Modern Fertility

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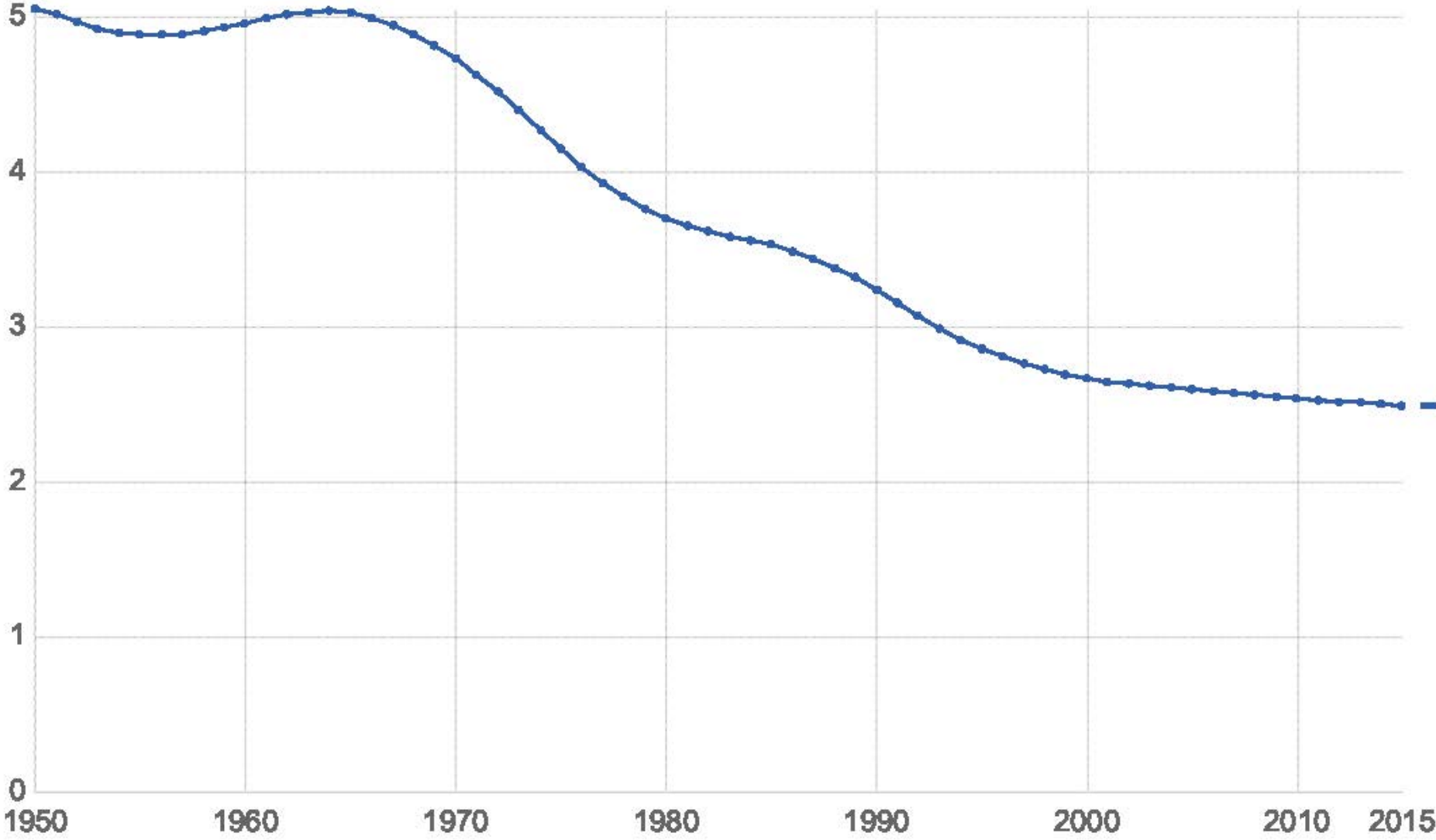
This talk is based on joint work with Romain Wacziarg (UCLA and NBER)

Children per woman

Shown is the 'total fertility rate' (TFR). The TFR is the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year.



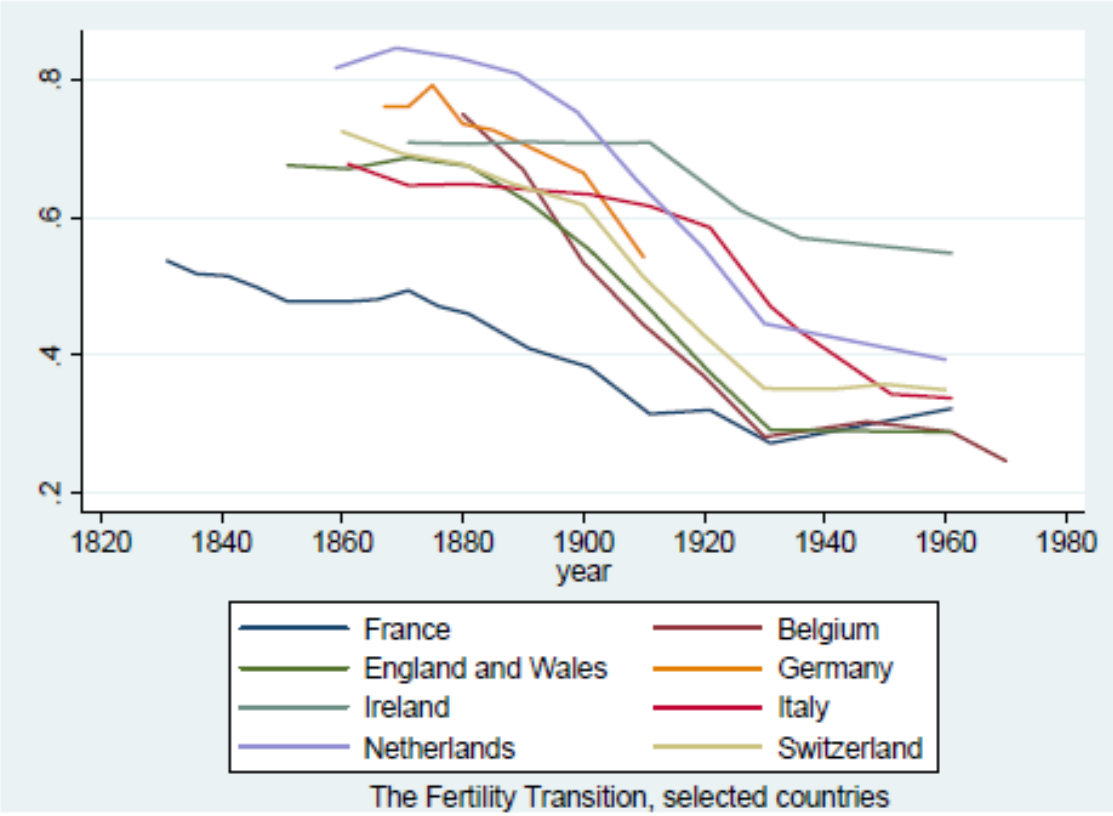
Source: UN Population Division (2017 Revision)

OurWorldInData.org/fertility-rate • CC

Fertility in Europe before 1790

Country	Children per woman	Children per married woman
England	4.9	5.4
Germany	5.1	5.6
France	5.8	6.5
Belgium	6.2	6

Fertility Decline in Europe



The Fertility Transition, selected countries

The Question

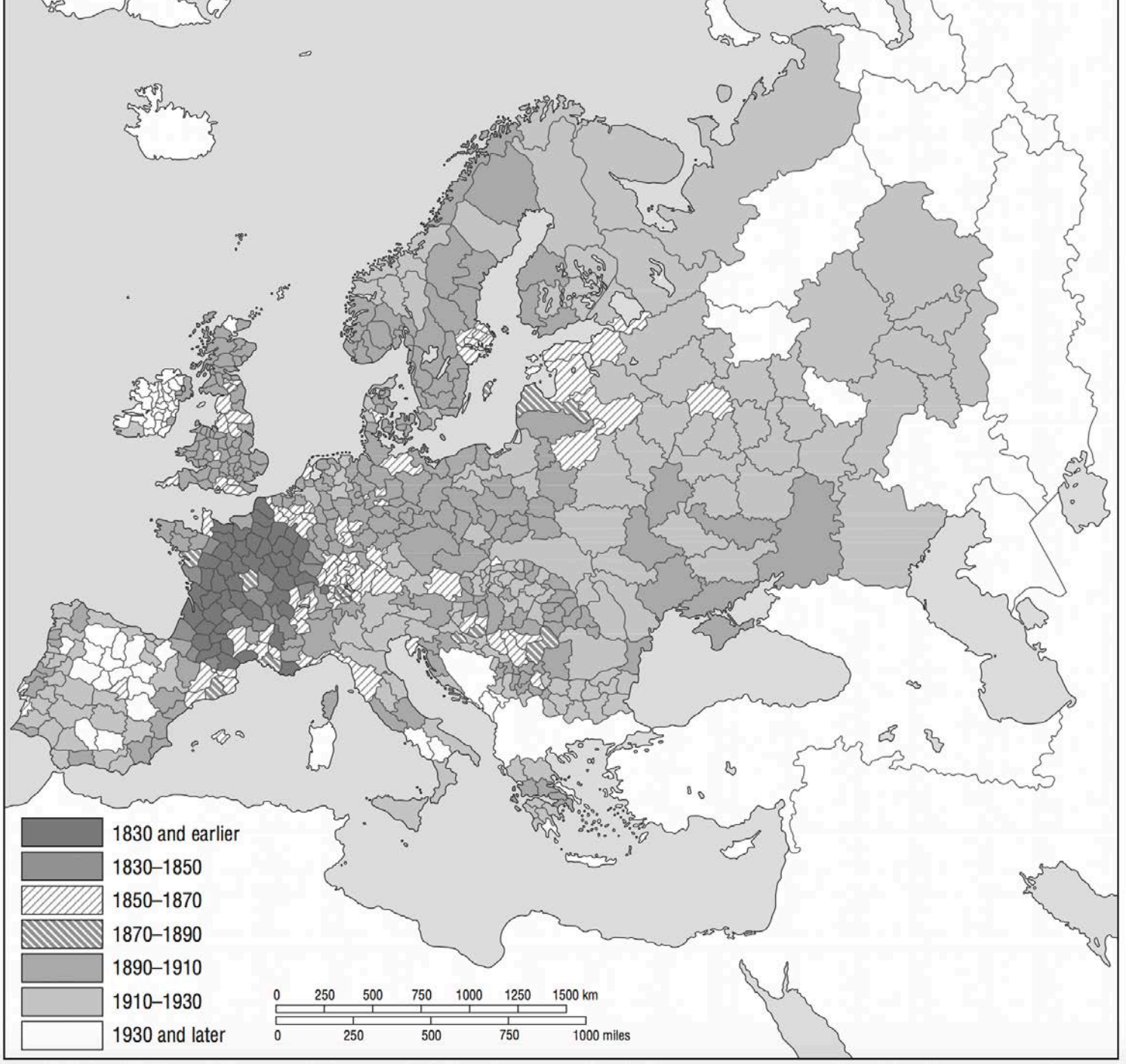
- What explains the transition from high to low fertility over the past two centuries?
- Economists' view: fertility decline and modern economic development go hand in hand (industrialization, education, health)
- Demographers and anthropologists: fertility decline as a cultural phenomenon (spread of new values and social norms)

A purely “economic” story is not sufficient

- European societies at a relatively low level of industrialization and income per capita experienced a decline in fertility at the same time, or even before, economically more advanced societies.
- The Industrial Revolution started in Britain, but the British were not among the first to reduce their fertility.

Transition Dates to Modern Fertility (Princeton Project)

- France: 1827
- Walloon Belgium: 1875
- Catalonia: 1875
- Switzerland: 1887
- Germany: 1888
- England: 1892
- Bretagne: 1905
- Flemish Belgium: 1905
- Basque Countries: 1930


1830 and earlier
1830–1850
1850–1870
1870–1890
1890–1910
1910–1930
1930 and later
0 250 500 750 1000 1250 1500 km
0 250 500 750 1000 miles

Modern fertility as a cultural innovation

- The shift to modern fertility can be viewed as a *cultural innovation*
- **France** was the early adopter
- The innovation spread from France to the other regions of Europe along **cultural/linguistic lines**

Theory and Empirics (Summary)

-) In our **model**, the transition to modern fertility occurs through a process of **social influence**, where late adopters observe and learn about the novel behaviors and norms introduced by earlier adopters (builds on Akerlof, 1997, Young, 2009).

-) In the **empirical analysis**, we test the implications of the model regarding the timing of the fertility transition and the dynamics of the relation between fertility levels and relative social/cultural distance from the earlier adopters.

-) Sample of 775 European regions. New dataset of linguistic distances constructed from 275 ancestral regional languages.

Linguistic Distance

Linguistic Distance from Ethnologue (Gordon)

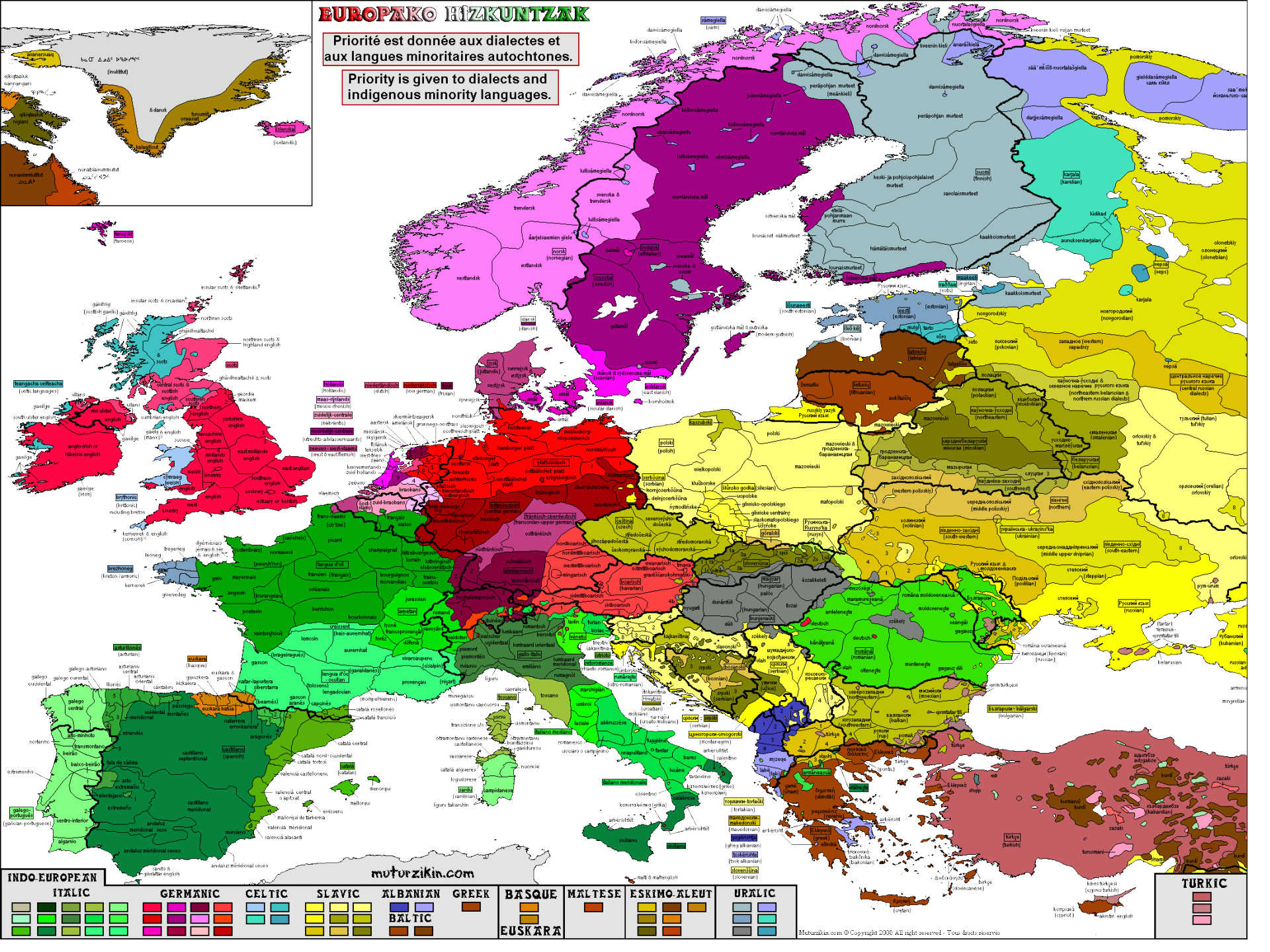
number of different linguistic nodes between language A and language B

Example:

Linguistic Distance between Paris and Madrid

Indo-European, Italic, Romance, Italo-Western, Western, Gallo-Iberian, **Gallo-Romance, Gallo-Rhaetian, Français (Langue d'Oïl)**

Indo-European, Italic, Romance, Italo-Western, Western, Gallo-Iberian, **Ibero-Romance, West Iberian, Castilian**


EUROPAKO HIZKUNTZAK
Priorité est donnée aux dialectes et aux langues minoritaires autochtones.
Priority is given to dialects and indigenous minority languages.
INDO-EUROPEAN
ITALIC
GERMANIC
CELTIC
SLAVIC
ALBANIAN
BALTIC
GREEK
BASQUE
EUSKARA
MALTESE
ESKIMO-ALEUT
URALIC
TURKIC
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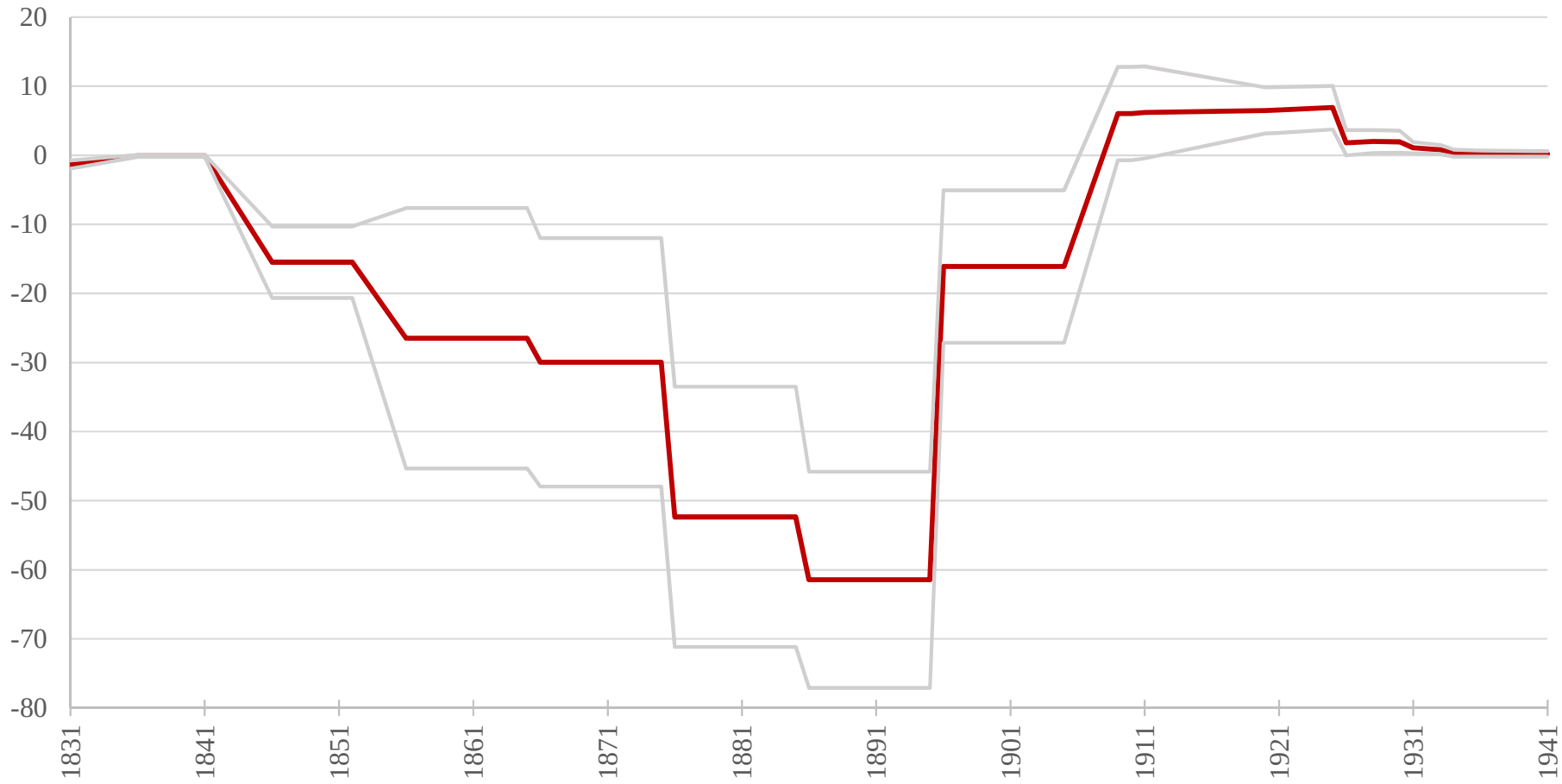
Empirical Findings

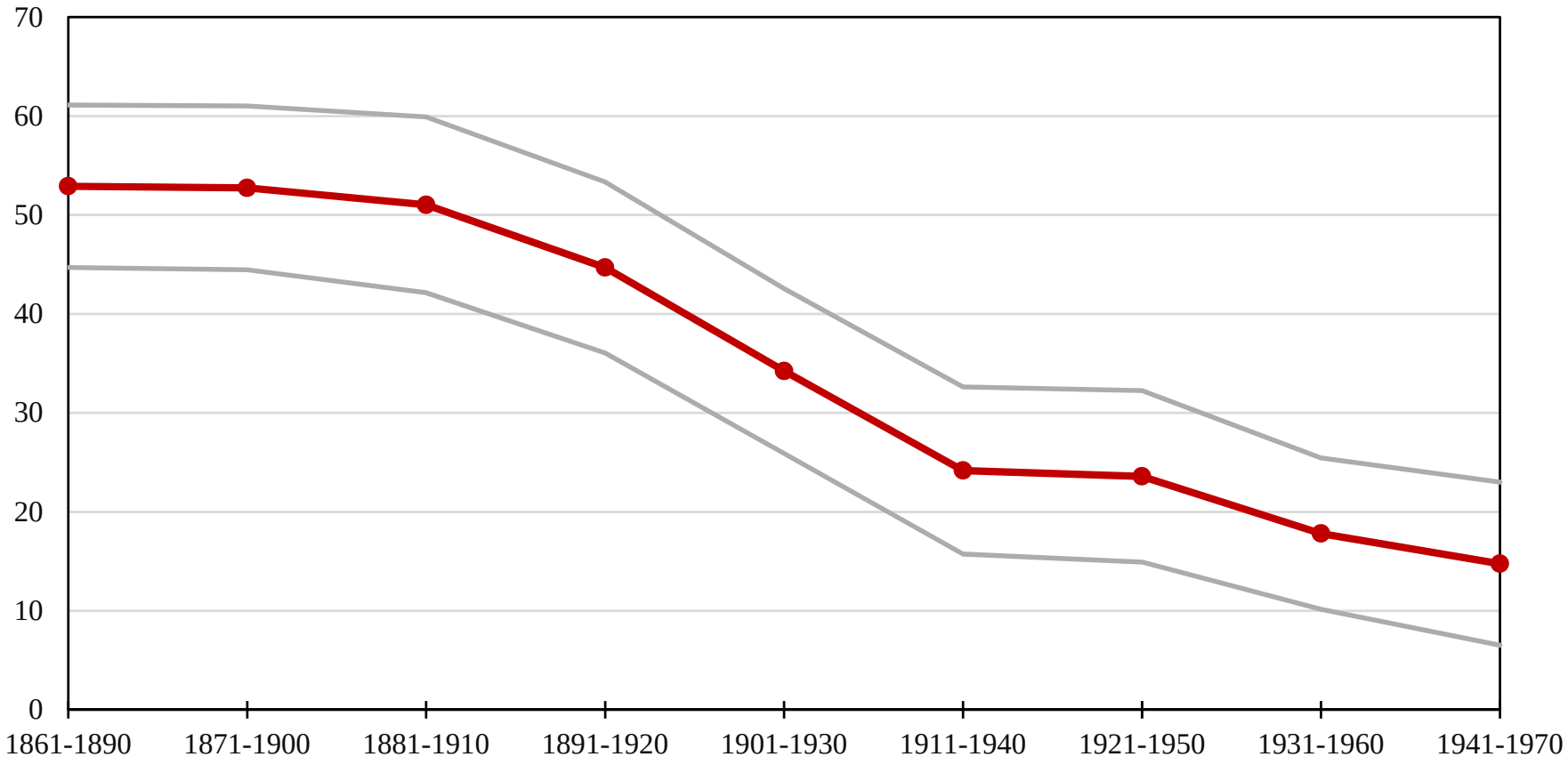
- Regions linguistically closer to the French reduced their fertility earlier.
- Variables emphasized by the economic analysis of fertility (such as human capital) also had an effect.
- However, initially those factors only mattered for those regions culturally **closer** to France.

Figure 6 - Standardized Effect of Linguistic Distance to Français on the Probability of Having Experienced the Fertility Transition (95% CI in grey)



This chart depicts the standardized effect of linguistic distance to Français on the probability of having experienced the fertility transition, defined by a 10% decline in Ig, prior to the date on the x-axis. Estimates are obtained from cross-sectional probit specifications run at periodic dates between 1831 and 1941 in a balanced sample of 771 European regions.

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.

Distance to French, education and transition dates

	Close to French	Far from French
Low Literacy in 1880	1898	1900
High Literacy in 1880	1853	1898

Distance to French, education and fertility levels (1881-1910)

	Close to French	Far from French
Low Literacy in 1880	0.60	0.68
High Literacy in 1880	**0.51**	0.69

	Literacy in 1880	Fertility Level (1881-1910)	Transition date
Liège (0 nodes)	59%	499	1875
Bruges (9 nodes)	61%	796	1905
Barcelona (3 nodes)	43%	460	1865
Bilbao (10 nodes)	46%	710	1925

Our interpretation: not culture vs economics but culture and economics

- Relative costs of having children increased across many European regions during the 19th century.
- But for people to adjust their behavior, social norms also had to change, and that cultural change took time, and spread from France.
- **Interaction** between economic incentives and cultural diffusion.

How Did Social Norms Diffuse?

An Example: The trial of Annie Besant and Charles Bradlaugh in England (1877)

Whether to publish a book at low cost that contained information on fertility control was obscene.

- Besant and Bradlaugh defended themselves by citing **French** teaching and practices.
- After they were acquitted on appeal in 1879, **social and legal norms** changed in Britain
- In particular, it became legal to use the **British mail system** to diffuse information about contraception and family planning.

Conclusions

- Modern fertility was a *cultural* innovation that spread along ancestral cultural lines (linguistic distance) *while* also responding to changing *economic* incentives associated with modernization (e.g., higher education)
- To understand the decline of fertility we need **both** culture and economics.

Table 2 – Summary Statistics for the Region-Level Dataset

Panel A. Means and Standard Deviations for the main variables of interest

Variable	# Obs	Mean	Std. Dev.	Min	Max
Marital Fertility Transition date	771	1899.096	24.989	1830	1945
Difference in linguistic nodes to Français	775	7.495	2.827	1	10
Geodesic distance to Paris (km)	775	1109.641	714.633	0.000	3977.143
Ig (1831-1860)	184	0.623	0.136	0.321	0.972
Ig (1861-1890)	609	0.664	0.123	0.271	1.001
Ig (1891-1920)	675	0.594	0.129	0.225	0.914
Ig (1921-1950)	766	0.421	0.121	0.086	0.763
Ig (1950-1970)	706	0.336	0.097	0.129	0.714

Panel B. Simple Correlations among the Main Variables of Interest

	Ig 1831-1860	**Ig 1861-1890**	**Ig 1891-1920**	**Ig 1921-1950**	**Ig 1950-1970**	**Marital Fertility Transition date**	**Difference in linguistic nodes to Français**
Difference in linguistic nodes to Français	0.729	0.514	0.511	0.197	-0.080	0.521	1
Geodesic distance to Paris (km)	0.366	0.089	0.399	0.491	-0.042	0.541	0.373
# of obs.	184	609	675	766	706	771	775

Note: There are 4 regions with Ig data but no fertility transition dates. These regions, in the Balkans, have too little data to ascertain when the transition occurred. These regions are Bosnia and Herzegovina, Kosovo in Serbia, Podrinje (a small region of Bosnia) and Zetska (Montenegro).

Determinants of the Transition Date

- Determinants of the marital fertility transition date - the results are consistent with Proposition 1:
  - linguistic distance from French and controls (Table 3): standardized beta of linguistic distance from French: 26.78%.
  - horserace: distances from French/Paris vs. distances from English/London (Table 4). French wins.

Table 3 - 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 4 - 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.

Determinants of Transition Status

- Determinants of transition status: using an indicator 1 at each period t if the region has transitioned.
  - cumulative share of regions (out of 771) - logistic pattern with hazard rate partly increasing in the number of adopters - not consistent with simple contagion but with social influence/social learning (Young, 2009).
  - probit estimates at 20-year intervals from 1841 and 1941 (Table 5 and Figure 6).

Figure 5 - Cumulative Distribution of Fertility Transition Dates

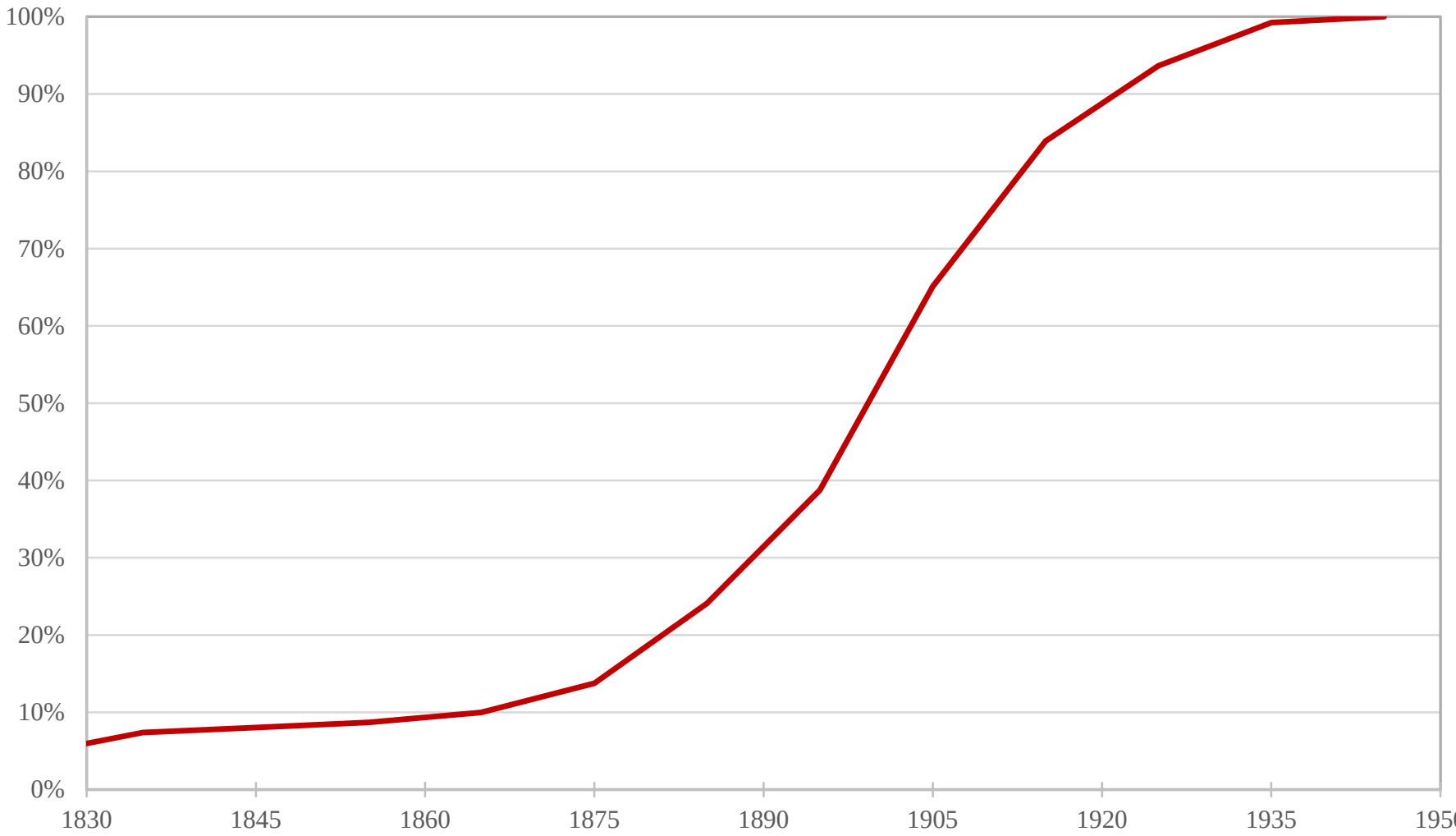


Table 5 - Probit Regressions for Fertility Transition

	(1)	(2)	(3)	(4)	(5)	(6)
	1841	**1861**	**1881**	**1901**	**1921**	**1941**
# of different nodes with Français	**-0.00002 (0.93)**	**-0.008 (2.76)*** **	**-0.025 (5.44)*** **	**-0.022 (2.86)*** **	**0.019 (3.87)*** **	**0.001 (1.07)**
Geodesic distance to Paris, 1000 km	0.0001 (0.33)	0.079 (1.95)*	-0.048 (0.46)	-1.036 (4.80)***	0.197 (1.93)*	0.004 (0.42)
Absolute difference in longitudes, to Paris	-0.032 (0.83)	-6.623 (2.55)**	-1.823 (0.28)	27.183 (2.05)**	-22.857 (3.51)***	-0.120 (0.24)
Absolute difference in latitudes, to Paris	-0.016 (0.40)	-9.104 (2.42)**	-11.418 (1.43)	48.128 (3.02)***	-30.036 (4.26)***	-0.969 (1.22)
Pseudo R^2	0.61	0.47	0.41	0.32	0.21	0.18
Standardized Effect (%)	-0.077	-26.495	-52.331	-16.097	6.549	0.204

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

The dependent variable for year t is defined as 1 is a region has undergone the fertility transition by year t (defined as having attained a 10% decline in I_g by date t), zero otherwise.

The table reports probit marginal effect. The standardized effect is equal to the probit marginal effect multiplied by the standard deviation of linguistic distance to Français, divided by the mean of the dependent variable.

Regressions are based on a balanced sample of 771 regions from 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.

Determinants of the Level of Fertility

- Determinants of marital fertility levels at 30-year intervals - results are consistent with Proposition 2.
  - dynamics of effect of distance from France - effect is high at the beginning, fades over time (Table 6 and Figure 7).
  - results hold when controlling for country fixed effects.
  - results are robust to controlling for infant mortality, population density, urbanization, and literacy, *while these controls bear the expected coefficients* (Table 7).

Table 6 – 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 from 23 countries.

Table 7: Ig regressions with country fixed effects and additional controls
(Dependent variable: Ig in period 5, i.e. 1871-1901)

	(1)	(2)	(3)	(4)	(5)	(6)
	Infant Mortality	**Population Density**	**Urbanization rate**	**Literacy**	**All but IMR**	**All controls together**
# of different nodes with Français	**25.223 (8.78)*** **	**15.741 (6.31)*** **	**14.580 (5.55)*** **	**27.289 (12.36)*** **	**19.883 (6.16)*** **	**26.135 (4.58)*** **
Geodesic distance to Paris, km	0.113 (0.72)	-0.037 (0.58)	-0.003 (0.03)	-0.110 (1.42)	-0.072 (0.79)	-0.080 (0.42)
Infant Mortality Rate	355.760 (2.16)**					473.437 (2.10)**
Population density, mid-19th century		-0.015 (3.60)***			-0.009 (1.86)*	-0.006 (0.89)
Urbanization rate, 1850			-101.998 (4.60)***		-64.724 (2.04)**	-130.911 (2.28)**
Literacy rate 1880				-0.728 (2.31)**	-0.526 (1.32)	-1.020 (1.40)
Constant	357.240 (4.17)***	546.746 (10.58)***	550.971 (8.88)***	378.741 (3.98)***	520.362 (7.85)***	475.055 (5.28)***
R2	0.61	0.64	0.66	0.67	0.66	0.66
# of regions	285	519	403	408	297	178
Standardized Beta (%) on linguistic distance	57.52	35.60	33.02	60.70	44.84	59.57

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 by a mountain range from France, dummy for contiguity to France, dummy =1 if area shares at least one sea or ocean with France, dummy=1 if region is landlocked, dummy =1 if region is on an island.

These regressions are for period 5 only. Regressions using the same control sets for all other periods are available in the Appendix.

Interaction Term Analysis for Literacy Rate

	Literacy	**Sample with literacy dummy=1**	**Sample with literacy dummy=0**
Linguistic distance from French	21.230 (5.24)***	31.527 (9.71)***	14.620 (3.89)***
Linguistic distance from French * high literacy dummy	7.796 (1.87)*		
Dummy for high literacy	-72.097 (2.22)**		
Geodesic distance to Paris, km	-0.104 (1.26)	0.015 (0.11)	-0.162 (1.86)*
Constant	267.396 (2.70)***	130.776 (1.22)	553.501 (9.67)***
R2	0.61	0.63	0.60
# of regions	408	277	131
Standardized Beta (%)	47.698	69.171	38.253

t-statistics in parentheses; * $p<0.1$; ** $p<0.05$; *** $p<0.01$

These regressions are for period 6 only (1881-1911).

The literacy dummy is defined as equal to 1 if the literacy rate in 1880 is greater than the 25^{th} percentile, zero otherwise.

The regression includes additional controls for: Absolute difference in longitudes to Paris, Absolute difference in latitudes to Paris, dummy if region is barred by a mountain range from France, dummy for contiguity to France, dummy if area shares at least one sea or ocean with France, dummy for landlocked region, dummy if region is on an island