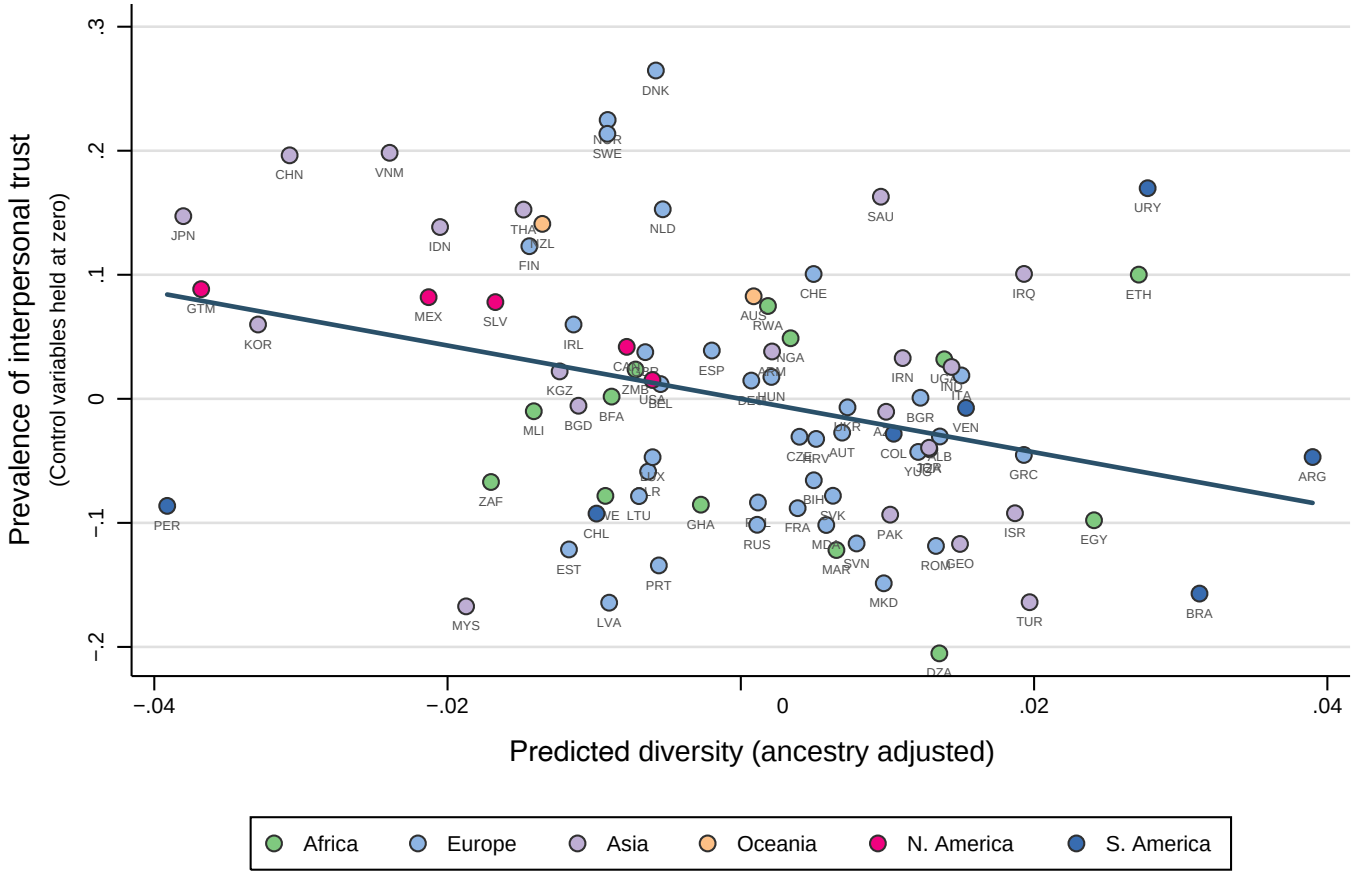


Relationship conditional on historical and geographical controls, as well as continent fixed effects
Slope coefficient = 6.397; (robust) standard error = 1.973; t−statistic = 3.242; partial R−squared = 0.059; observations = 144

Source: Ashraf and Galor (2013b)

Source: Ashraf-Galor (AER, May 2013)

Cost of Diversity – Diversity & Trust



Relationship conditional on geographical controls and region fixed effects
Slope coefficient = −2.151; (robust) standard error = 0.756; t−statistic = −2.845; partial R−squared = 0.105; observations = 84

Source: Arbatli, Ashraf, and Galor (2015)

Diversity & Trust – 2nd-Generation Migrants (US)

	Trust			
	(1)	(2)	(3)	(4)
Predicted Population Diversity (Ancestral country)	**–7.008*****	**–7.750*****	**–8.045*****	**–8.605*****
	(0.011)	(0.577)	(2.325)	(2.599)
Ancestral Continent FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Age & Gender FE	No	Yes	Yes	Yes
Income FE	No	No	Yes	Yes
Religion FE	No	No	Yes	Yes
Education FE	No	No	Yes	Yes
US Region FE	No	No	No	Yes
Observations	1149	1149	906	906
Adjusted R^2	0.062	0.168	0.216	0.231

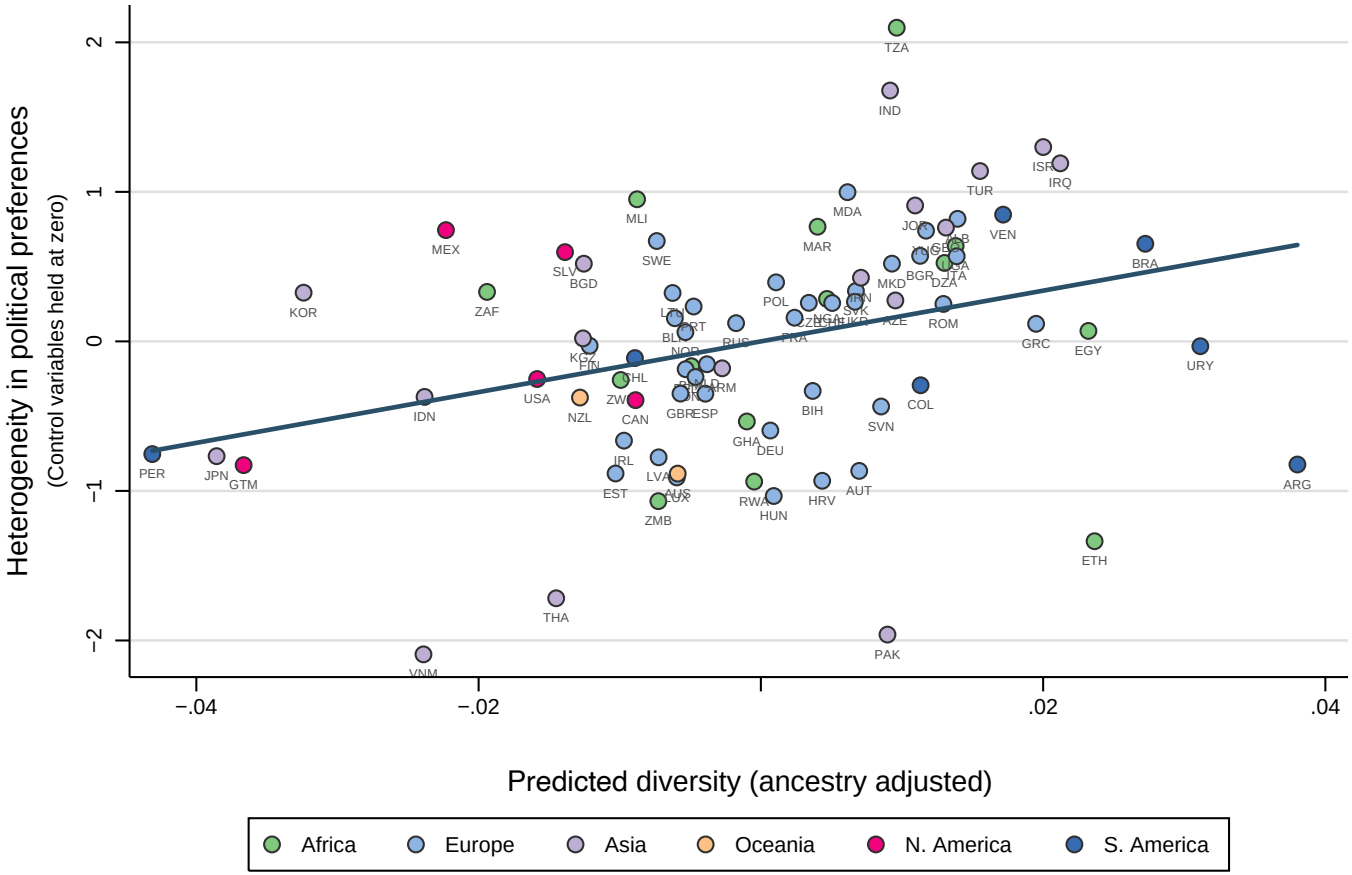
Source: Arbatli-Ashraf-Galor-Klemp (ECMA, 2020)

Diversity & Trust – 2nd-Generation Migrants (Africa)

	Trust			
	(1)	(2)	(3)	(4)
Observed Population Diversity (Ancestral ethnic homeland)	**–23.010****	**–21.851****	**–28.775****	**–25.436*****
	(10.472)	(10.148)	(11.959)	(7.588)
Host Country FE	Yes	Yes	Yes	Yes
Age & Gender FE	No	Yes	Yes	Yes
Slave Exports	No	Yes	Yes	Yes
Living Conditions FE	No	No	No	Yes
Education FE	No	No	No	Yes
Observations	3448	3448	3448	3448
Adjusted R^2	0.220	0.227	0.236	0.253

Source: Arbatli-Ashraf-Galor-Klemp (ECMA, 2020)

Cost of Diversity – Diversity & Heterogeneity in Preferences



Relationship conditional on geographical controls and region fixed effects
Slope coefficient = 16.963; (robust) standard error = 5.954; t−statistic = 2.849; partial R−squared = 0.111; observations = 81

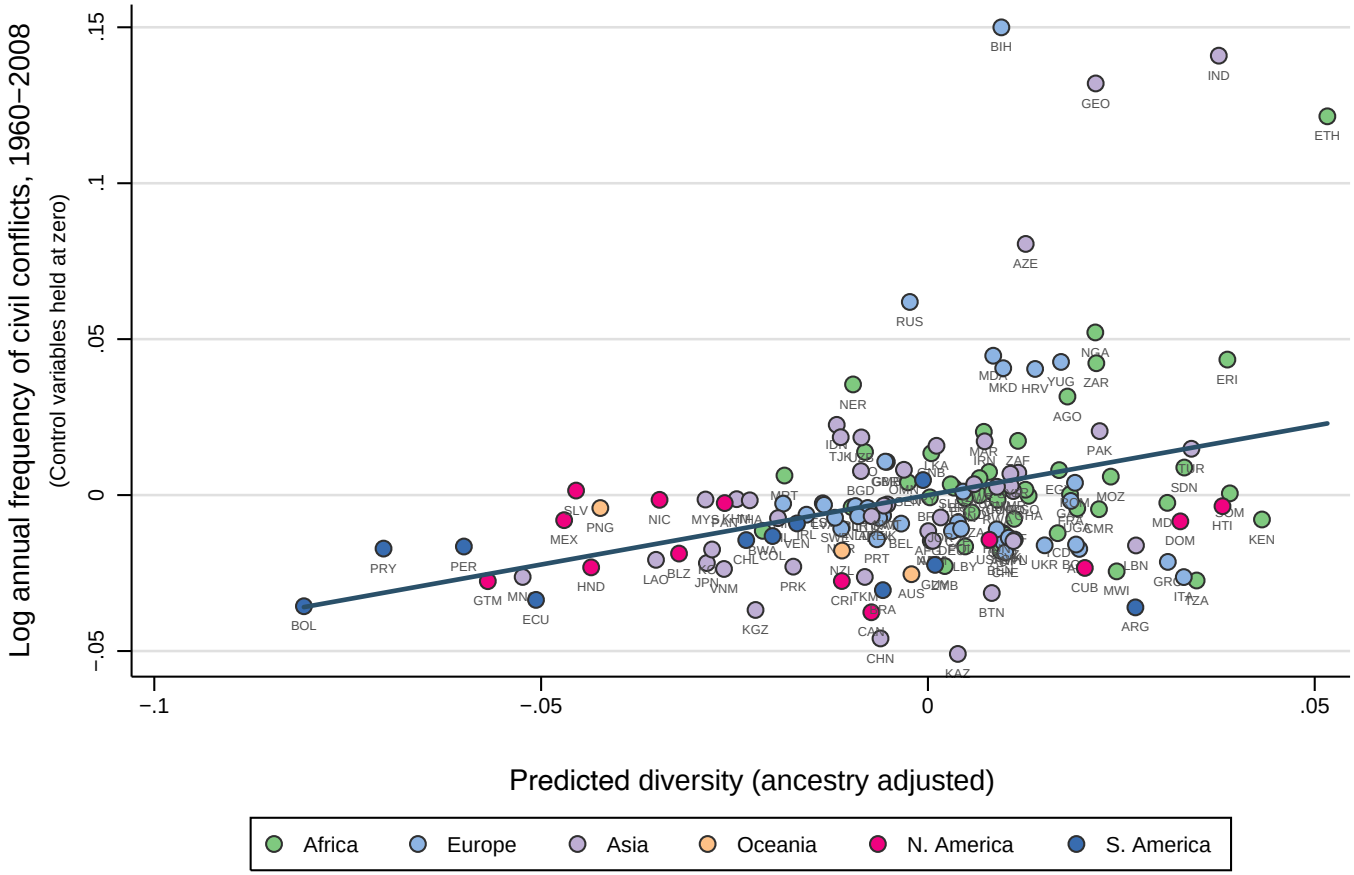
Source: Arbatli, Ashraf, and Galor (2015)

Cost of Diversity – Diversity & Civil Conflict across Countries

	Log **Civil Conflict Onsets, 1960–2017**			
	OLS	OLS	OLS	IV
Population diversity (ancestry adjusted)	**0.209***** (0.066)	**0.318***** (0.119)		**0.537***** (0.176)
Within-group population diversity			**0.364***** (0.140)	
Between-group population diversity			**0.284*** (0.166)	
Ethnic fractionalization		0.004 (0.013)	0.004 (0.013)	–0.005 (0.010)
Ethnolinguistic polarization		0.014 (0.011)	0.014 (0.012)	0.020* (0.012)
Geographic Controls		×	×	×
Continent dummies		×	×	×
Observations	150	150	150	150
Adjusted R^2	0.029	0.215	0.212	
First Stage				**Pop Diversity**
Migratory distance from East Africa				– 0.065*** (0.007)
First-stage F statistic				92.69

Source: Arbatli-Ashraf-Galor-Klemp (ECMA, 2020)

Cost of Diversity – Diversity & Civil Conflict across Countries

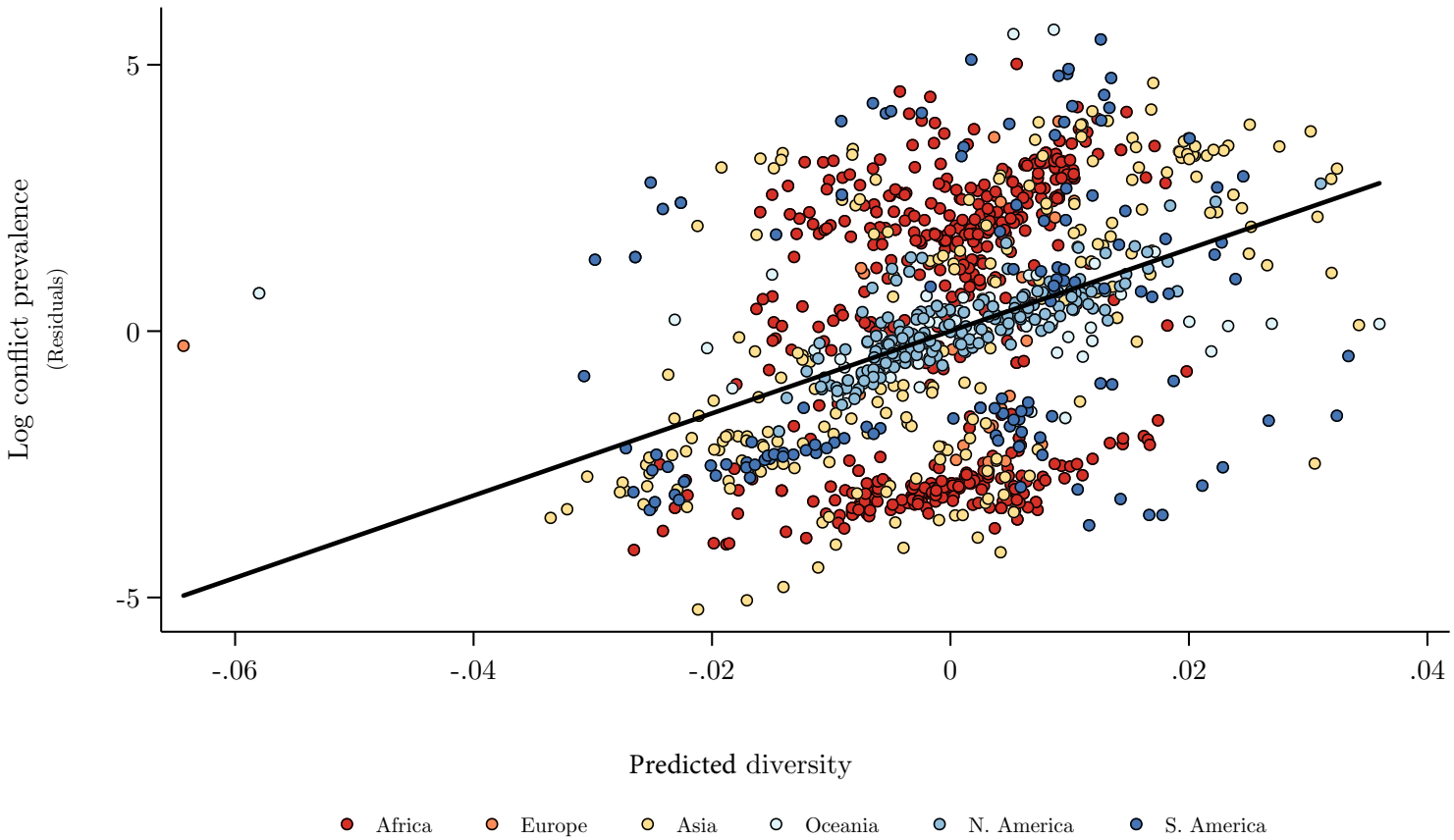


Relationship conditional on geographical controls
Slope coefficient = 0.445; (robust) standard error = 0.117; t−statistic = 3.790; partial R−squared = 0.112; observations = 151

Source: Arbatli, Ashraf, and Galor (2015)

Source: Arbatli-Ashraf-Galor-Klemp (ECMA, 2019)

Cost of Diversity: Diversity & Civil Conflict across Ethnic Homelands

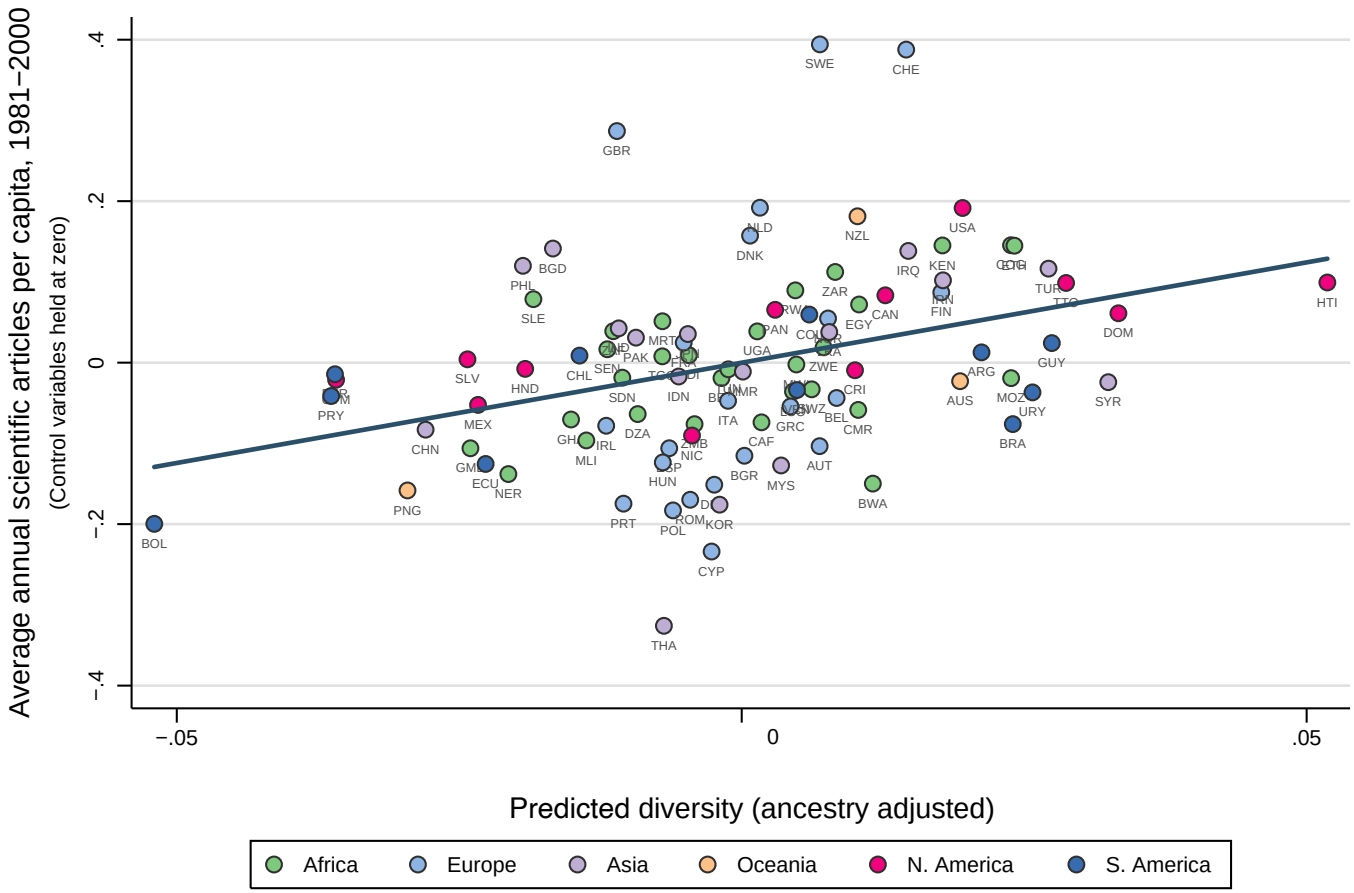


Relationship in the global sample; conditional on baseline geographical controls

Slope coefficient = 77.170; (robust) standard error = 6.089; t-statistic = 12.675; partial R-squared = 0.145; observations = 1238

Source: Arbatli-Ashraf-Galor-Klemp (ECMA, 2019)

Mechanisms: Benefits of Diversity – Diversity & Scientific Research



Relationship conditional on historical, geographical, and institutional controls, as well as continent fixed effects
Slope coefficient = 2.484; (robust) standard error = 0.511; t−statistic = 4.864; partial R−squared = 0.131; observations = 93

Source: Ashraf and Galor (2013a)

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- Diversity enhances innovations and knowledge creation

Policy Implications

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