How Deep Are the Roots of Economic Development?

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This talk will be based on

“How Deep Are the Roots of Economic Development?”
by E. Spolaore and R. Wacziarg, *Journal of Economic Literature*, June 2013

“Long-term Barriers to Economic Development”
by E. Spolaore and R. Wacziarg, *Handbook of Economic Growth*, *vol. 3* (P. Aghion and S. Durlauf eds., North Holland-Elsevier, 2014)

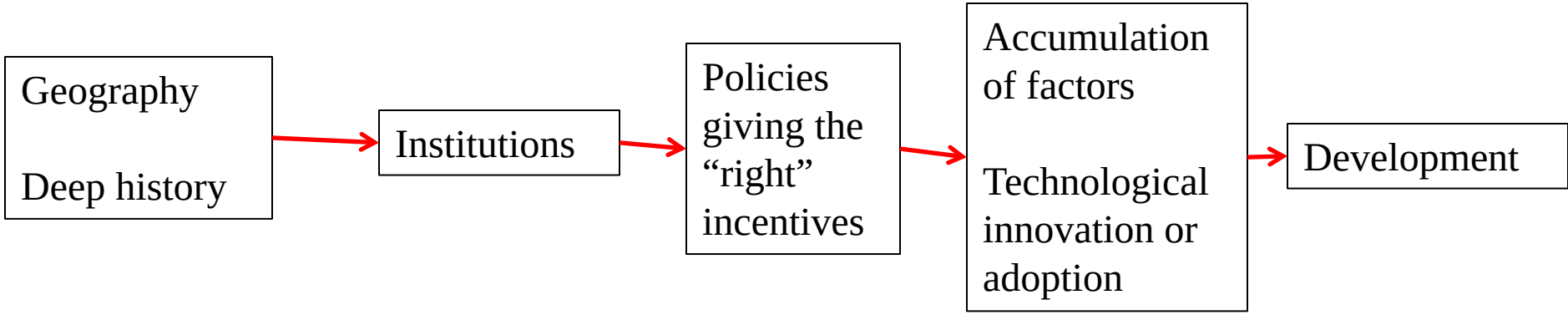
“Fertility and Modernity” by E. Spolaore and R. Wacziarg

Available at *http://sites.tufts.edu/enricospolaore/*

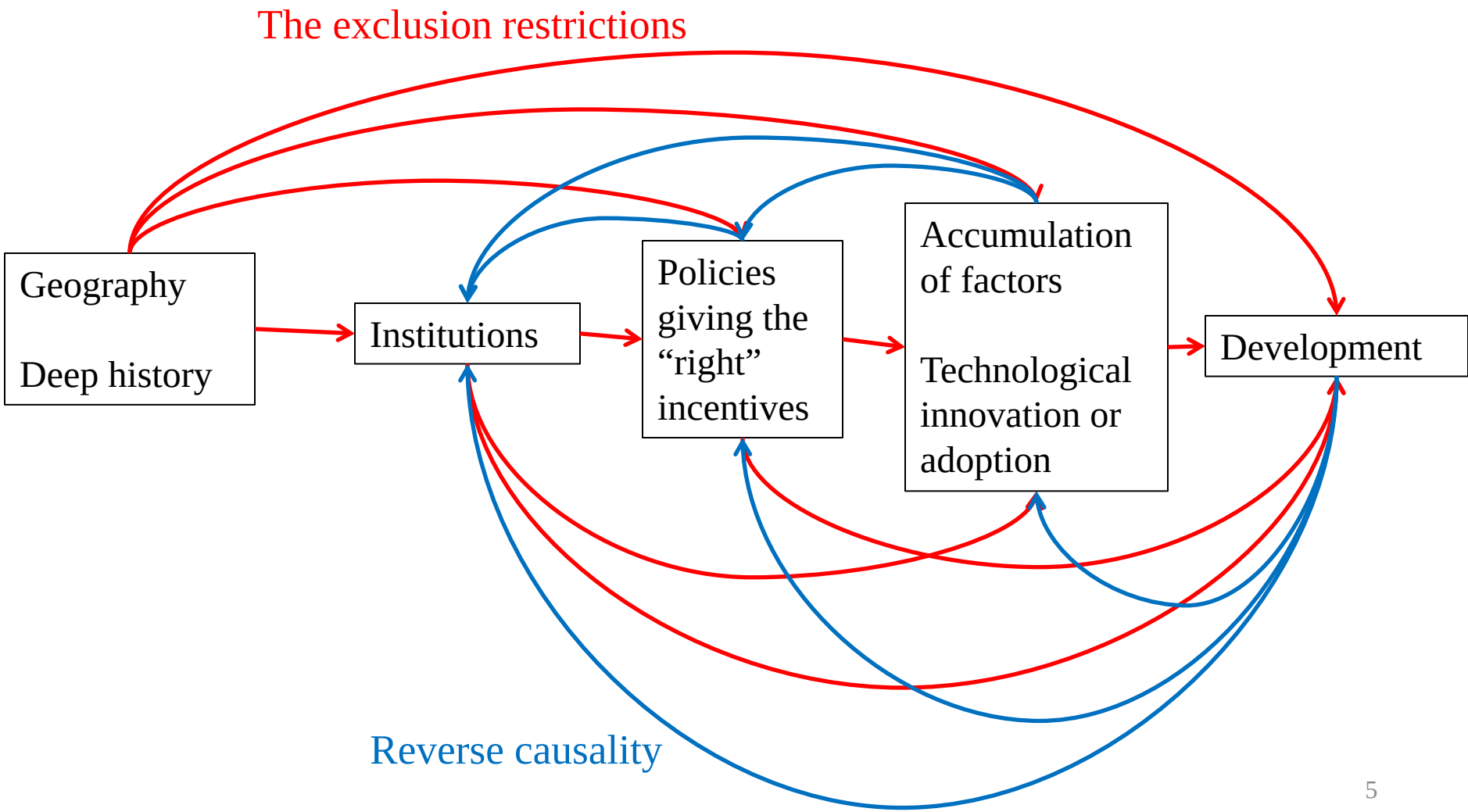
Why Are Some Societies Richer and Others Poorer?

- Decades ago, the emphasis was on the accumulation of factors of production and exogenous technological progress.
- Later, the focus switched to policies and incentives endogenously affecting factor accumulation and innovation.
- More recently, the attention has moved to the institutional framework underlying these policies and incentives.
- The question remains as to why the proximate determinants of the wealth of nations vary across societies.

A Schematic View of Development



A Schematic View of Development
(with minor complicating factors)



Main Themes of this Talk

1. There is a lot of **persistence** in development outcomes and technological sophistication.

2. But there is also (often dramatic) **change:** spread of new technologies, diffusion of novel fertility behavior, modernization

3. Both persistence and change are associated with **intergenerational** links: ***long-term history of populations matters***.

4. The mechanisms through which ancestral links between populations matter can take a wide variety of forms and can involve **complex interactions**.

5. The interaction between persistence and change can be partly explained by historically-dependent **barriers** to the transmission of innovations (broadly understood), an idea that is too often overlooked.

Main References

- On long-term effects of geography: Jared Diamond (1997), Olsson and Hibbs (EER, 2005) and Ashraf and Galor (AER, 2011)
- On reversal of fortune and role of European colonization: Acemoglu, Johnson and Robinson (QJE, 2002), Easterly and Levine (2012)
- On ancestry-adjusted variables: Putterman and Weil (QJE, 2010), Comin, Easterly and Gong (AEJ: Macro, 2010).
- On ancestral distance, barrier effects and development:

  Spolaore and Wacziarg (QJE, 2009)

Table 1 JEL – Geography and Contemporary Development (dependent variable: log per capita income, 2005)

	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	**Whole World**	**Olsson-Hibbs sample**	**Olsson-Hibbs sample**	**Olsson-Hibbs sample**	**Olsson-Hibbs sample**	**Old World only**
Absolute latitude	0.044 (6.645)***	0.052 (7.524)***				
% land area in the tropics	-0.049 (0.154)	0.209 (0.660)	-0.410 (1.595)	-0.650 (2.252)**	-0.421 (1.641)	-0.448 (1.646)
Landlocked dummy	-0.742 (4.375)***	-0.518 (2.687)***	-0.499 (2.487)**	-0.572 (2.622)**	-0.505 (2.523)**	-0.226 (1.160)
Island dummy	0.643 (2.496)**	0.306 (1.033)	0.920 (3.479)***	0.560 (1.996)**	0.952 (3.425)***	1.306 (4.504)***
Geographic conditions (Olsson-Hibbs)			0.706 (6.931)***		0.768 (4.739)***	0.780 (5.167)***
Biological conditions (Olsson-Hibbs)				0.585 (4.759)***	-0.074 (0.483)	0.086 (0.581)
Constant	7.703 (25.377)***	7.354 (25.360)***	8.745 (61.561)***	8.958 (58.200)***	8.741 (61.352)***	8.438 (60.049)***
Observations	155	102	102	102	102	83
Adjusted R-squared	0.440	0.546	0.521	0.449	0.516	0.641

Table 2 JEL – Geography and Development in 1500

	(1)	(2)	(3)	(4)
Dependent Variable:	**Years since agricultural transition**	**Population density in 1500**	**Population density in 1500**	**Population density in 1500**
Estimator:	**OLS**	**OLS**	**OLS**	**IV**
Absolute latitude	-0.074 (3.637)***	-0.022 (1.411)	0.027 (2.373)**	0.020 (1.872)*
% land area in the Tropics	-1.052 (2.356)**	0.997 (2.291)**	1.464 (3.312)***	1.636 (3.789)***
Landlocked Dummy	-0.585 (2.306)**	0.384 (1.332)	0.532 (1.616)	0.702 (2.158)**
Island dummy	-1.085 (3.699)***	0.072 (0.188)	0.391 (0.993)	0.508 (1.254)
Number of annual or perennial wild grasses	0.017 (0.642)	0.030 (1.105)		
Number of domestic-cable big mammals	0.554 (8.349)***	0.258 (3.129)***		
Years since agriculture transition			0.426 (6.694)***	0.584 (6.887)***
Constant	4.657 (9.069)***	-0.164 (0.379)	-2.159 (4.421)***	-2.814 (5.463)***
Observations	100	100	98	98
Adjusted R-squared	0.707	0.439	0.393	-

Reversal of Fortune

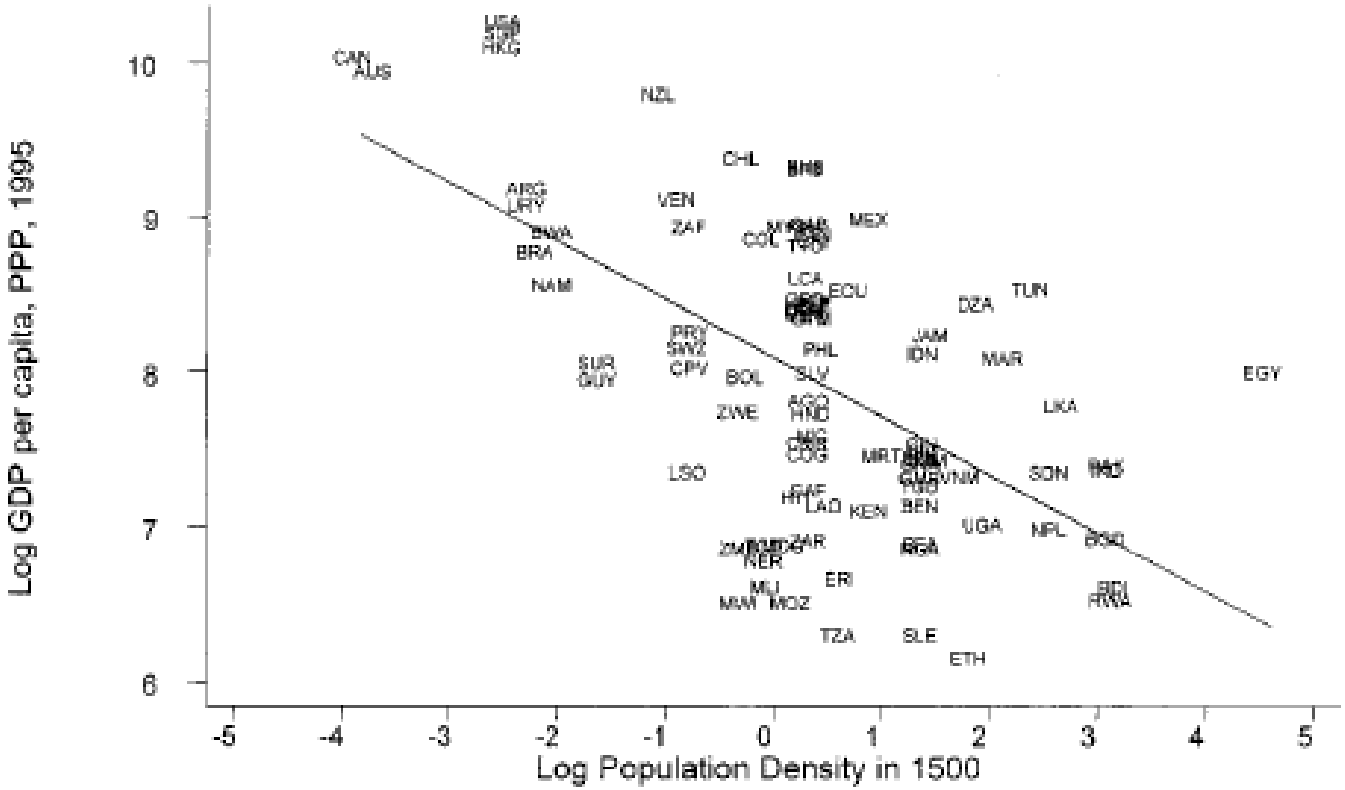


FIGURE II
Log GDP per Capita (PPP) against Log Population Density in 1500

- Source: Acemoglu, Johnson, Robinson (QJE 2002)
- This picture does not square well with a simple geography story
- This is for a sample of former colonies only…

Table 3 JEL – Reversal of Fortune
(dependent variable: log per capita income, 2005)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample:	**Whole World**	**Europe Only**	**Former European Colony**	**Not Former European Colony**	**Non Indige-nous**	**Indige-nous**	**Former European colony, Non Indige-nous**	**Former European colony, Indige-nous**
	With European Countries							
Log of pop. density, 1500	0.027 (0.389)	0.117 (1.276)		0.170 (2.045)**		0.193 (2.385)**		
Beta coefficient on 1500 density	3.26%	22.76%		22.34%		20.00%		
Observations	171	35		73		138		
R-squared	0.001	0.052		0.050		0.040		
	Without European Countries							
Log of pop. density, year 1500	-0.246 (3.304)***		-0.393 (7.093)***	-0.030 (0.184)	-0.232 (2.045)**	-0.117 (1.112)	**-0.371** **(4.027)*** **	-0.232 (2.740)**
Beta coefficient on 1500 density	-27.77%		-47.88%	-3.08%	-32.81%	-11.72%	**-51.69%**	-26.19%
Observations	136		98	38	33	103	28	70
R-squared	0.077		0.229	0.001	0.108	0.014	0.267	0.069

Ancestry Adjustment

- A focus on populations rather than locations helps us understand both persistence and reversal of fortune, and sheds light on the spread of economic development.
- The need to adjust for population ancestry is at the core of Putterman and Weil's contribution, showing that current economic development is correlated with historical characteristics of a population's ancestors, including ancestors' years of experience with agriculture, going back, again, to the Neolithic transition.

Table 4 JEL – Historical correlates of development, with and without ancestry adjustment

	Log per capita income 2005	Years of Agriculture	Ancestry adjusted years of agriculture	State history	Ancestry adjusted state history
Years of agriculture	0.228	1.000			
Ancestry-adjusted years of agriculture	0.457	0.817	1.000		
State history	0.257	0.618	0.457	1.000	
Ancestry-adjusted state history	0.481	0.424	0.613	0.783	1.000

Table 5 JEL – The History of Populations and Economic Development (Dependent variable: log per capita income, 2005)

	(1)	(2)	(3)	(4)
Main regressor:	**Years of agriculture**	**Ancestry-adjusted years of agriculture**	**State history**	**Ancestry-adjusted state history**
Years of agriculture	**0.019** **(0.535)**			
Ancestry-adjusted years of agriculture		**0.099** **(2.347)****		
State history			**0.074** **(0.245)**	
Ancestry-adjusted state History				**1.217** **(3.306)*****
Absolute latitude	0.042 (6.120)***	0.040 (6.168)***	0.047 (7.483)***	0.046 (7.313)***
% land area in the tropics	-0.188 (0.592)	-0.148 (0.502)	0.061 (0.200)	0.269 (0.914)
Landlocked dummy	-0.753 (4.354)***	-0.671 (3.847)***	-0.697 (4.122)***	-0.555 (3.201)***
Island dummy	0.681 (2.550)**	0.562 (2.555)**	0.531 (2.216)**	0.503 (2.338)**
Constant	7.699 (22.429)***	7.270 (21.455)***	7.458 (22.338)***	6.773 (19.539)***
Beta coefficients on the bold variable	3.75%	17.23%	1.50%	21.59%
Observations	150	148	136	135
R-squared	0.475	0.523	0.558	0.588

Mechanisms

- Intergenerational transmission can take place through **different inheritance systems**: **biological**, **cultural,** or **dual** (gene-culture interaction)
- The effects of inherited traits on productivity and other economic outcomes may be **direct** or operate as **barriers** to the transmission of productivity-enhancing innovations
- We provide a **general taxonomy** to discuss different channels through which inherited human characteristics may impact economic development.

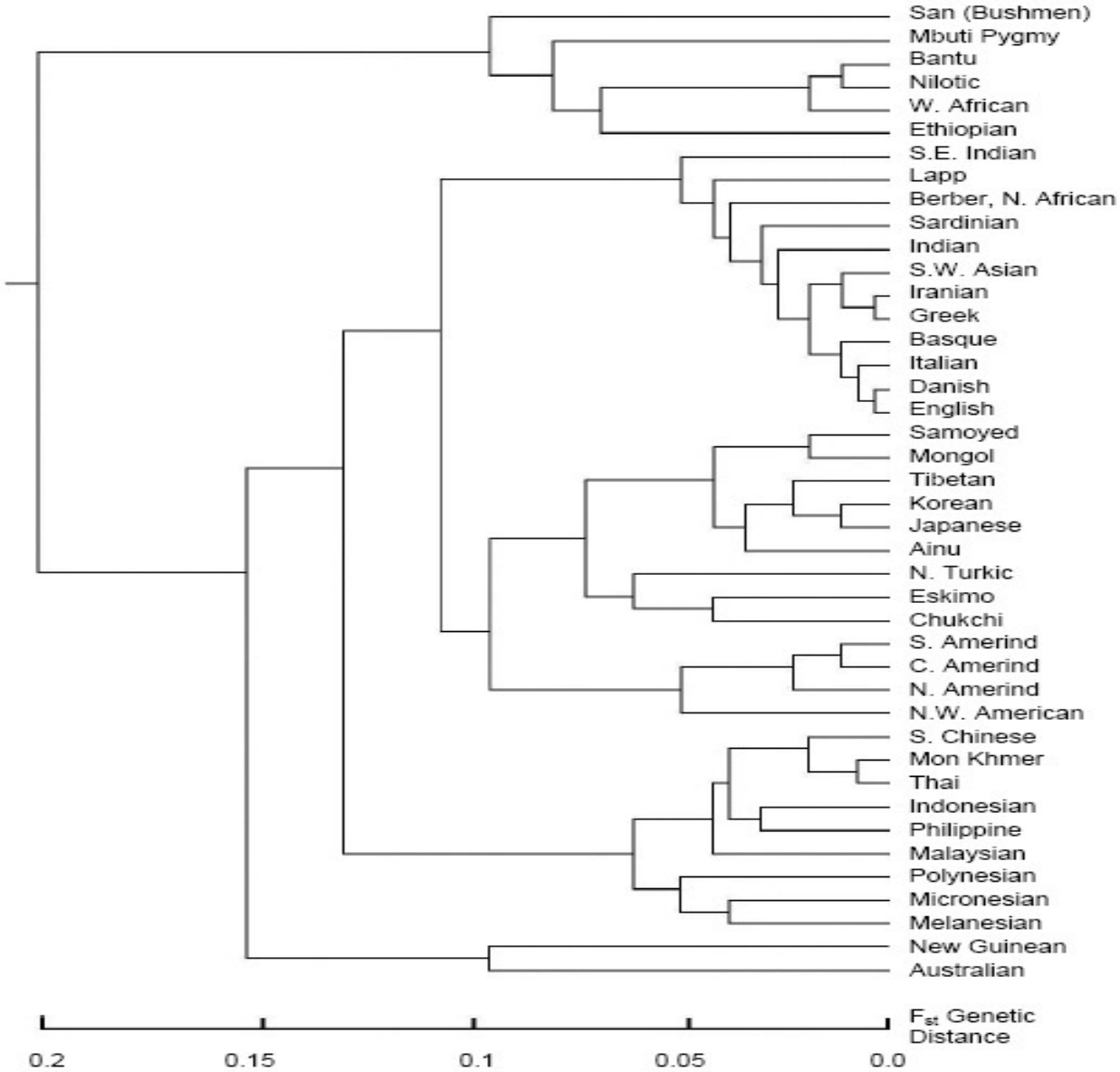
A Taxonomy

Mechanism of impact / Type of transmission	Direct Effect	Barrier Effect
Biological (genetic or epigenetic)	e.g. Galor-Moav (2002), Clark (2007)	e.g., Spolaore and Wacziarg (2009, 2011, 2013, 2014)
Cultural (behavioral or symbolic)	e.g. Max Weber and many others (Bisin-Verdier, Tabellini, Alesina-Giuliano, ..)	
Dual (gene-culture interaction)	e.g., Boyd and Richerson	

Ancestral Distance and Trees

- Measures of ancestral distance between populations are based on aggregate differences in the frequencies of alleles (i.e., gene variants) for various loci on a chromosome.
- Geneticists have focused on genes that are ***neutral markers*** i.e., their evolution is affected by genetic drift but not natural selection
- Since most genetic differences tend to accumulate at a regular pace over time, as in a molecular clock, genetic distance is linearly linked to the **time since two populations last shared common ancestors.**
- Hence, genetic distance can be used to determine paths of genealogical **relatedness** of different populations over time
- We use measures of F_{ST} distance, also known as "coancestor coefficients"

Phylogenetic Tree of Human Populations



Source: Cavalli-Sforza et al., 1994

The Diffusion of the Industrial Revolution

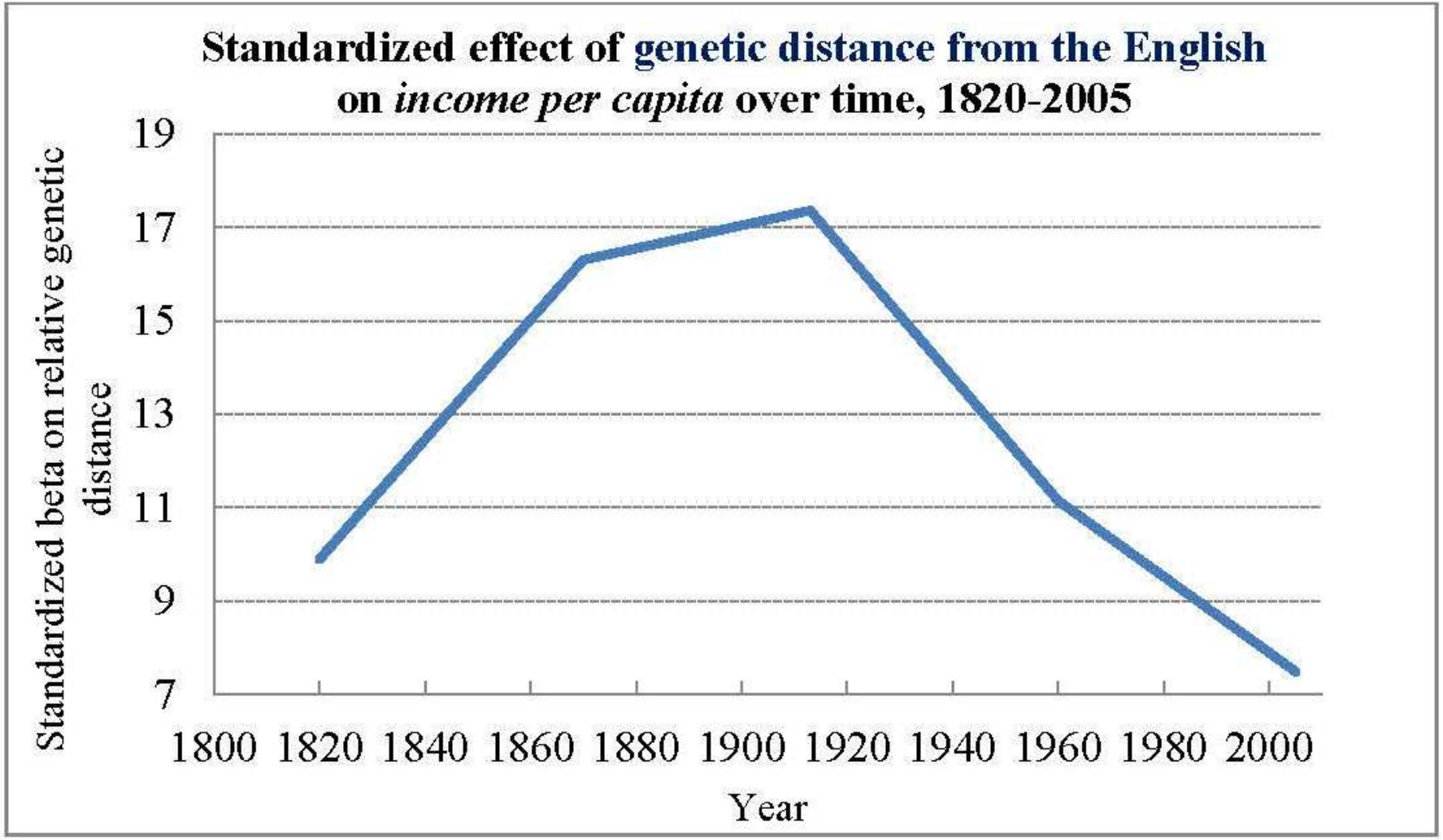
Table 9 JEL –

(dep. var.: absolute difference in log per capita income, 1820 to 2005)

	(1)	(2)	(3)	(4)	(5)
Income measured as of:	**Income 1820**	**Income 1870**	**Income 1913**	**Income 1960**	**Income 2005**
Relative Fst genetic distance to the English population	0.793 (0.291)**	1.885 (0.933)**	1.918 (0.955)**	4.197 (0.822)**	4.842 (0.877)**
Observations	990	1,431	1,596	4,005	10,878
Standardized Beta (%)	14.31	23.06	20.93	31.56	28.50
Standardized Beta (%), common sample[a]	10.98	16.37	15.53	9.00	7.77
R-Squared	0.36	0.30	0.29	0.22	0.23

All regressions include an intercept term and following geographic control variables: absolute difference in latitudes, absolute difference in longitudes, geodesic distance (1000s of km), dummy for contiguity, dummy if either country is an island, difference in % land area in KG tropical climates, dummy if either country is landlocked, dummy if pair shares at least one sea or ocean, freight rate.

The Diffusion of the Industrial Revolution



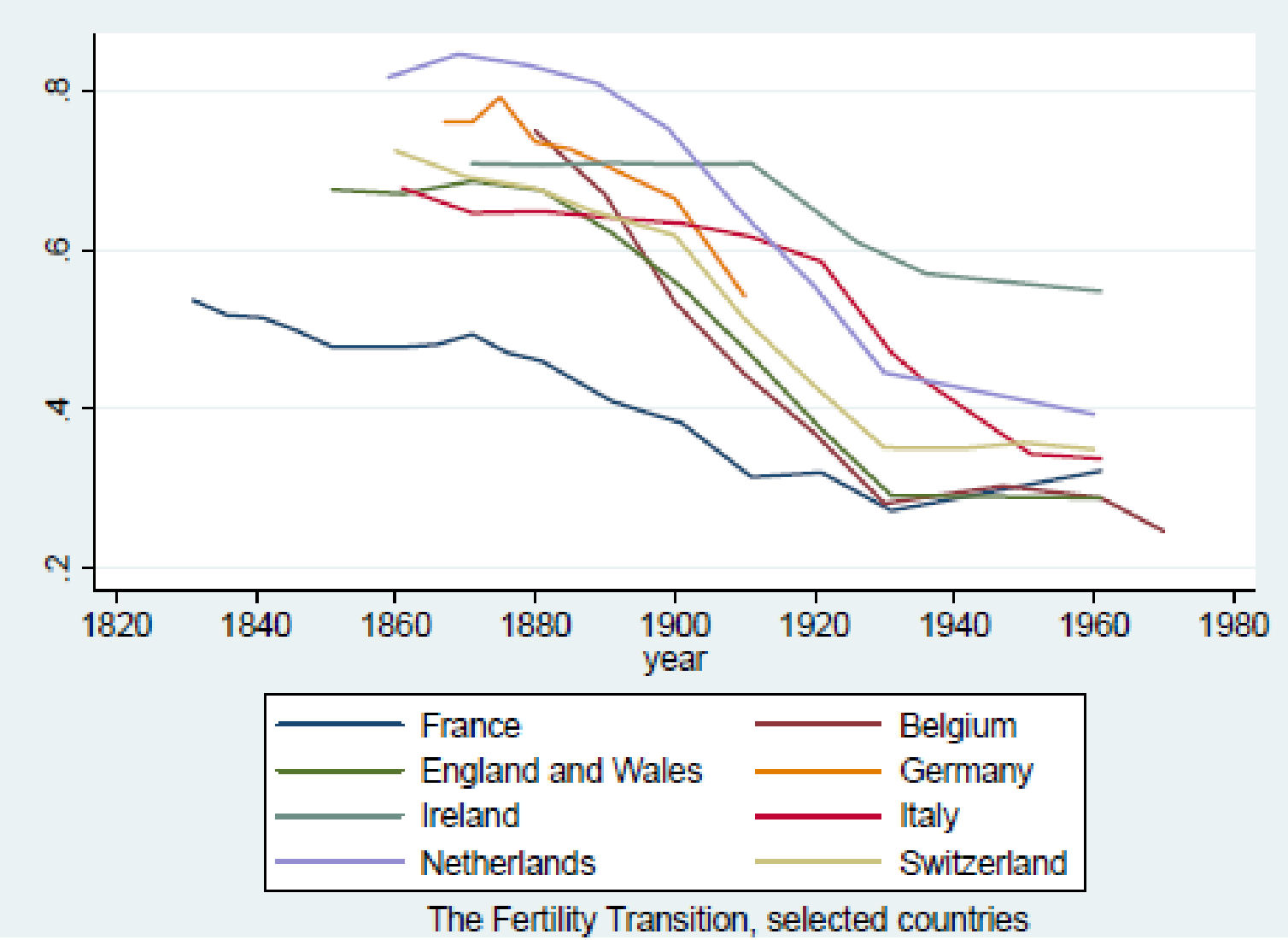
The Spread of Technological Innovations

Table 10 JEL –Bilateral regressions of technological distance on genetic and geographic distance (CEG dataset for 2000, dependent variable as in first row)

	(1)	(2)	(3)	(4)	(5)
	Agricultural Technology	**Communi-cations Technology**	**Transpor-tation Technology**	**Industrial Technology**	**Overall Technology**
Fst gen. dist. relative to the USA, weighted	**0.689** **(0.415)***	**0.504** **(0.276)***	**0.901** **(0.236)*****	**1.119** **(0.341)*****	**1.015** **(0.299)*****
Bilateral Fst Genetic Distance	**-0.289** **(0.194)**	**-0.004** **(0.137)**	**-0.302** **(0.095)*****	**0.030** **(0.150)**	**-0.278** **(0.128)****
Constant	0.093 (0.028)***	0.199 (0.018)***	0.153 (0.017)***	0.198 (0.023)***	0.152 (0.017)***
Observations (countries)	6,105 (111)	7,381 (122)	6,441 (114)	5,565 (106)	7,503 (122)
Standardized Beta (%)	14.37	12.83	27.68	25.31	26.97
R-Squared	0.26	0.10	0.15	0.16	0.18

Two-way clustered standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. All columns include controls for: absolute difference in latitudes, absolute difference in longitudes, geodesic distance, dummy for for contiguity, dummy for if either country is an island, dummy for if either country is landlocked, difference in % land area in KG tropical climates, dummy for if pair shares at least one sea or ocean.

Decline of Marital Fertility in Europe over time in selected countries



Two Important Facts

- France was the first country where marital fertility declined, decades before this novel behavior spread to the rest of Europe

  Estimated transition time for **France**: **1827**

- England followed much later. Transition to lower marital fertility in **England**: **1892**

Dates of the fertility transition in selected European populations

Country or Region	Date	Country or Region	Date
France	1827	Austria	1907
Latvia	1865	Hungary	1910
Catalonia	1875	Ukraine	1910
Walloon Belgium	1875	Finland	1912
Switzerland	1887	Poland	1912
Germany	1888	Greece	1913
England	1892	Italy	1913
Scotland	1894	Lapland	1915
Freisland	1897	Slovakia	1915
Netherlands	1897	Portugal	1916
Denmark	1898	Spain	1920
Sweden	1902	Ireland	1922
Norway	1903	Russia	1922
Czech Republic	1905	Belarus	1925
Flemish Belgium	1905	Basque Country	1930
Lithuania	1905	Iceland	1930
Wales	1905	Sardinia	1961

Inter-Group Barriers

- Evidence from individual regions suggest that the behavior spread more quickly to groups who were **culturally and linguistically closer to the French**.
- For instance, in Belgium during the 19th century "*the early adoption of fertility control [...] stopped at the language border. Not only did **Flemings** and **Walloons** who lived as neighbors in this very narrow strip along the language border fail to intermarry to a considerable extent, but they also did not take each other's attitude toward fertility. As a result, two separate diffusion patterns developed in Flanders and Wallonia.*" (Lesthaeghe, 1977, p. 227).

A Tale of Two Diffusions

The spread of "modernity" involved two separate diffusions

1) The spread of technological and economic innovations associated with the **Industrial Revolution**, where **England** played a leading role

2) The spread of **social/behavioral changes** – such as **marital fertility decline** - where **France** played a leading role

Measuring Social Distance

- **Genetic distance** between European populations
- **Linguistic distance** between European populations and between European regions

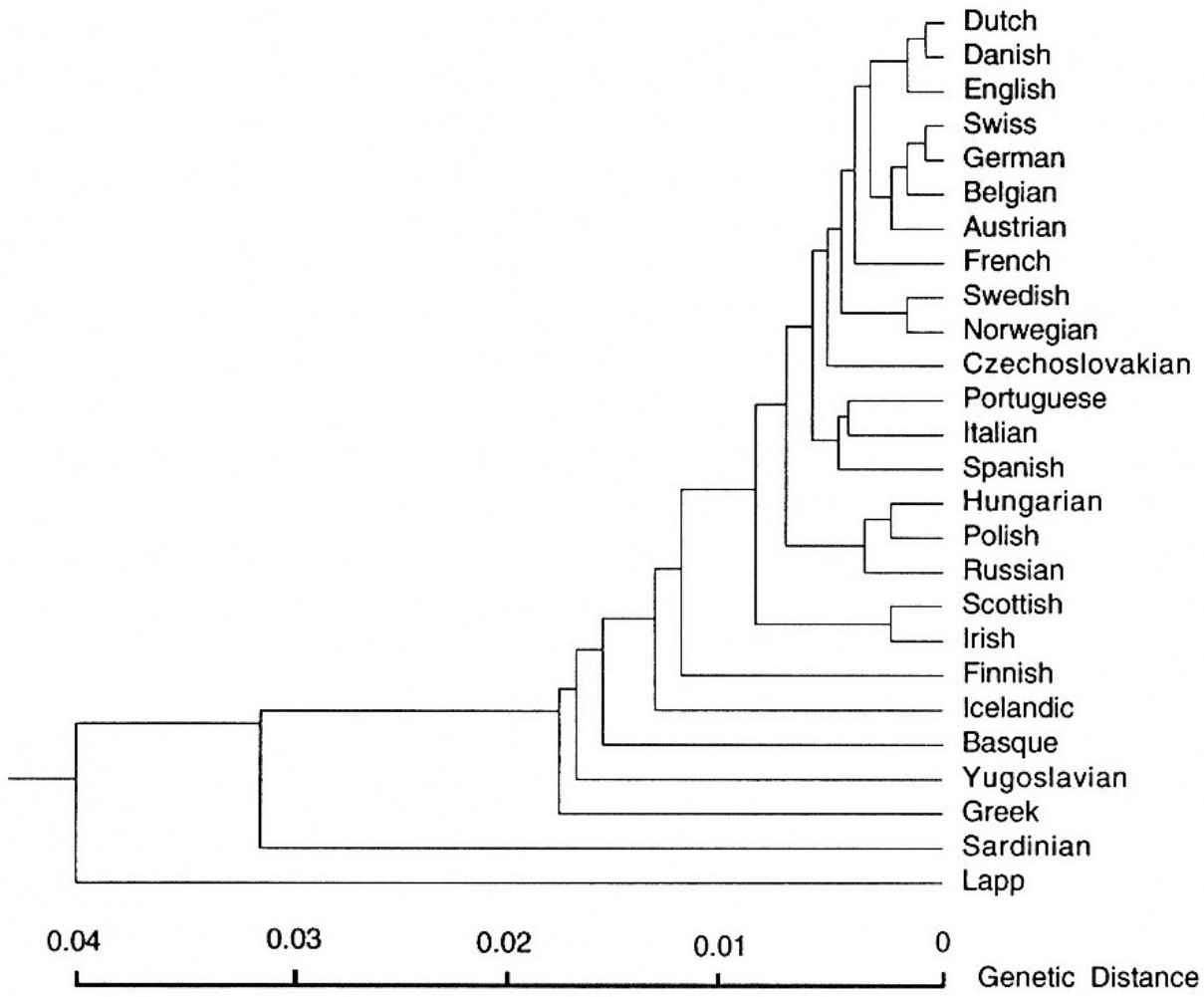


Figure 2 – Phylogenetic Tree of 26 European Populations
(Source: Cavalli Sforza et al., 1994)

Two Measures of Linguistic Distance

- Two measures of linguistic distance:
  - number of different linguistic nodes between languages (Ethnologue)
  - lexicostatistical distance - percentage of not cognate words in a list of 200 basic meanings (Dyen et al., 1992)
- Example, French (Français) is classified as: Indo-European - Italic - Romance - Italo-Western - Western - Gallo-Iberian - Gallo-Romance - Gallo-Rhaetian - Oïl - Français.
- Italian shares 4 nodes in common with French (Indo-European - Italic - Romance - Italo-Western) out of a possible 10 nodes, and therefore its linguistic distance to French is equal to 6.

Linguistic Distance between Populations and Regions

- At the population level, we use both measures of linguistic distance for 37 European languages. Correlation between two measures of linguistic distance is 0.939. Correlation with genetic distance is $0.26 - 0.27$.
- At the regional level, we matched 275 ancestral languages and dialects spoken in the 18th and 19th century in 775 regions (e.g., regions of Southern France were matched to Langue d'Oc, Provençal or Savoyard), for which we have fertility data from PEFP, and calculated distance by number of different linguistic nodes.

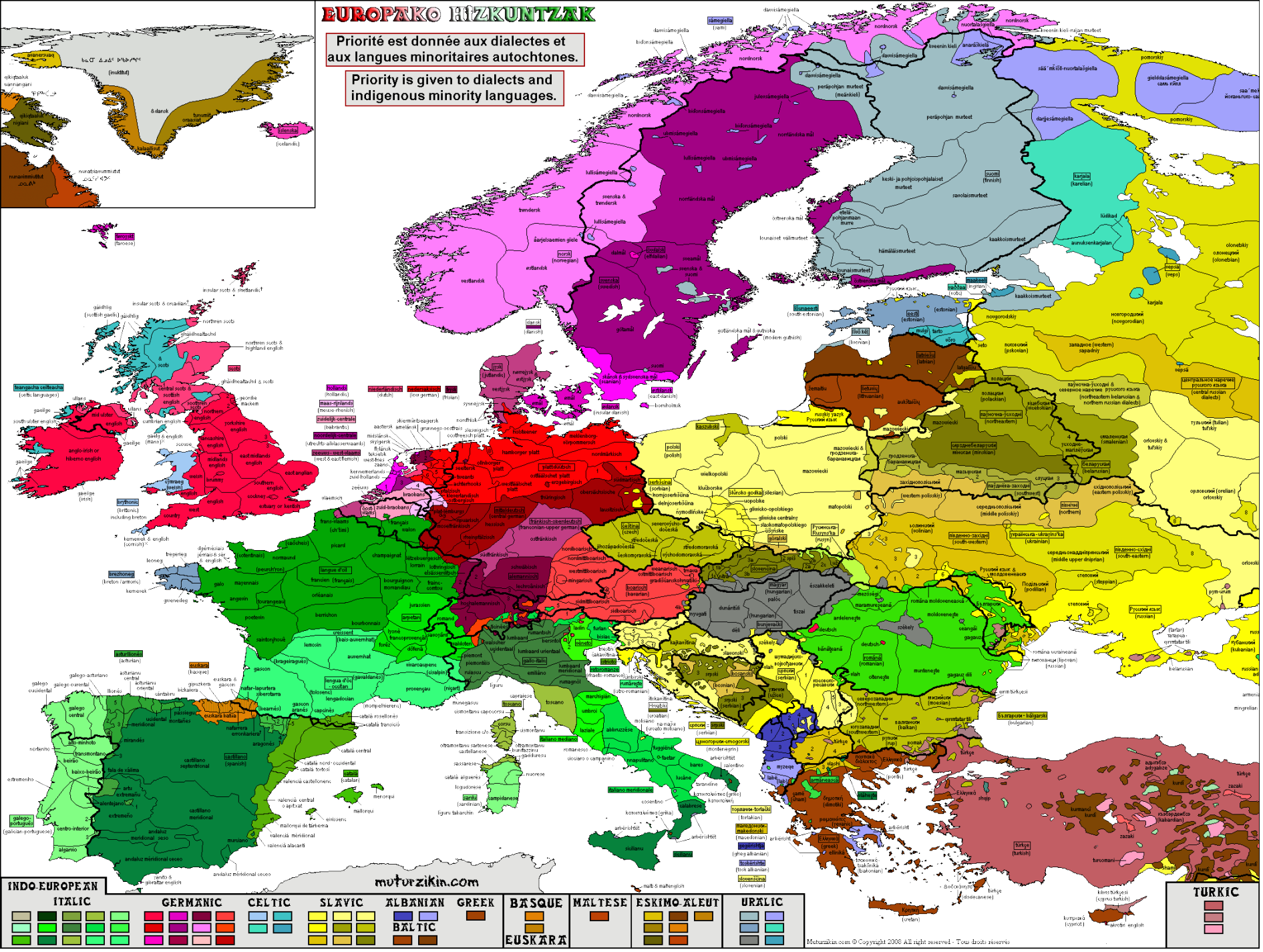

EUROPAKO HIZKUNTZAK
Priorité est donnée aux dialectes et aux langues minoritaires autochtones.
Priority is given to dialects and indigenous minority languages.
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Table 3 - Population-level Regressions for the Transition Date
(Dependent variable: Marital Fertility Transition Date)

	(1)	(2)	(3)	(4)
	Univariate	**Control for distance**	**Control for geography**	**Control for initial income 1820**
Genetic distance from France	**0.130** **(2.45)****	**0.104** **(1.93)***	**0.111** **(2.26)****	**0.107** **(2.05)***
Geodesic distance from France (1000s of km)		4.666 (0.88)	4.316 (0.40)	-12.222 (0.55)
Absolute difference in latitudes, from France			-69.611 (0.88)	-52.858 (0.46)
Absolute difference in longitudes, from France			4.782 (0.21)	124.772 (0.54)
1 for contiguity with France			-11.320 (1.09)	-13.818 (1.57)
=1 if an island			1.167 (0.10)	2.738 (0.20)
=1 if shares at least one sea or ocean with France			7.862 (1.00)	12.035 (0.57)
Average elevation between countries to France			28.236 (0.70)	45.242 (0.94)
=1 if landlocked			-1.599 (0.22)	-13.797 (0.53)
Per capita income, 1820, from Maddison				-0.007 (0.39)
Constant	1,895.115 (361.65)***	1,891.406 (256.60)***	1,885.426 (131.40)***	1,889.543 (35.65)***
R^2	0.20	0.23	0.30	0.36
Number of populations	37	37	37	26
Standardized Beta (%)	44.842	35.969	38.298	41.187

(Robust t-statistics in parentheses: * p<0.1; ** p<0.05; *** p<0.01)

Figure 3 - Genetic Distance to France and the Fertility Transition

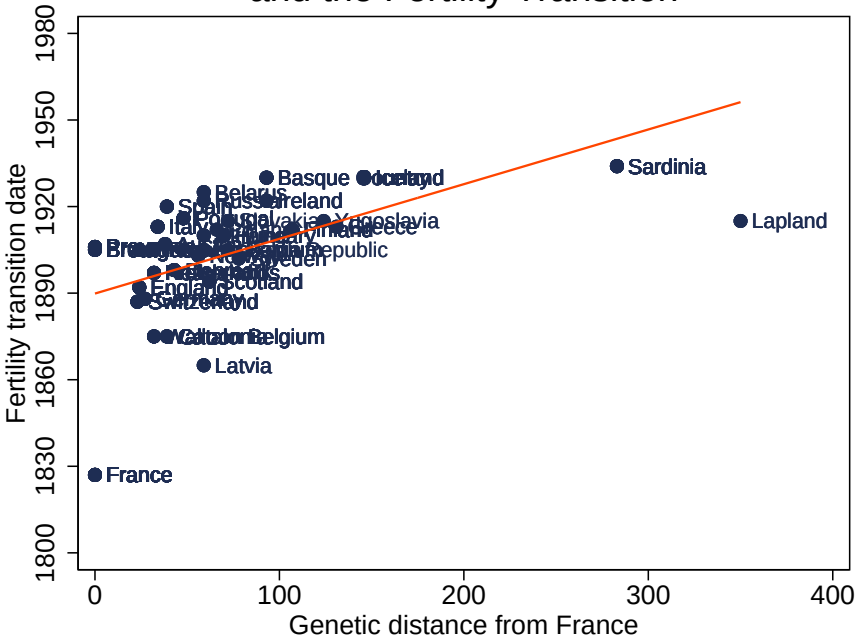


Figure 4 - Genetic Distance to France and the Fertility Transition, controlling for geodesic distance

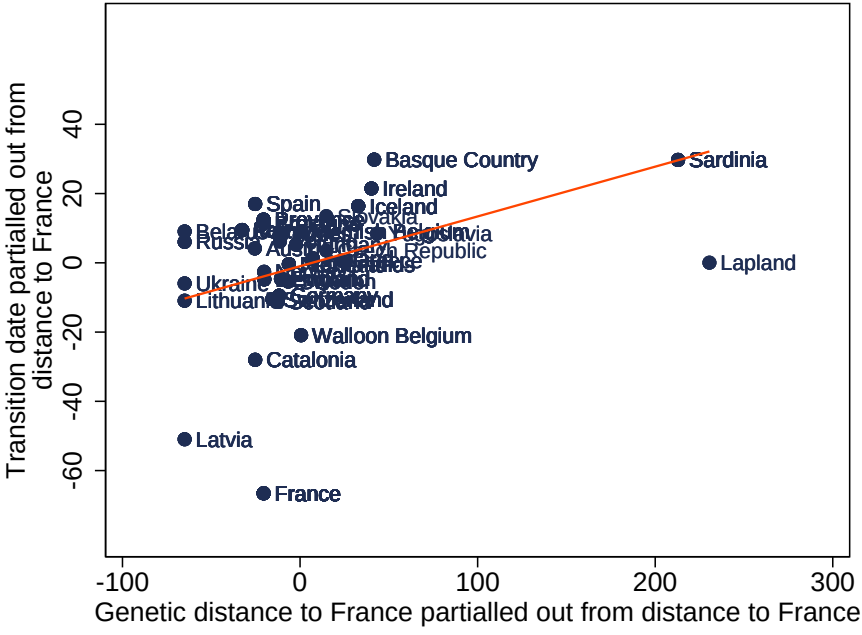


Table 4 - Horserace with Distance to England, Population-level Regressions
(Dependent variable: Marital Fertility Transition Date)

	(1)	(2)	(3)	(4)
	Univariate	**Control for distance**	**Horserace, simple**	**Horserace, geographic controls**
Genetic distance from England	0.152 (2.67)**	0.062 (0.89)	-0.036 (0.67)	-0.125 (1.35)
Geodesic Distance from England (1000s of km)		6.520 (0.93)	9.776 (0.90)	76.939 (3.08)***
Genetic distance from France			0.117 (2.54)**	0.160 (3.49)***
Geodesic distance from France (1000s of km)			-3.472 (0.30)	-59.688 (1.96)*
Constant	1,895.918 (377.11)***	1,892.873 (279.48)***	1,890.223 (275.00)***	1,893.256 (140.95)***
R^2	0.10	0.13	0.24	0.40
Number of populations	37	37	37	37
Standardized Beta on genetic distance from England (%)	32.147	13.079	-7.708	-26.406
Standardized Beta on genetic distance from France (%)			40.302	55.217

(Robust t-statistics in parentheses: * p<0.1; ** p<0.05; *** p<0.01)
All regressions are based on a sample of 37 populations.
Additional geographic controls in column 4 (estimates not reported) include all those in column 3 of Table 3, i.e. absolute difference in latitudes, absolute difference in longitudes, contiguity dummy, island dummy, landlocked dummy, shared sea/ocean dummy, average elevation along the path to France / England, entered both relative to France and relative to England where applicable.

Table 5 - Population-level Regressions for Marital Fertility, 1911-1941 period
(Dependent variable: Index of Marital Fertility, Ig)

	(1)	(2)	(3)	(4)
	Univariate	**Distance control**	**All Geography Controls**	**All Geography Controls**
Genetic distance from France	**0.733** **(3.55)*** **	**0.582** **(2.39)** **	**0.802** **(3.66)*** **	**0.961** **(3.24)*** **
Geodesic distance to France (1000s of km)		27.360 (1.49)	-17.484 (0.33)	-65.110 (0.43)
Absolute difference in latitudes, from France			-832.471 (1.89)*	-413.682 (0.64)
Absolute difference in longitudes, from France			135.769 (1.33)	-373.766 (0.32)
1 for contiguity with France			-86.143 (1.83)*	-109.189 (1.96)*
=1 if an island			61.349 (1.34)	98.192 (0.92)
=1 if shares at least one sea or ocean with France			28.761 (0.57)	12.274 (0.13)
Average elevation between countries to France			225.541 (2.05)*	221.951 (1.76)*
=1 if landlocked			-133.433 (1.93)*	-93.008 (0.81)
Per capita income, 1913, from Maddison				-0.040 (1.27)
Constant	410.528 (20.13)***	388.782 (15.46)***	412.678 (5.95)***	603.407 (3.71)***
R^2	0.27	0.31	0.51	0.55
# of populations	37	37	37	29
Standardized Beta on genetic distance (%)	52.141	41.429	57.066	72.114

(Robust t-statistics in parentheses: * p<0.1; ** p<0.05; *** p<0.01)
The data on marital fertility is for the 1911-1941 period: if more than one observation was available on Ig for a given country in that period, the available observations were averaged.

Table 6 - Population-level Regressions Using Linguistic Distance
(Dependent variable: As in the second row)

	(1)	(2)	(3)	(4)
	Transition Date	**Transition Date**	**Ig 1911-1940**	**Ig 1911-1940**
# of different nodes with Français	**4.432**		**13.739**	
	(2.43)**		**(2.16)****	
% not cognate with French, lexicostatistical measure		**0.034**		**0.113**
		(1.81)*		**(1.58)**
Geodesic distance to France (1000s of km)	22.318	22.365	91.735	93.127
	(2.39)**	(2.10)**	(1.94)*	(1.77)*
Absolute difference in latitudes, from France	-139.423	-146.493	-1,040.387	-1,081.450
	(1.82)*	(1.67)	(2.10)**	(2.00)*
Absolute difference in longitudes, from France	-22.115	-19.797	-57.001	-49.367
	(1.28)	(1.12)	(0.73)	(0.63)
1 for contiguity with France	3.961	1.754	-20.579	-25.314
	(0.55)	(0.27)	(0.41)	(0.53)
=1 if an island	-3.678	-2.289	30.500	34.897
	(0.29)	(0.18)	(0.58)	(0.68)
=1 if shares at least one sea or ocean with France	9.775	10.800	15.612	20.622
	(1.11)	(1.04)	(0.27)	(0.34)
Average elevation between countries to France	6.577	10.842	124.769	135.742
	(0.25)	(0.35)	(1.31)	(1.45)
=1 if landlocked	-3.933	-3.304	-147.410	-145.477
	(0.52)	(0.41)	(2.04)*	(2.00)*
Constant	1,849.404	1,860.408	311.517	338.945
	(79.45)***	(73.14)***	(3.57)***	(3.87)***
R-squared	0.43	0.34	0.44	0.41
Standardized Beta (%)	56.684	45.080	36.174	31.020

(Robust t-statistics in parentheses; * p<0.1; ** p<0.05; *** p<0.01)
Ig was multiplied by 1000 to make the numbers more readable.
All regressions are based on a sample of 37 populations.
Results do not change materially with the addition of per capita income in 1820 to columns (1) and (2) or the addition of per capita income in 1913 to columns (3) or (4).

Table 8 - Cross-Regional Regressions for the Marital Fertility Transition Date, with country fixed-effects (Dependent variable: Marital Fertility Transition Date)

	(1)	(2)	(3)	(4)
	Univariate	**Control for geodesic distance**	**Control for all distances**	**Control for micro-geography**
# of different nodes with Français	**2.409 (5.30)*** **	**2.248 (4.94)*** **	**2.289 (5.05)*** **	**2.363 (5.11)*** **
Geodesic distance to Paris, km		0.011 (7.14)***	-0.0002 (0.03)	0.001 (0.16)
Absolute difference in longitudes, to Paris			0.795 (2.16)**	0.744 (1.96)*
Absolute difference in latitudes, to Paris			0.341 (0.99)	0.233 (0.66)
=1 if area is barred by a mountain range from France				11.761 (2.19)**
=1 if area is contiguous with France				-4.653 (1.30)
=1 if area shares at least one sea or ocean with France				1.196 (0.52)
=1 if area is landlocked				1.975 (0.93)
=1 if area is an island				0.887 (0.16)
Constant	1,889.677	1,880.531	1,879.800	1,872.125
	(408.72)***	(378.89)***	(365.08)***	(345.88)***
R^2 overall	0.70	0.71	0.71	0.72
Standardized Beta (%) on linguistic distance	27.298	25.471	25.938	26.775

Robust t-statistics in parentheses: * p<0.1; ** p<0.05; *** p<0.01.
The sample is comprised of 771 regions from the following 25 countries: Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, England and Wales, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxemburg, Netherlands, Norway, Poland, Portugal, Romania, Russia, Scotland, Spain, Sweden, Switzerland, Yugoslavia.
Country fixed effects are based on 1846 borders.

Table 9 - Cross-Regional Regressions, English-French Horserace, with country fixed-effects
(Dependent variable: Marital Fertility Transition Date)

	(1)	(2)	(3)	(4)	(5)
	Univariate	**Control for geodesic distance**	**Horserace with geodesic distance**	**Horserace with all distance controls**	**Horserace with all geography controls**
# of different nodes with English	**-0.070** **(0.09)**	**-0.959** **(1.15)**	**1.354** **(1.75)***	**1.336** **(1.67)***	**1.847** **(2.26)****
# of different nodes with Français			**2.234** **(4.87)*****	**2.274** **(4.96)*****	**2.410** **(5.21)*****
Geodesic distance to London, km		0.011 (5.74)***	-0.025 (2.01)**	-0.043 (2.58)**	-0.050 (2.90)***
Geodesic distance to Paris, km			0.033 (2.94)***	0.043 (2.41)**	0.053 (2.84)***
Constant	1,909.021 (723.81)***	1,898.308 (602.79)***	1,884.775 (285.71)***	1,882.509 (268.31)***	1,871.968 (266.92)***
R^2 overall	0.68	0.69	0.72	0.72	0.72
Standardized Beta on linguistic distance to English (%)	-0.341	-4.642	6.558	6.472	8.944
Standardized Beta on linguistic distance to Français (%)			25.321	25.771	27.305

Robust t-statistics in parentheses: * p<0.1; ** p<0.05; *** p<0.01
All regressions estimated on a sample of 771 European regions.
Column (4) includes controls for: absolute difference in longitudes to London, absolute difference in latitudes to London, absolute difference in longitudes to Paris, absolute difference in latitudes to Paris.
Column (5) includes all the controls in column (4) plus: dummy for contiguity to England, dummy for regions that share at least one sea or ocean with England, dummy for contiguity to France, dummy for regions barred by a mountain range to France, dummy for regions that share at least one sea or ocean with France, dummy for landlocked region, dummy for regions located on an island.
The sample is comprised of the regions of the following 25 countries: Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, England and Wales, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxemburg, Netherlands, Norway, Poland, Portugal, Romania, Russia, Scotland, Spain, Sweden, Switzerland, Yugoslavia.

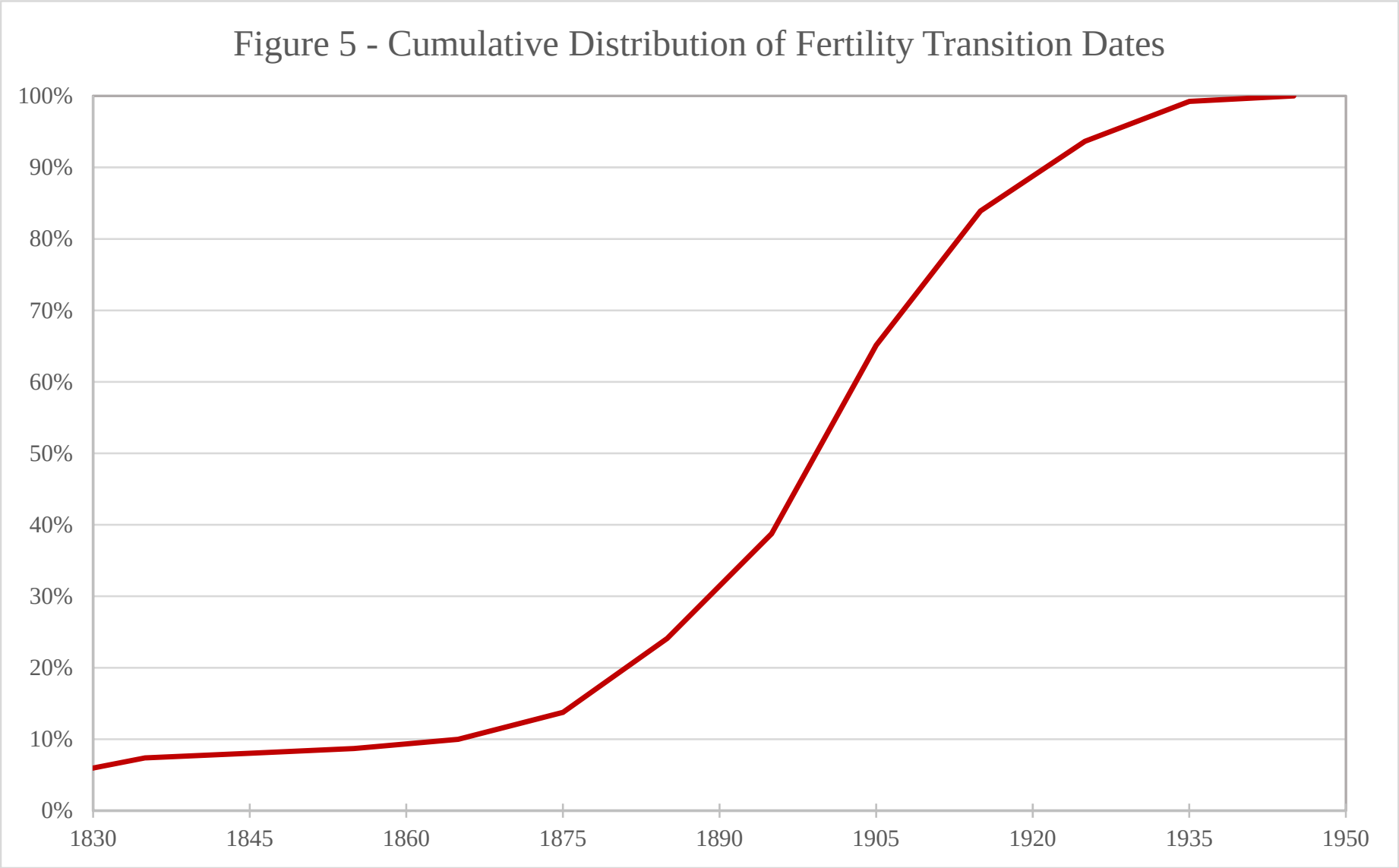


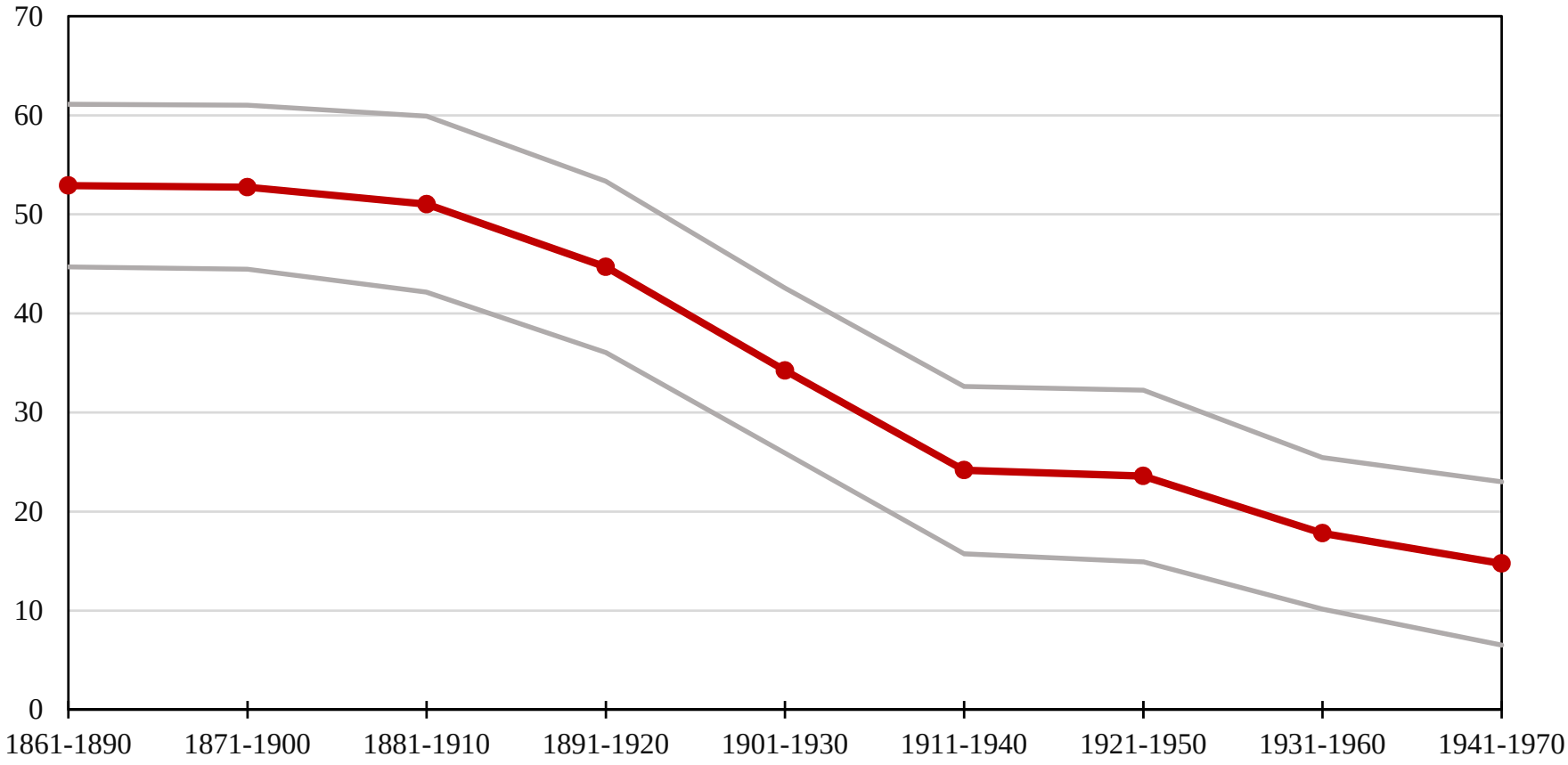
Figure 5 - Cumulative Distribution of Fertility Transition Dates
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1830
1845
1860
1875
1890
1905
1920
1935
1950

Table 11 – Cross-regional Regressions for Ig through Time, with Country Fixed-Effects
(Dependent variable: Index of Marital Fertility, Ig)

	(1)	(2)	(3)	(4)	(5)	(6)
	Period 1[a] (1831-1860)	**Period 3[b] (1851-1880)**	**Period 5[c] (1871-1900)**	**Period 7[d] (1891-1920)**	**Period 9[e] (1911-1940)**	**Period 11[f] (1931-1960)**
# of different nodes with Français	**16.299 (4.24)*** **	**23.346 (12.53)*** **	**22.183 (11.57)*** **	**20.105 (9.66)*** **	**12.858 (6.68)*** **	**7.601 (4.74)*** **
Geodesic distance to Paris, km	0.142 (0.55)	0.068 (1.02)	0.006 (0.10)	0.018 (0.28)	-0.008 (0.25)	-0.022 (0.77)
Constant	578.165 (5.46)***	494.478 (12.08)***	468.778 (11.66)***	375.595 (8.78)***	55.956 (1.04)	191.099 (4.59)***
R-squared	0.69	0.69	0.61	0.59	0.65	0.64
# of regions	184	531	659	675	766	748
# of nations	5	20	24	25	25	24
Standardized Beta (%)	41.074	54.865	49.900	43.141	26.431	18.354
Standardized Beta (%), common sample of 630 regions [g]	-	-	49.548	43.218	26.978	17.980

Notes: t-statistics in parentheses: * $p<0.1$; ** $p<0.05$; *** $p<0.01$
All regressions include additional controls for: Absolute difference in longitudes to Paris, absolute difference in latitudes to Paris, dummy =1 if region is barred from France by a mountain range, dummy for contiguity to France, dummy if region shares at least one sea or ocean with France, dummy for landlocked region, dummy for region being on an island.
Ig was multiplied by 1000 for readability of the estimates.
In terms of their 1946 borders, countries to which regions belong are as follows:
(a): 5 countries as follows: Denmark, England and Wales, France, Netherlands, Switzerland.
(b): 20 countries as follows: as in (a) plus: Austria, Belgium, Finland, Germany, Ireland, Italy, Norway, Poland, Russia, Scotland, Sweden, Czechoslovakia, Hungary, Romania, Yugoslavia.
(c): 24 countries as follows: as in (b) plus Greece, Luxemburg, Portugal and Spain.
(d): 25 countries as follows: as in (c) plus Bulgaria.
(e): 25 countries as follows: as in (d).
(f): 24 countries as follows: as in (e) minus Czechoslovakia.
(g): Common sample of 630 regions comprises the following 23 countries: Austria, Luxemburg, Belgium, Denmark, England and Wales, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia, Scotland, Spain, Sweden, Switzerland, Hungary, Romania, Yugoslavia.

Figure 7: Standardized Effect of Linguistic Distance to Français on Ig, common sample (95% CI in grey; 30 year bandwidth)



This chart depicts the standardized effect of linguistic distance to Français on marital fertility (I_g) through time, in overlapping samples of 30 years depicted on the x-axis. The sample is a balanced sample of 519 European regions.

Policy Implications

- Long-term history, while very important, is not a deterministic straightjacket.
  - In Putterman and Weil, the R-squared on state history, agriculture adoption and the fraction of European descent jointly does not exceed 60%.
  - In Spolaore and Wacziarg, a standard deviation change in genetic distance relative to the world technological frontier accounts for about 35% of the variation in income differences.
- There have also been significant shifts in the technological frontier, with populations at the periphery becoming major innovators, and former frontier societies falling behind. There is much scope for variations, exceptions and contingencies.
- The impact of historical factors changes over time. Under a barriers interpretation, there are many policy tools available to accelerate horizontal transmission.