Understanding Cultural Persistence and Change

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Cultural persistence

There are many examples of cultural persistence:

- First settlements of America:
  - Hacket Fischer (1989)
- Immigrants and their offspring:
  - Giuliano (2007)
  - Fernandez and Fogli (2006, 2009)
  - Fernandez (2007)
  - Algan and Cahuc (2010)
- Persecution perpetuated:
  - Voigtlander and Voth (2012)
- Deep roots of development:
  - Comin, Easterly, and Gong (2010)
  - Putterman and Weil (2010)
  - Spolaore and Wacziarg (2013)

Cultural change

But, there are also many examples of cultural change:

- Providence Island:
  - Kupperman (1995)
- Protestant Reformation:
  - Becker and Woessman (2008, 2009)
- Ethnographies of social change:
  - Margaret Mead (1956)
  - Raymond Firth (1959)
  - Joel Robbins (2004)

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The stability of a society's environment.

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- **If the environment is stable**, then the culture that has evolved up until the previous generation will be similar to the best cultural practice for the current generation.
  - There is valuable information in the culture of the previous generation.
  - Thus, there are significant benefits to following tradition.

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- Consider a model where environmental shocks determine the best action (i.e., culture) during a particular generation.
- **If the environment is stable**, then the culture that has evolved up until the previous generation will be similar to the best cultural practice for the current generation.
  - There is valuable information in the culture of the previous generation.
  - Thus, there are significant benefits to following tradition.
- **If the environment is unstable**, then it is less likely that the culture of the previous generation is still relevant now.
  - The culture of the previous generation has little value.
  - Therefore, one is better off ignoring tradition and figuring out the best action on one's own.

A stylized model (Rogers, 1988)

Players:

- Society consists of a large population of individuals.
- Each period, a new generation is born, and the older generation eventually dies.

Actions:

- The new generation chooses an action, either 0 or 1.
  - This can be thought of as a cultural practice.
- There are two (unobservable) states of the world, either 0 or 1.
- In each state, one of the two cultures yields a higher payoff than the other.

Payoffs

		Environment	
		0	1
Culture	0	$\pi + b$	$\pi - b$
	1	$\pi - b$	$\pi + b$

- The state of the environment is unobservable.
- Each period, there is a shock with probability $\Delta \in (0, 1)$.
- When a shock is experienced, then there is a new draw and thus an equal probability of being in state 0 or 1.

Players

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p **denotes the proportion of traditionalists in the economy**.

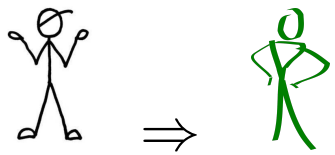
Expected payoffs to non-traditionalists

- Non-traditionalists ignore tradition and engage in trial and error.
- They bear a cost c, but choose the right action with certainty.
- Therefore, expected payoffs are:

$$\Pi^{NT} = \pi + b - c$$

Some ways for traditionalists to obtain the right action

1. I copy a non-traditionalist from the previous generation; and the environment hasn't changed from last period:



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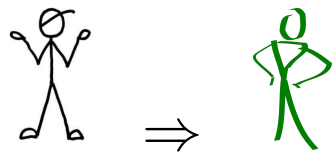


$$\Pr = (1 - p)(1 - \Delta)$$

Some ways for traditionalists to obtain the right action

2. I copy a traditionalist from the previous generation, who had copied a non-traditionalist from the previous generation; and the environment has not changed since then:

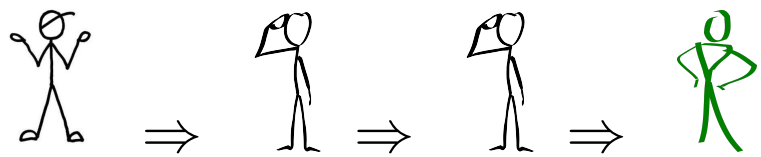
Some ways for traditionalists to obtain the right action

2. I copy a traditionalist from the previous generation, who had copied a non-traditionalist from the previous generation; and the environment has not changed since then:

$$\Pr = p(1-p)(1-\Delta)^2$$

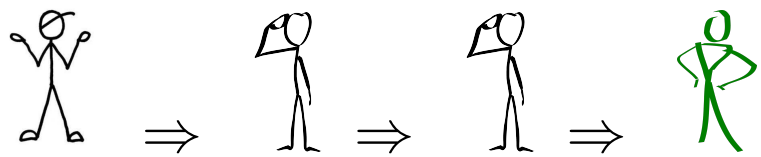
Some ways for traditionalists to obtain the right action

3. I copy a traditionalist, who copied a traditionalist, who copied a non-traditionalist; and the environment has not changed since then:



Some ways for traditionalists to obtain the right action

3. I copy a traditionalist, who copied a traditionalist, who copied a non-traditionalist; and the environment has not changed since then:



$$\Pr = p^2(1-p)(1-\Delta)^3$$

Some ways for traditionalists to obtain the right action

4. I copy a traditionalist, who copied a traditionalist, who copied a traditionalist, who copied a non-traditionalist; and the environment has not changed since then:

Some ways for traditionalists to obtain the right action

4. I copy a traditionalist, who copied a traditionalist, who copied a traditionalist, who copied a non-traditionalist; and the environment has not changed since then:

$$\Pr = p^3(1-p)(1-\Delta)^4$$

Some ways for traditionalists to obtain the right action

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5. Etc, etc, until infinity.

Some ways for traditionalists to obtain the right action

4. I copy a traditionalist, who copied a traditionalist, who copied a traditionalist, who copied a non-traditionalist; and the environment has not changed since then:

$$\Pr = p^3(1-p)(1-\Delta)^4$$

5. Etc, etc, until infinity.

The sum probability of all of these events is:

$$\sum_{t=1}^{\infty} p^{t-1}(1-p)(1-\Delta)^t$$

Expected payoffs to traditionalists

- With probability $\sum_{t=1}^{\infty} p^{t-1}(1-p)(1-\Delta)^t$, a traditionalist:
  - Adopts the right action and receives $\pi + b$.
- With probability $1 - \sum_{t=1}^{\infty} p^{t-1}(1-p)(1-\Delta)^t$, a traditionalist:
  - Either, still adopts the right action and receives $\pi + b$ (50% chance)
  - Or, adopts the wrong action and receives $\pi - b$ (50% chance)

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  - Either, still adopts the right action and receives $\pi + b$ (50% chance)
  - Or, adopts the wrong action and receives $\pi - b$ (50% chance)
  - Thus, her expected payoff is:

$$0.5(\pi + b) + 0.5(\pi - b) = \pi$$

Expected payoffs to traditionalists

$$
\begin{aligned}
\Pi^T &= \sum_{t=1}^{\infty} p^{t-1}(1-p)(1-\Delta)^t \cdot [\pi + b] \\
&\quad + \left[1 - \sum_{t=1}^{\infty} p^{t-1}(1-p)(1-\Delta)^t\right] \cdot \pi \\
&= \pi + b \sum_{t=1}^{\infty} p^{t-1}(1-p)(1-\Delta)^t \\
&= \pi + b(1-p)(1-\Delta) \sum_{t=1}^{\infty} p^{t-1}(1-\Delta)^{t-1} \\
&= \pi + \frac{b(1-p)(1-\Delta)}{1-p(1-\Delta)}
\end{aligned}
$$

Summarizing the expected payoffs to both types

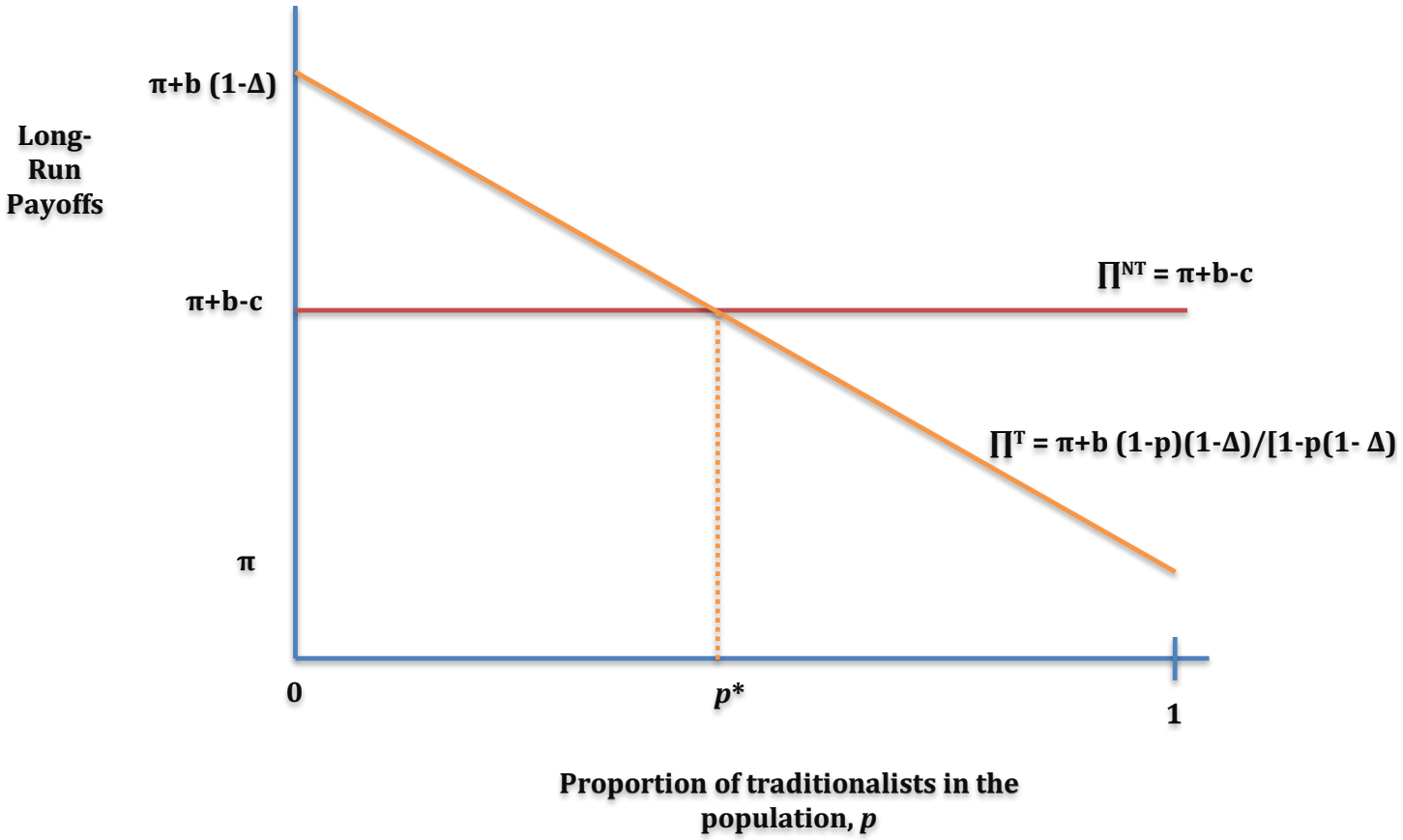
Expected payoffs to non-traditionalists:

$$\Pi^{NT} = \pi + b - c$$

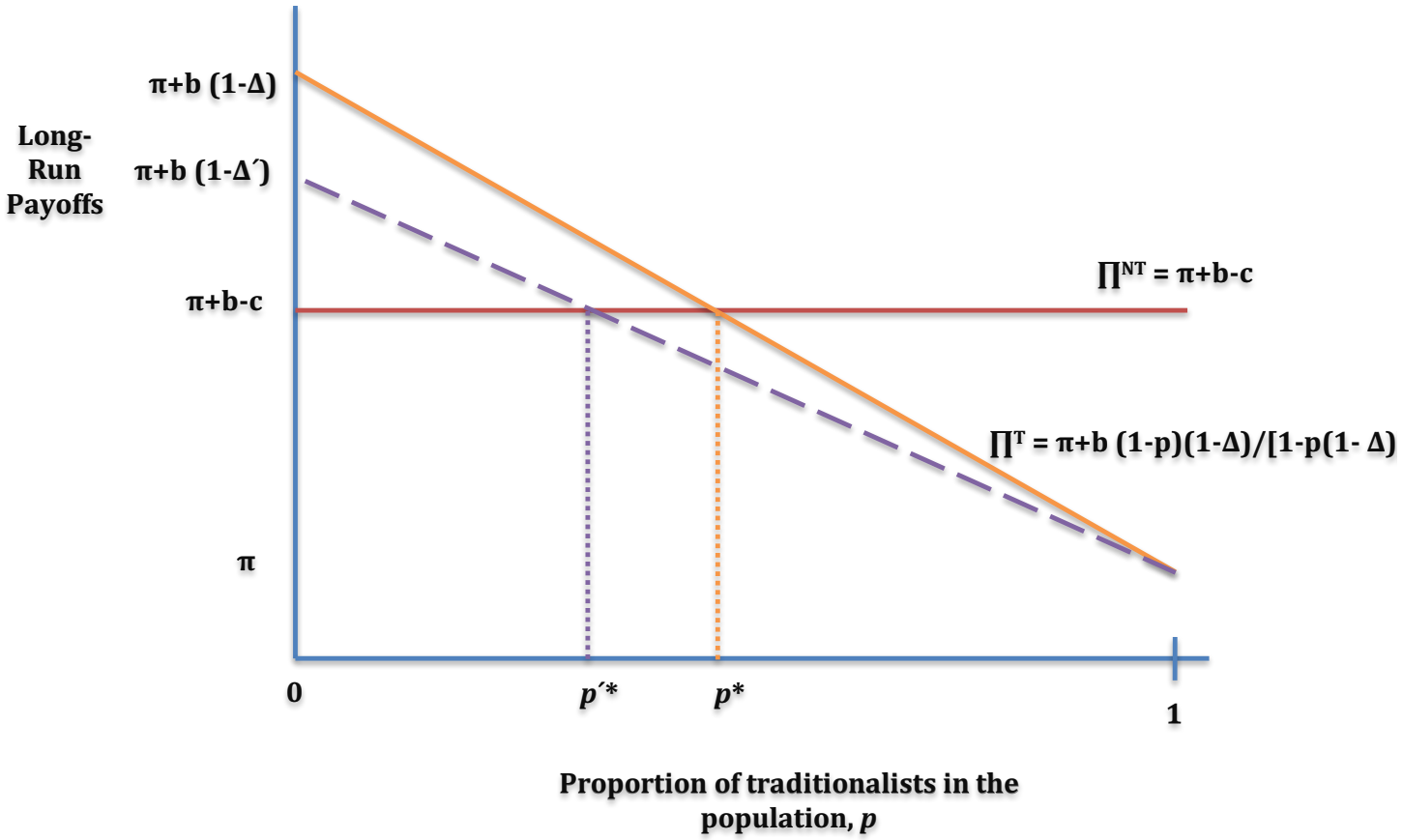
Expected payoffs to traditionalists:

$$\Pi^{T} = \pi + \frac{b(1-p)(1-\Delta)}{1-p(1-\Delta)}$$

Expected payoffs and the frequency of traditionalists



Effects of an increase in instability: $\Delta' > \Delta$



Model's predictions

1. If Δ is sufficiently high, then the society has no traditionalists, $p = 0$.

2. In an equilibrium with both types present, the proportion of traditionalists p is decreasing in the instability of the environment Δ.

General prediction:

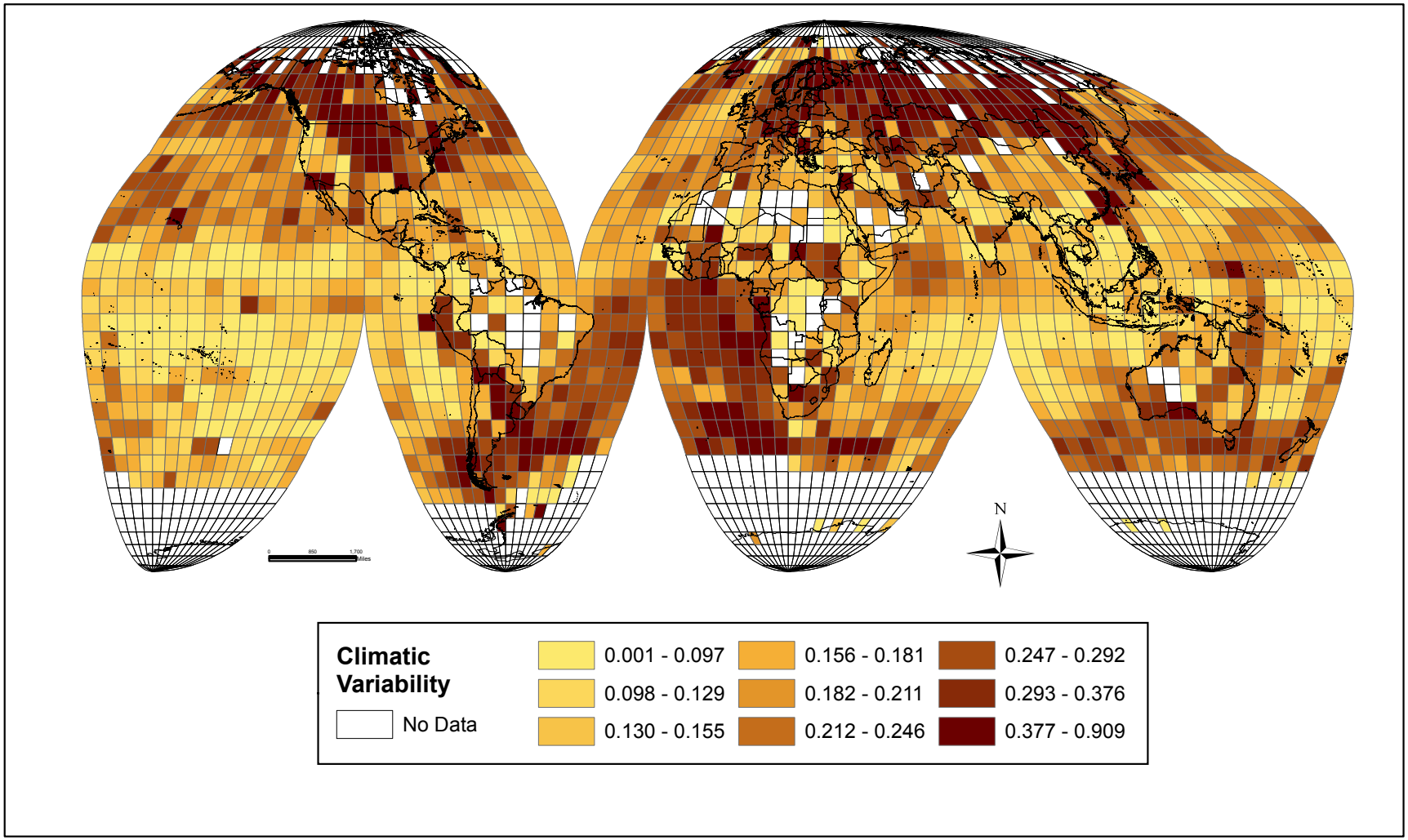
When the environment is more variable, tradition is valued less and there is less cultural persistence.

An example of the benefits of tradition

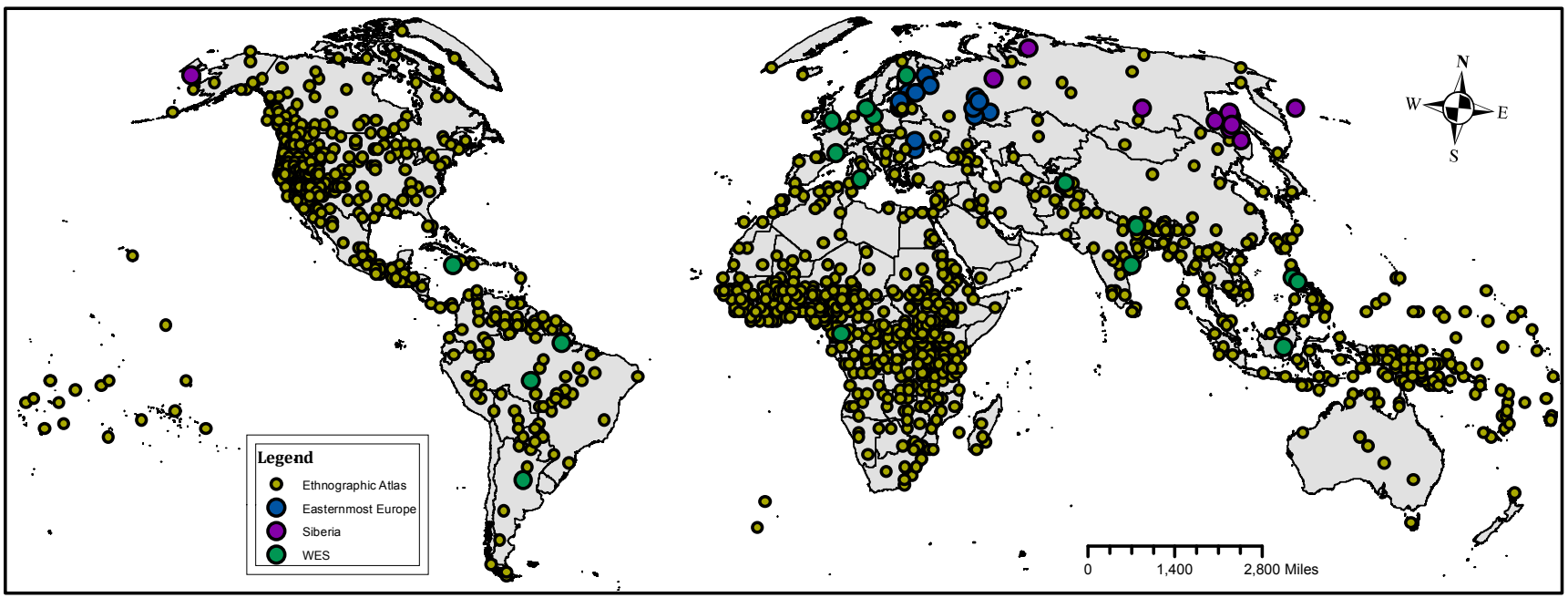
Climatic instability

- We measure the instability of the environment using variation in temperature across generations from 500–1900.
  - Climate data are from Mann et al. (2009)
  - Available at a 5-degree resolution globally.
  - Temperature reconstruction using proxy data:
    - 1,036 tree ring series, 32 ice core series, 15 marine coral series, 19 documentary series, 14 speleothem series, 19 lacustrine sediment series, and 3 marine sediment series.
- For each grid-cell, we calculate the average temperature for each generation (20 years) and then the variability (standard deviation) across generations.

Climatic instability across grid-cells, 500–1900



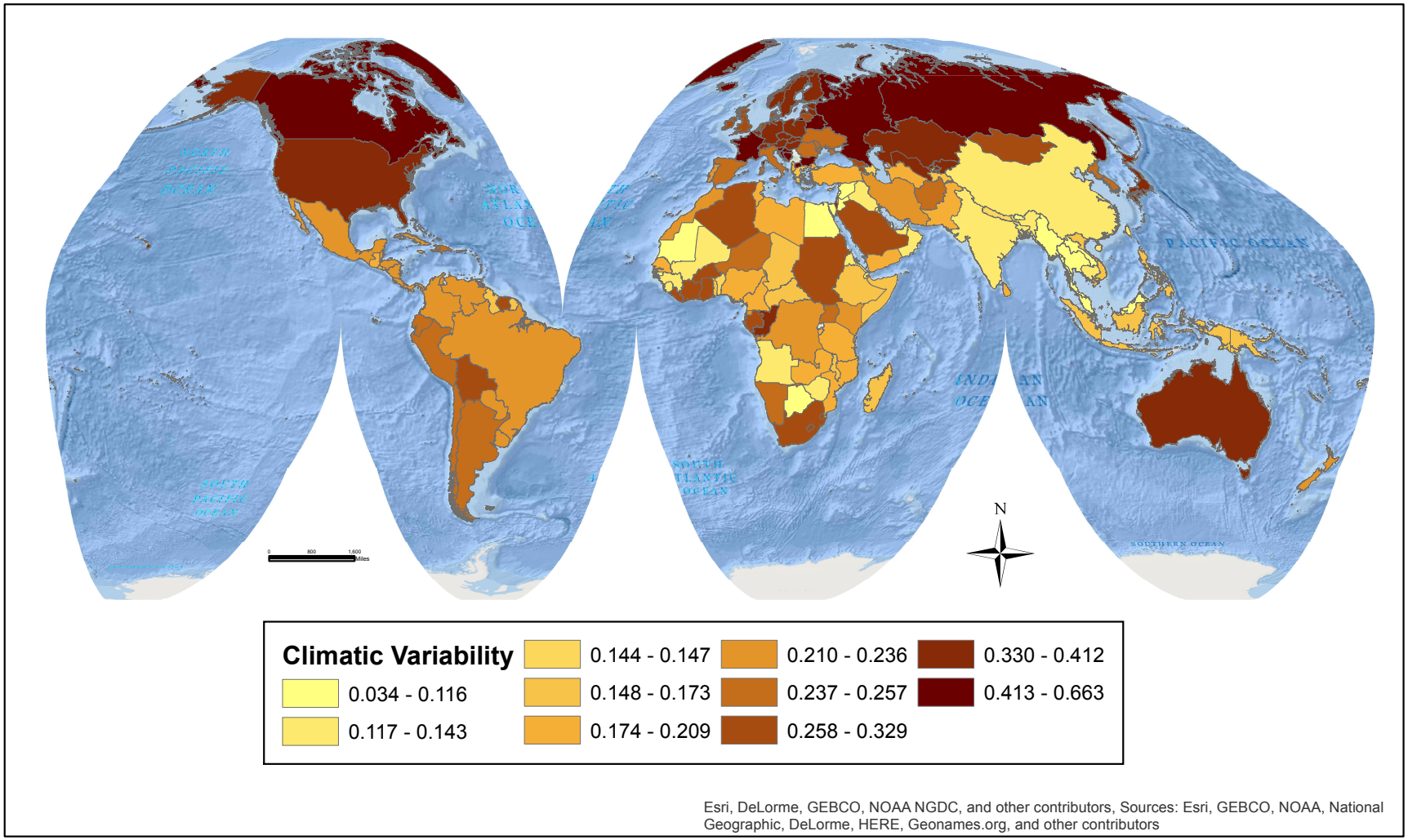
Ethnicity-level measures: Use the *Ethnographic Atlas+Eastern Europeans+Siberia+WES*



Procedure to construct country-level ancestral climatic instability

1. Assign a climatic instability measure to each of the approx. 1,400 ethnic groups in the Murdock samples.
2. Link each of the approx. 7,000+ languages and dialects in *Ethnologue* to an ethnic group in the Murdock samples.
3. Then, construct population weighted measures at the country level using *Landscan*'s 1km population grids.
4. The final measure is the average climatic instability that was faced by the ancestors of the inhabitants of a country today.

Ancestral climatic instability across countries



Overview of empirical tests

1. Observational data across ethnic groups and countries.
   - Self-reported importance of tradition.
   - Differential persistence of cultural traits over time.

2. 'Natural experiments' where individuals face a 'new' culture.
   - Descendants of immigrants to the U.S.
   - Descendants of Indigenous populations of North America.

Measuring the importance of tradition

- Respondents are given the description of a person:

  "Tradition is important to this person; to follow the family customs handed down by one's religion or family."

- Respondents then choose the response that best describes how similar this person is to them:
  (1) Not at all like me
  (2) Not like me
  (3) A little like me
  (4) Somewhat like me
  (5) Like me
  (6) Very much like me

Tradition regressions: Country level

$$Tradition_c = \beta\, Climatic\ Instability_c + \mathbf{X}_c^H \mathbf{\Omega} + \mathbf{X}_c^C \mathbf{\Pi} + \varepsilon_c$$

- c indexes countries.
- $Tradition_c$ is the average self-reported importance placed on upholding tradition in country c.
- $Climatic\ Instability_c$ is our measure of historical weather variability among the ancestors of the population in country c.
- $\mathbf{X}_c^H$ denotes historical ethnographic covariates.
- $\mathbf{X}_c^C$ denotes contemporary covariates.
  - Log real per capita GDP.

Historical ethnographic covariates, $\mathbf{X}_c^H$

- Average ancestral distance from equator (degrees).
- Average ancestral pre-industrial economic complexity index.
  (1) nomadic or fully migratory,
  (2) semi-nomadic
  (3) semi-sedentary
  (4) compact but not permanent settlements
  (5) neighborhoods of dispersed family homesteads
  (6) separate hamlets forming a single community
  (7) compact and relatively permanent settlements
  (8) complex settlements.
- Average ancestral pre-industrial political complexity.
  - Average levels of political authority beyond the local community: 0–4.

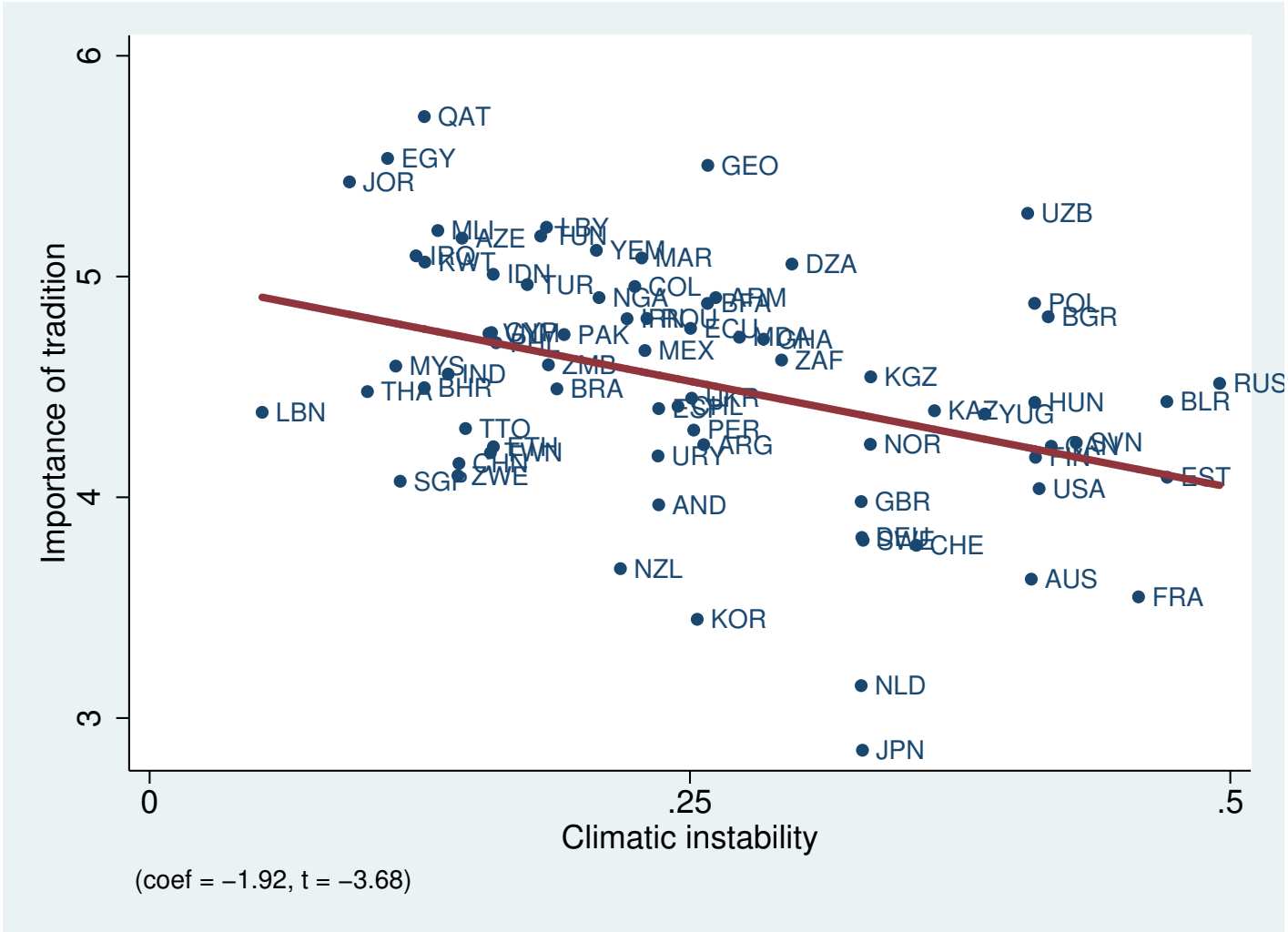


Figure: The bivariate cross-country relationship between average ancestral climatic instability and the average self-reported importance of tradition.

Table: Estimates of the determinants of tradition, country level

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: Importance of Tradition, 1-6					
	Ancestral Characteristics Measures					
	Original EA		With Eastern Europe & Siberia Extension		Also with the World Ethnographic Sample Extension	
Climatic instability	**-1.951*** **	**-1.783** **	**-1.923*** **	**-1.824** **	**-1.837*** **	**-1.756** **
	(0.540)	**(0.696)**	**(0.523)**	**(0.696)**	**(0.493)**	**(0.667)**
Historical controls:						
Distance from equator		0.005		0.005		0.006
		(0.005)		(0.005)		(0.005)
Economic complexity		-0.069*		-0.065*		-0.064*
		(0.035)		(0.035)		(0.033)
Political hierarchies		0.025		0.013		0.013
		(0.099)		(0.097)		(0.110)
Contemporary controls:						
Ln (per capita GDP)		-0.164***		-0.165***		-0.164***
		(0.048)		(0.049)		(0.051)
Number of countries	75	74	75	74	75	74
Mean (st. dev.) of dep var	4.52 (0.55)	4.52 (0.55)	4.52 (0.55)	4.52 (0.55)	4.52 (0.55)	4.52 (0.55)
Observations	75	74	75	74	75	74
R-squared	0.147	0.388	0.148	0.388	0.144	0.384

Notes : The unit of observation is a country. The dependent variable is the average at the country level of a measure of the self-reported importance of tradition. The mean and st. dev. of Climatic Instability is 0.25 (0.11). ***, ** and * indicate significance at the 10, 5 and 1% levels.

Tradition regressions: Ethnicity level

$$Tradition_{i,e,c} = \alpha_c + \beta\, Climatic\ Instability_e + \mathbf{X}_e^H \mathbf{\Pi} + \mathbf{X}_i^C \mathbf{\Phi} + \varepsilon_{i,e,c}$$

- i indexes individuals, e ethnic groups, and c countries.
- $Tradition_{i,e,c}$ is the self-reported importance placed on upholding tradition.
- α_c denote country fixed effects.
- $Climatic\ Instability_e$ is our measure of historical weather variability among ethnic group e.
- $\mathbf{X}_e^H$ denotes our set of historical ethnographic covariates, measured at the ethnicity-level.
- $\mathbf{X}_i^C$ denotes contemporary individual-level covariates.
  - age, age squared, gender, marriage status, education FE, income FE, employment status FE, survey year FE.

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	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: Importance of Tradition, 1-6					
	Ancestral Characteristics Measures					
	Original EA		With Eastern Europe & Siberia Extension		Also with the World Ethnographic Sample Extension	
Climatic instability	**-0.839*** **	**-0.582** **	**-0.742*** **	**-0.548** **	**-0.772*** **	**-0.561** **
	(0.268)	**(0.282)**	**(0.276)**	**(0.244)**	**(0.278)**	**(0.248)**
Historical ethnicity-level controls:						
Distance from equator		-0.003		-0.004		-0.004
		(0.004)		(0.003)		(0.003)
Economic complexity		-0.033***		-0.039***		-0.035***
		(0.012)		(0.012)		(0.012)
Political hierarchies		0.015		0.026		0.024
		(0.028)		(0.030)		(0.028)
Gender, age, age squared	yes	yes	yes	yes	yes	yes
Survey wave fixed effects	yes	yes	yes	yes	yes	yes
Other individual controls	no	yes	no	yes	no	yes
Country fixed effects	yes	yes	yes	yes	yes	yes
Number of countries	75	75	75	75	75	75
Number of ethnic groups	186	176	193	183	193	183
Mean (st. dev.) of dep var	4.50 (1.41)	4.49 (1.41)	4.50 (1.41)	4.49 (1.41)	4.50 (1.41)	4.49 (1.41)
Observations	140,629	127,667	140,681	127,685	139,583	126,630
R-squared	0.179	0.181	0.179	0.181	0.179	0.182

Estimating historical persistence

$$\begin{aligned} \textit{Cultural Trait}_{c,t} &= \alpha_{r(c)} + \beta\, \textit{Cultural Trait}_{c,t-1} \\ &\quad + \mathbf{X}_{c,t}\mathbf{\Pi} + \mathbf{X}_{c,t-1}\mathbf{\Omega} + \varepsilon_{c,t} \end{aligned}$$

- c indexes countries, r continents.
- t and $t-1$ indicate the current and historical time periods.
- $\textit{Cultural Trait}_{c,t}$ is the cultural trait of interest, measured in a more recent period t.
- $\textit{Cultural Trait}_{c,t-1}$ is the cultural trait, measured in an earlier period $t-1$.

Examining heterogeneity in cultural persistence over time

$$
\begin{aligned}
\textit{Cultural Trait}_{c,t} \quad = \quad & \alpha_{r(c)} + \beta_1 \, \textit{Cultural Trait}_{c,t-1} \\
& + \beta_2 \, \textit{Cultural Trait}_{c,t-1} \times \textit{Climatic Instability}_{c} \\
& + \mathbf{X}_{c,t}\mathbf{\Pi} + \mathbf{X}_{c,t-1}\mathbf{\Omega} + \varepsilon_{c,t}
\end{aligned}
$$

- c indexes countries, r continents.
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- $\textit{Cultural Trait}_{c,t}$ is the cultural trait of interest, measured in a more recent period t.
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- Question: Is $\beta_2 < 0$?

Table: The differential persistence of FLFP, 1970–2012

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: Female labor force participation (FLFP) 2012						
FLFP 1970	0.330***	0.717***	0.704***	0.393	0.613**	-0.239	-0.768
	(0.079)	(0.161)	(0.161)	(0.590)	(0.267)	(0.879)	(1.100)
FLFP 1970 * Climatic instability		**-1.660****	**-1.813***	**-1.671****	**-1.667****	**-1.648****	**-1.088**
		(0.683)	**(0.933)**	**(0.698)**	**(0.689)**	**(0.698)**	**(1.206)**
Country-level controls:							
Climatic Instability		44.701	50.462	41.065	45.943	41.109	18.455
		(36.845)	(42.064)	(38.870)	(37.349)	(38.945)	(53.998)
Distance from equator	-0.174	-0.135	-0.201	-0.119	-0.137	-0.164	0.063
	(0.115)	(0.145)	(0.220)	(0.140)	(0.147)	(0.142)	(0.290)
Economic complexity	1.931	2.663*	2.682*	2.096	2.628*	2.193	1.781
	(1.253)	(1.546)	(1.570)	(1.839)	(1.553)	(1.591)	(1.886)
Political hierarchies	-1.606	-1.878	-1.948	-2.164	-3.119	-1.708	-2.101
	(1.567)	(1.397)	(1.479)	(1.335)	(2.980)	(1.301)	(3.419)
Ln (per capita GDP)	-71.614***	-67.906***	-67.966***	-66.913***	-67.867***	-83.558***	-90.795**
	(24.480)	(23.724)	(23.815)	(24.111)	(23.911)	(30.525)	(35.195)
Ln (per capita GDP) squared	3.822***	3.649***	3.652***	3.587***	3.648***	4.308***	4.608***
	(1.255)	(1.212)	(1.216)	(1.232)	(1.221)	(1.469)	(1.666)
FLFP 1970 * Distance from equator			0.002				-0.007
			(0.006)				(0.009)
FLFP 1970 * Economic complexity				0.049			0.008
				(0.082)			(0.089)
FLFP 1970 * Political hierarchies					0.029		0.016
					(0.061)		(0.079)
FLFP 1970 * Ln (per capita GDP)						0.104	0.155
						(0.089)	(0.124)
Continent fixed effects	yes	yes	yes	yes	yes	yes	yes
Mean (st. dev.) of dep. var.	50.7(13.7)	50.7(13.7)	50.7(13.7)	50.7(13.7)	50.7(13.7)	50.7(13.7)	50.7(13.7)
Observations	77	77	77	77	77	77	77
R-squared	0.599	0.633	0.634	0.635	0.634	0.645	0.649

Notes : OLS estimates are reported with robust standard errors in parentheses. The unit of observation is a country. The female labor force participation variables (from 1970 ad 2012) are measured as the percentage of women aged 15 to 64 that are in the labor force. Historical controls are defined in the appendix. The mean and standard deviation of climatic instability is 0.24 (0.09). ***, ** and * indicate significance at the 10, 5, and 1% levels.

Magnitudes (column 2)

- Ancestral climatic instability ranges from about 0.05 to 0.50.
- Persistence for the most stable countries:

$$0.717 - (1.660 \times 0.05) = \mathbf{0.634}$$

- Persistence for the least stable countries:

$$0.717 - (1.660 \times 0.50) = -\mathbf{0.113}$$

Measuring traditional female participation in agriculture

1. Males only
2. Males appreciably more
3. Differentiated but equal participation
3. Equal participation
4. Females appreciably more
5. Females only

Table: The differential persistence of FLFP, traditionally and today

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: Female labor force participation, 2012							
Traditional female participation in agriculture	0.262***	0.642***	0.619***	0.696**	0.697***	1.013*	0.833**	1.324*
	(0.071)	(0.168)	(0.179)	(0.307)	(0.222)	(0.577)	(0.360)	(0.799)
Trad female part in agric * Climatic instability		**-1.703*** **	**-1.631*** **	**-1.686*** **	**-1.667** **	**-1.582** **	**-1.671*** **	**-1.453** **
		(0.598)	**(0.609)**	**(0.616)**	**(0.645)**	**(0.651)**	**(0.605)**	**(0.702)**
Country-level controls:								
Climatic instability		69.112***	67.528***	67.967***	67.474***	63.248**	66.664***	56.933**
		(21.545)	(21.597)	(22.740)	(23.583)	(24.715)	(22.818)	(28.365)
Distance from equator	-0.074	-0.150	-0.120	-0.150	-0.145	-0.154	-0.155	-0.137
	(0.109)	(0.116)	(0.123)	(0.116)	(0.119)	(0.117)	(0.115)	(0.134)
Economic complexity	0.834	0.717	0.695	1.237	0.683	0.754	0.786	1.357
	(1.198)	(1.259)	(1.259)	(3.053)	(1.216)	(1.257)	(1.310)	(2.993)
Political hierarchies	-0.529	-0.633	-0.865	-0.735	0.615	-0.778	-0.559	-0.331
	(1.795)	(1.883)	(2.075)	(1.841)	(4.670)	(1.945)	(1.882)	(5.160)
Ln (per capita GDP)	-72.562***	-58.820***	-59.243***	-58.533***	-58.947***	-50.445**	-59.999***	-52.331**
	(14.144)	(14.349)	(14.359)	(14.593)	(14.432)	(19.833)	(14.519)	(21.100)
Ln (per capita GDP) squared	3.883***	3.102***	3.118***	3.088***	3.107***	2.791***	3.173***	2.896***
	(0.768)	(0.779)	(0.779)	(0.791)	(0.783)	(0.929)	(0.791)	(0.966)
Year ethnicity sampled	2.554	0.292	0.512	0.415	0.401	1.015	3.258	5.312
	(1.586)	(1.858)	(1.957)	(1.879)	(1.907)	(2.261)	(5.039)	(5.934)
Female part in agric * Distance from equator			-0.022					-0.016
			(0.035)					(0.036)
Female part in agric * Economic complexity				-0.251				-0.262
				(1.185)				(1.172)
Female part in agric * Political hierarchies					-0.482			-0.241
					(1.621)			(1.829)
Female part in agric * Ln (per capita GDP)						-1.121		-1.090
						(1.706)		(1.956)
Female part in agric * Year ethnicity sampled							-0.003	-0.004
							(0.004)	(0.005)
Continent fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Mean (st. dev.) of dep. var.	53.2(15.4)	53.2(15.4)	53.2(15.4)	53.2(15.4)	53.2(15.4)	53.2(15.4)	53.2(15.4)	53.2(15.4)
Observations	166	165	165	165	165	165	165	165
R-squared	0.354	0.379	0.380	0.379	0.379	0.382	0.379	0.385

Notes: OLS estimates are reported with robust standard errors in parentheses. The unit of observation is a country. Female labor force participation is the percentage of women in the labor force, measured in 2012 and from the Ethnographic Atlas. Historical controls are defined in the appendix. The mean and standard deviation of climatic instability is 0.24 (0.10). ***, ** and * indicate significance at the 10, 5 and 1% levels.

Differential persistence of FLFP between ethnic groups

$$
\begin{aligned}
FLFP_{e,c,t} \quad = \quad & \alpha_{c,t} + \beta_1 \, FLFP_{e,c,t-1} \\
& + \beta_2 \, FLFP_{e,c,t-1} \times Climatic\ Instability_e \\
& + \mathbf{X}_{e,c,t-1}\mathbf{\Omega} + \varepsilon_{e,c,t}
\end{aligned}
$$

- Sample include all countries from IPUMS-International with ethnicity-level variation:
  - Belarus, Cambodia, Malaysia, Nepal, Philippines, Sierra Leone, Uganda, Vietnam.
- e indexes ethnicities and c countries.
- $FLFP_{e,c,t}$ is the FLFP rate of ethnicity e in the modern period.
- $FLFP_{e,c,t-1}$ is the FLFP of ethnicity e in the pre-industrial period.

Table: Within-country ethnicity-level estimates of the differential persistence of female labor force participation over time

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: Average female labor force participation rate						
Traditional female participation in agriculture	0.157**	0.400***	0.406***	0.685***	0.372*	3.225	4.280*
	(0.069)	(0.127)	(0.149)	(0.214)	(0.200)	(2.436)	(2.501)
Trad female part in agric * Climatic instability		**-0.317****	**-0.314****	**-0.265***	**-0.317****	**-0.341****	**-0.261***
		(0.139)	**(0.145)**	**(0.142)**	**(0.139)**	**(0.140)**	**(0.149)**
Ethnicity-level controls:							
Climatic instability		0.869**	0.856**	0.683*	0.871**	0.947**	0.681
		(0.393)	(0.429)	(0.407)	(0.394)	(0.398)	(0.443)
Distance from equator	0.000	-0.001	-0.000	-0.001	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.003)
Economic complexity	0.009	0.008	0.008	0.035*	0.008	0.006	0.047**
	(0.009)	(0.009)	(0.009)	(0.018)	(0.009)	(0.009)	(0.021)
Political hierarchies	-0.006	-0.002	-0.003	-0.007	-0.006	-0.001	-0.033
	(0.011)	(0.011)	(0.011)	(0.011)	(0.022)	(0.011)	(0.026)
Year ethnicity sampled	-0.034	0.000	-0.000	0.001	0.001	0.008	0.021
	(0.064)	(0.066)	(0.066)	(0.065)	(0.066)	(0.066)	(0.066)
Female part agric * Distance from equator			-0.000				-0.001
			(0.005)				(0.006)
Female part agric * Economic complexity				-0.052			-0.080**
				(0.032)			(0.037)
Female part agric * Political hierarchies					0.008		0.059
					(0.042)		(0.051)
Female part agric * Year ethnicity sampled						-1.452	-1.873
						(1.250)	(1.267)
Country-survey-year fixed effects	yes	yes	yes	yes	yes	yes	yes
Mean (st. dev.) of dep. var.	0.55(0.22)	0.55(0.22)	0.55(0.22)	0.55(0.22)	0.55(0.22)	0.55(0.22)	0.55(0.22)
Observations	211	211	211	211	211	211	211
R-squared	0.478	0.492	0.492	0.499	0.492	0.496	0.509

Table: The differential persistence of polygamy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: Indicator variable for the practice of polygamy today							
Traditional polygamy	0.330***	0.845***	0.863***	0.612**	1.786***	1.862***	3.159*	3.805**
	(0.121)	(0.212)	(0.219)	(0.290)	(0.368)	(0.666)	(1.683)	(1.771)
Traditional polygamy * Climatic instability		**-2.177****	**-2.157****	**-2.153****	**-2.071*****	**-1.805***	**-2.171****	**-1.797****
		(0.878)	**(0.877)**	**(0.864)**	**(0.765)**	**(0.914)**	**(0.877)**	**(0.761)**
Country-level controls:								
Climatic instability		2.363***	2.334***	2.399***	2.184***	1.975***	2.383***	1.975***
		(0.667)	(0.668)	(0.659)	(0.511)	(0.681)	(0.666)	(0.480)
Distance from equator	-0.004	-0.006*	-0.005	-0.006*	-0.005	-0.006**	-0.006*	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Economic complexity	-0.007	-0.013	-0.015	-0.042	-0.014	-0.014	-0.013	-0.044**
	(0.020)	(0.021)	(0.021)	(0.025)	(0.021)	(0.020)	(0.020)	(0.022)
Political hierarchies	-0.041	-0.033	-0.034	-0.034	0.186***	-0.030	-0.030	0.188***
	(0.038)	(0.036)	(0.036)	(0.036)	(0.059)	(0.035)	(0.036)	(0.060)
Ln (per capita GDP)	-0.032	-0.043	-0.044	-0.043	-0.042	0.065	-0.045	0.027
	(0.031)	(0.031)	(0.031)	(0.031)	(0.030)	(0.064)	(0.032)	(0.068)
Year ethnicity sampled	-0.102**	-0.109**	-0.111**	-0.109**	-0.108**	-0.118**	1.091	0.708
	(0.044)	(0.045)	(0.046)	(0.045)	(0.045)	(0.046)	(0.855)	(1.006)
Traditional polygamy * Distance from equator			-0.001					-0.000
			(0.003)					(0.003)
Traditional polygamy * Economic complexity				0.038				0.038
				(0.034)				(0.033)
Traditional polygamy * Political hierarchies					-0.262***			-0.260***
					(0.077)			(0.077)
Traditional polygamy * Log (per capita GDP)						-0.122*		-0.081
						(0.072)		(0.075)
Traditional polygamy * Year sampled							-0.001	-0.001
							(0.001)	(0.001)
Continent fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Mean (st. dev.) of dep. var.	0.44(0.41)	0.44(0.41)	0.44(0.41)	0.44(0.41)	0.44(0.41)	0.44(0.41)	0.44(0.41)	0.44(0.41)
Observations	110	109	109	109	109	109	109	109
R-squared	0.535	0.574	0.575	0.576	0.597	0.581	0.577	0.605

Notes: OLS estimates are reported with robust standard errores in brackets. The unit of observation is a country. Polygamy is variable indicating whether polygamy is accepted or legal in a country. The variable takes the value of one if having more than one spouse is an accepted practice. The measure is from the OECD Gender, Institutions and Development Database. The mean and st. dev. of climatic instability is 0.21 (0.09). ***, ** and * indicate significance at the 10, 5 and 1% levels.

Immigration as a 'natural experiment'

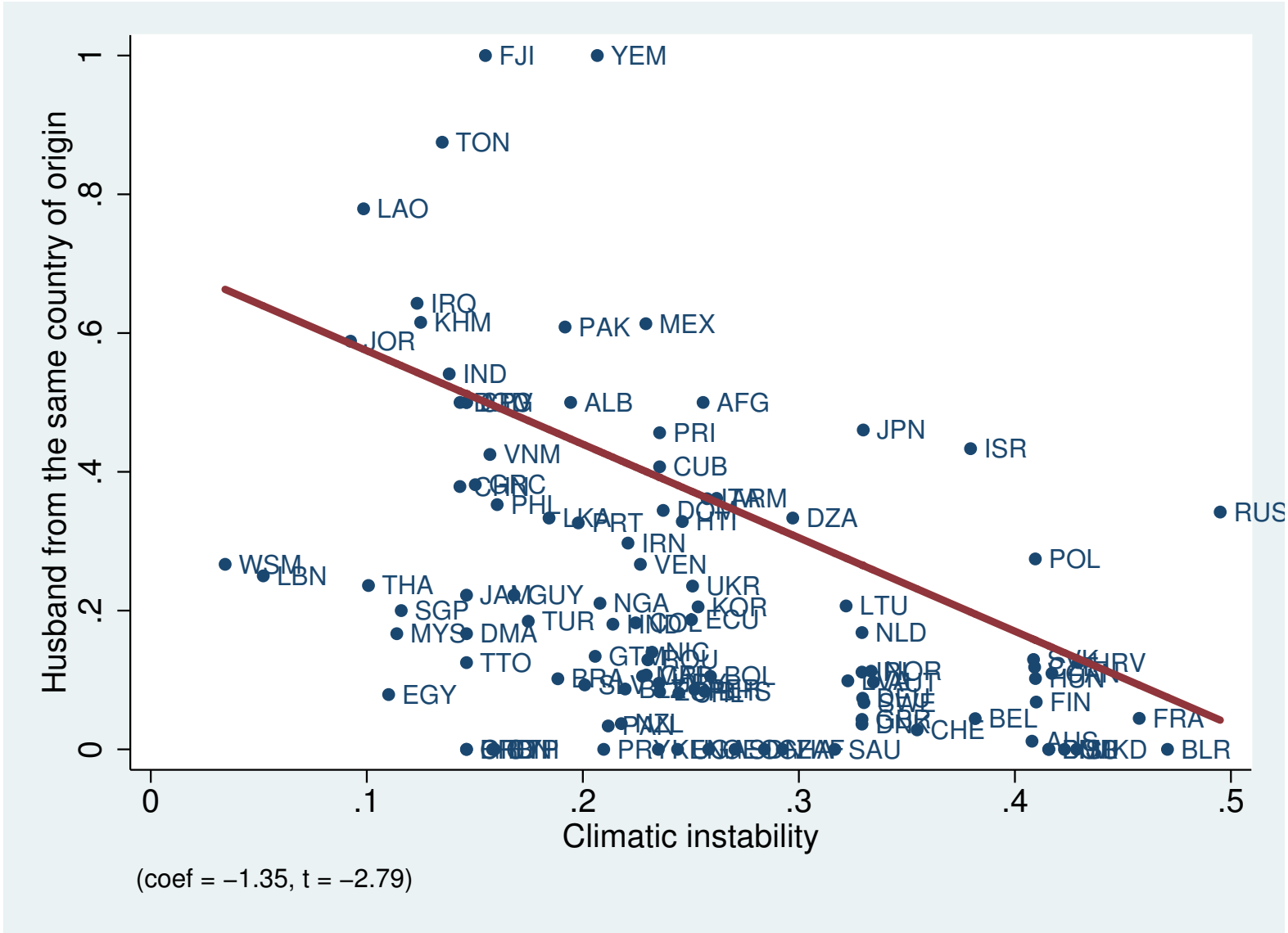
- Immigration provides a setting where we can study differences in the persistence of culture.
- We examine the extent to which the descendants of immigrants continue to engage in traditional practices:
  1. Marrying others with the same ancestry.
  2. Continuing to speaking their origin language at home.

In-group marriage

$$I_{i,c}^{Ingroup\ Marriage} = \alpha + \beta\ Climatic\ Instability_c + \mathbf{X}_c\mathbf{\Pi} + \mathbf{X}_i\mathbf{\Phi} + \varepsilon_{i,c}$$

- i indexes married women (or men) who were born in the U.S., but with an immigrant parent born in country c.
- $I_{i,c}^{Ingroup\ Marriage}$ is an indicator that equals one if an individual's spouse is from the same origin-country.
- $\mathbf{X}_c$ now also includes the genetic distance (FST) between the origin country and the U.S.
- $\mathbf{X}_i$ now also includes the fraction of the population living in an individual's location that are first- or second-generation immigrants from the same country of origin.

Bivariate plot: Sample of married women. Is the husband from same country of origin?



Bivariate plot: Sample of married women. Is the husband from same country of origin?

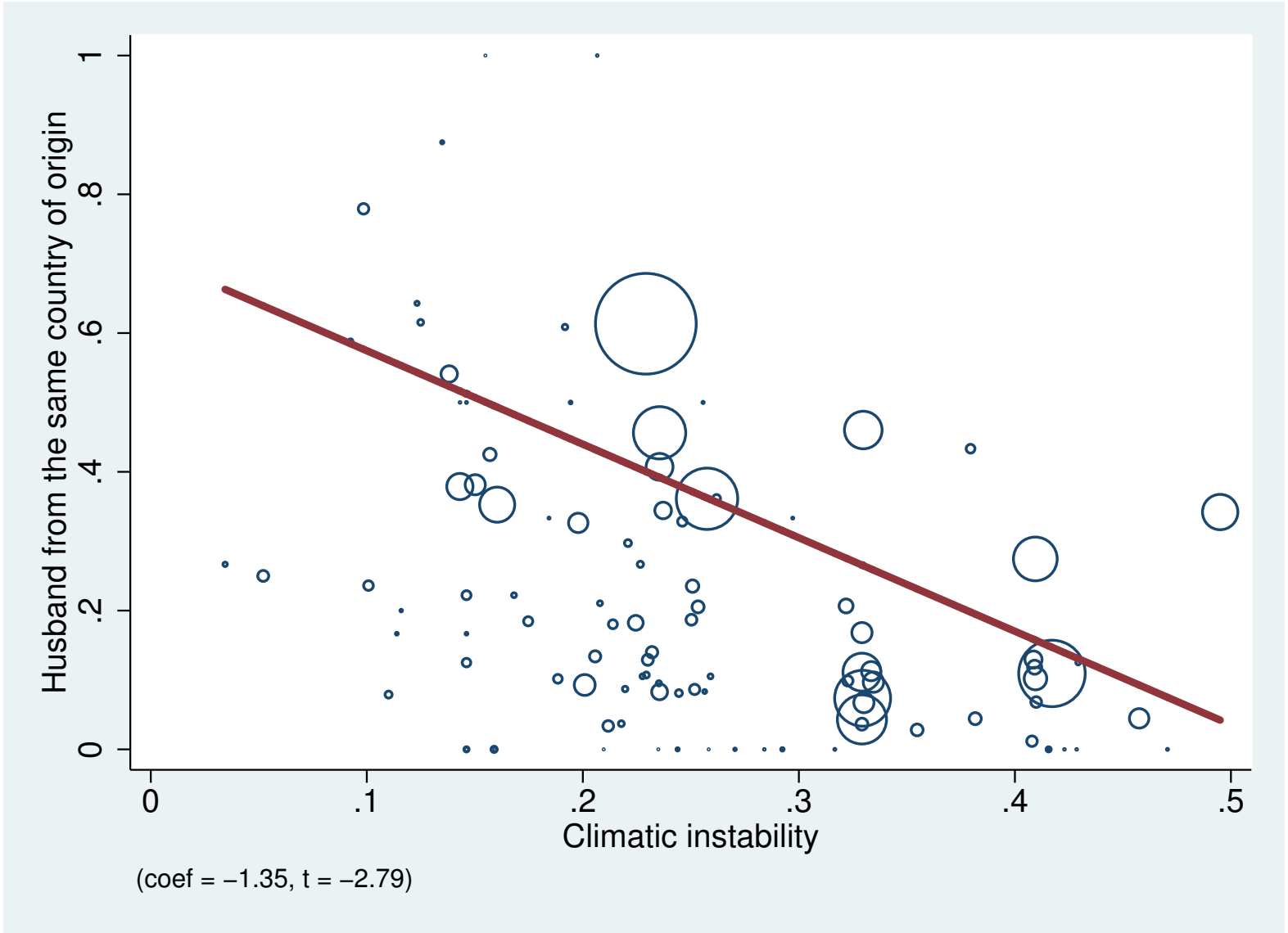


Table: Women and men marrying a spouse from the same origin country, from CPS 1994–2014

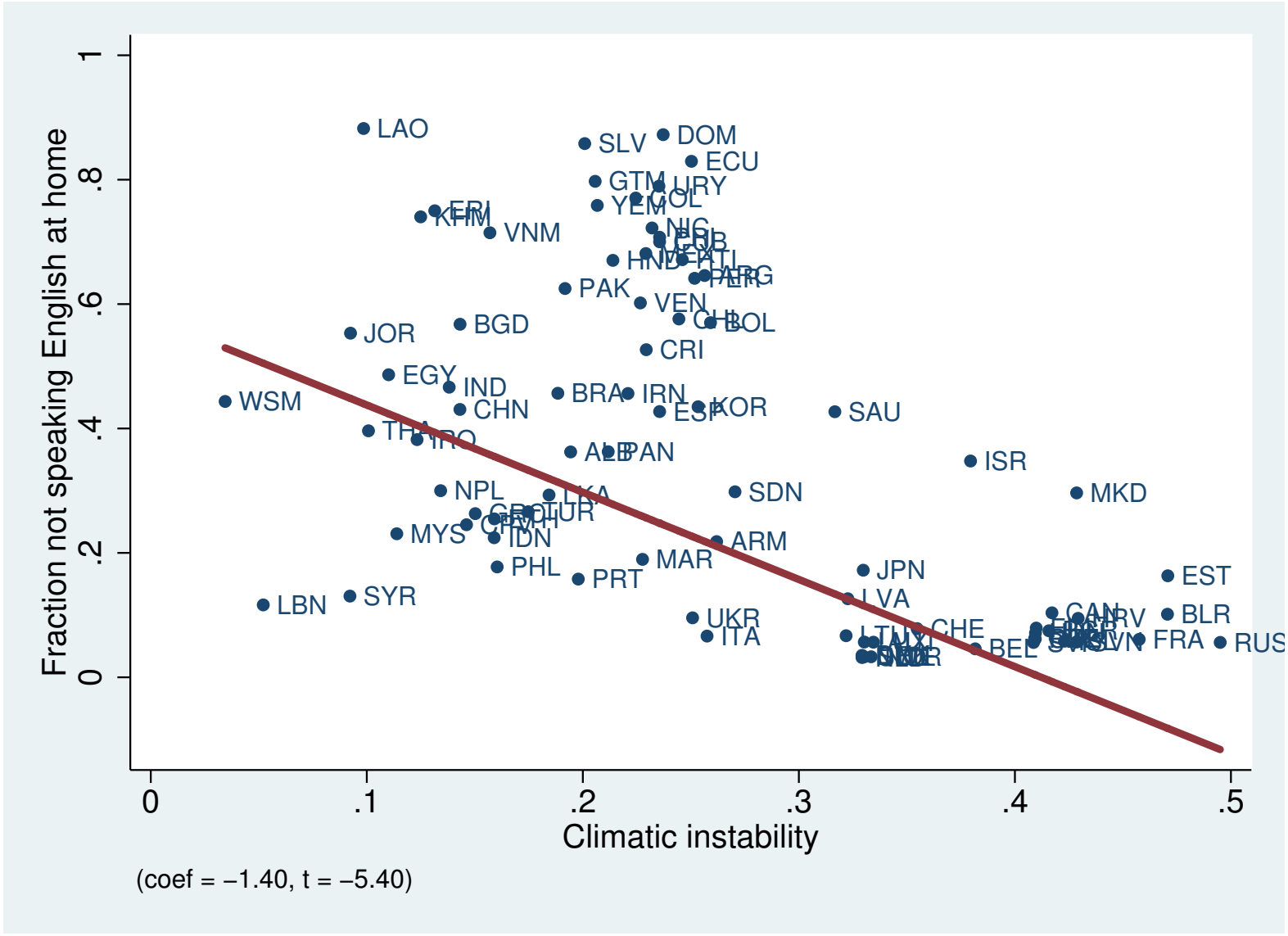
	(1)	(2)	(3)	(4)
	Dependent variable: Indicator varible for spouse being from the same origin country			
	Sample: Married women		Sample: Married men	
	Origin country identified from father	Origin country identified from mother	Origin country identified from father	Origin country identified from mother
Climatic instability	**-0.274***	**-0.492*****	**-0.103**	**-0.250***
	(0.156)	**(0.178)**	**(0.138)**	**(0.148)**
Country-level controls:				
Distance from equator	-0.006**	-0.005	-0.008***	-0.009***
	(0.003)	(0.003)	(0.003)	(0.003)
Economic complexity	0.009	0.019	-0.010	-0.021
	(0.026)	(0.035)	(0.039)	(0.037)
Political hierarchies	0.089***	0.084***	0.092**	0.085**
	(0.027)	(0.029)	(0.037)	(0.037)
Ln (per capita GDP)	-0.005	-0.022	-0.003	-0.004
	(0.030)	(0.033)	(0.036)	(0.035)
Genetic distance from the United States	0.031	0.010	0.011	-0.010
	(0.046)	(0.053)	(0.043)	(0.044)
Fraction of population in location that are first- or second-generation immigrants from the same country of origin	3.314***	3.533***	3.071***	3.409***
	(0.489)	(0.627)	(0.504)	(0.483)
Individual level controls	yes	yes	yes	yes
Number of countries	108	105	110	105
Mean (st. dev.) of dependent variable	0.33 (0.47)	0.32 (0.47)	0.28 (0.45)	0.29 (0.45)
Observations	36,082	34,045	38,419	35,639
R-squared	0.239	0.254	0.223	0.245

Speaking one's traditional language at home

$$I_{i,c}^{\textit{Foreign Lang}} = \alpha + \beta\, \textit{Climatic Instability}_c + \mathbf{X}_c\mathbf{\Pi} + \mathbf{X}_i\mathbf{\Phi} + \varepsilon_{i,c}$$

- i denotes an individual and c his/her country of origin.
- Sample includes all individuals born in the United States that report ancestry as being a non-English-speaking country.
- $I_{i,c}^{\textit{Foreign Lang}}$ is an indicator that equals one if English is not the primary language spoken at home.
- $\textit{Climatic Instability}_c$ is our measure of ancestral weather variability among those living in origin-country c.

Bivariate plot: Speaking a foreign language at home



Bivariate plot: Speaking a foreign language at home

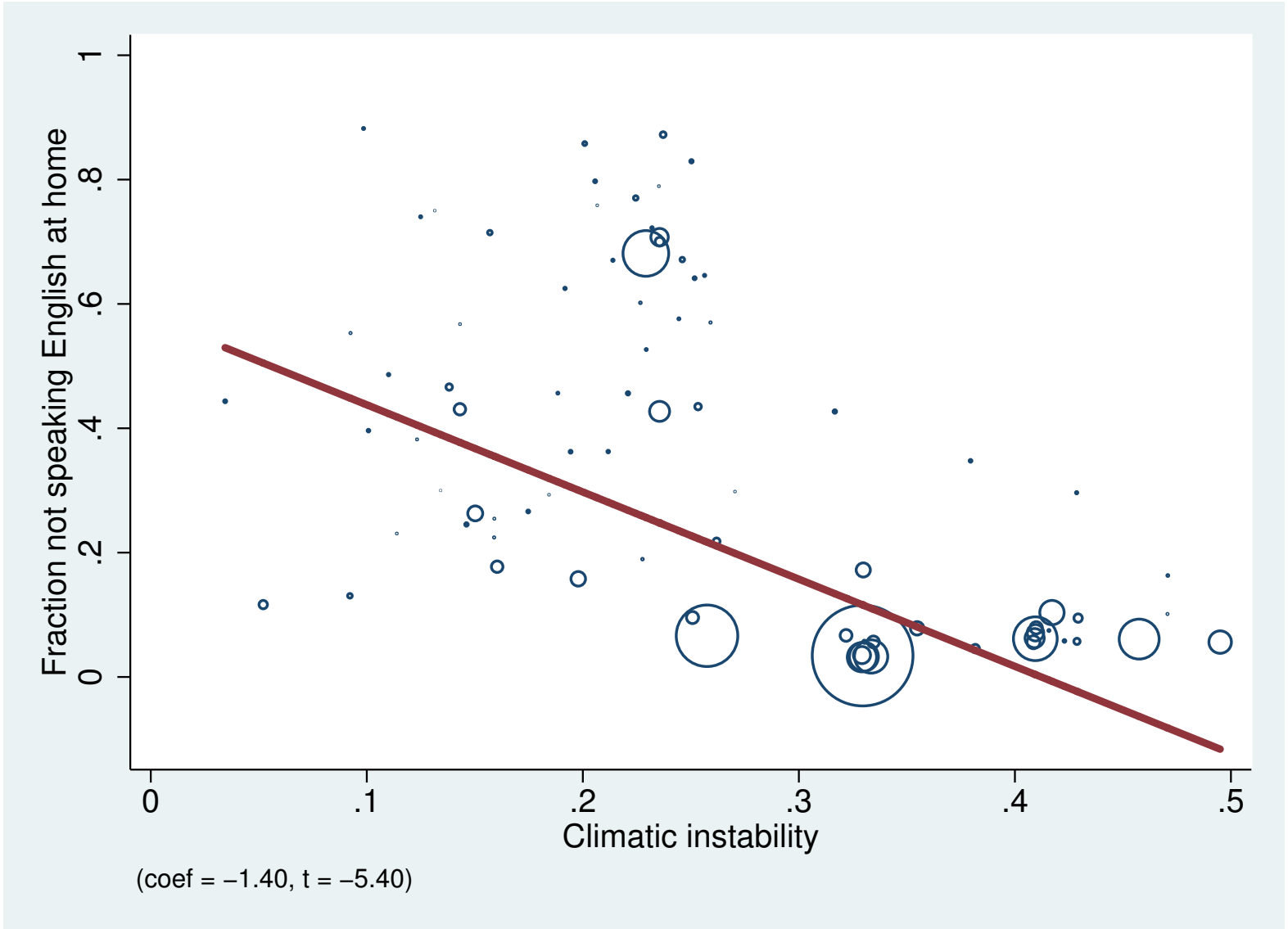


Table: Speaking a foreign language at home, from 2000 Census

	(1)	(2)	(3)	(4)	(5)
	Dep variable: Indicator for speaking a foreign language at home				
	All 2nd gen+ individuals	Not living with parents	Living with parents		
			All ages	18 or younger	Over 18
Climatic instability	**-0.346****	**-0.279***	**-0.731*****	**-0.642*****	**-0.783*****
	(0.161)	**(0.162)**	**(0.195)**	**(0.188)**	**(0.202)**
Country-level controls:					
Distance from equator	-0.015***	-0.016***	-0.011***	-0.009***	-0.012***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
Economic complexity	-0.164***	-0.160***	-0.172***	-0.147***	-0.189***
	(0.047)	(0.048)	(0.048)	(0.044)	(0.050)
Political hierarchies	0.122	0.105	0.169*	0.151*	0.183**
	(0.090)	(0.086)	(0.087)	(0.088)	(0.086)
Ln (per capita GDP)	0.017	0.016	0.012	0.004	0.016
	(0.021)	(0.019)	(0.025)	(0.025)	(0.026)
Genetic distance from the US	0.154**	0.144*	0.191***	0.202***	0.180**
	(0.075)	(0.076)	(0.066)	(0.060)	(0.069)
Fraction of population with the same ancestry	0.093	0.098	0.019	0.034	0.009
in the same location	(0.059)	(0.059)	(0.065)	(0.063)	(0.068)
Individual level controls	yes	yes	yes	yes	yes
Number of countries	84	84	84	84	84
Mean (st. dev.) of dependent variable	0.12 (0.33)	0.11 (0.31)	0.23 (0.42)	0.22 (0.42)	0.23 (0.42)
Observations	3,343,097	2,915,673	427,424	176,893	250,531
R-squared	0.304	0.278	0.383	0.367	0.399

Notes : The unit of observation is a person born in the United States with an ancestry from a non-English speaking country. The dependent variable is an indicator that equals one if the person does not speak English at home. All specifications include the following control varaibles: a quadratic in age, two indicator variables for education (less than high school and high school), labor force participation fixed effects, personal income, and location (i.e., MSA) fixed effects. Standard errors are clustered at the ancestry-country level. The mean and standard deviation of Climatic instability is 0.33 (0.07). ***, ** and * indicate significance at the 10, 5 and 1% levels.

Examining Indigenous populations in the United States and Canada

- One shortcoming of our analysis of immigrants is that they are not necessarily a representative sample of the origin population.
- We pursue the complementary strategy of studying Indigenous populations and whether they have been able to maintain their culture.
- We study individuals in the U.S. and Canadian Censuses who are Indigenous and examine whether they continue to speak their traditional language.

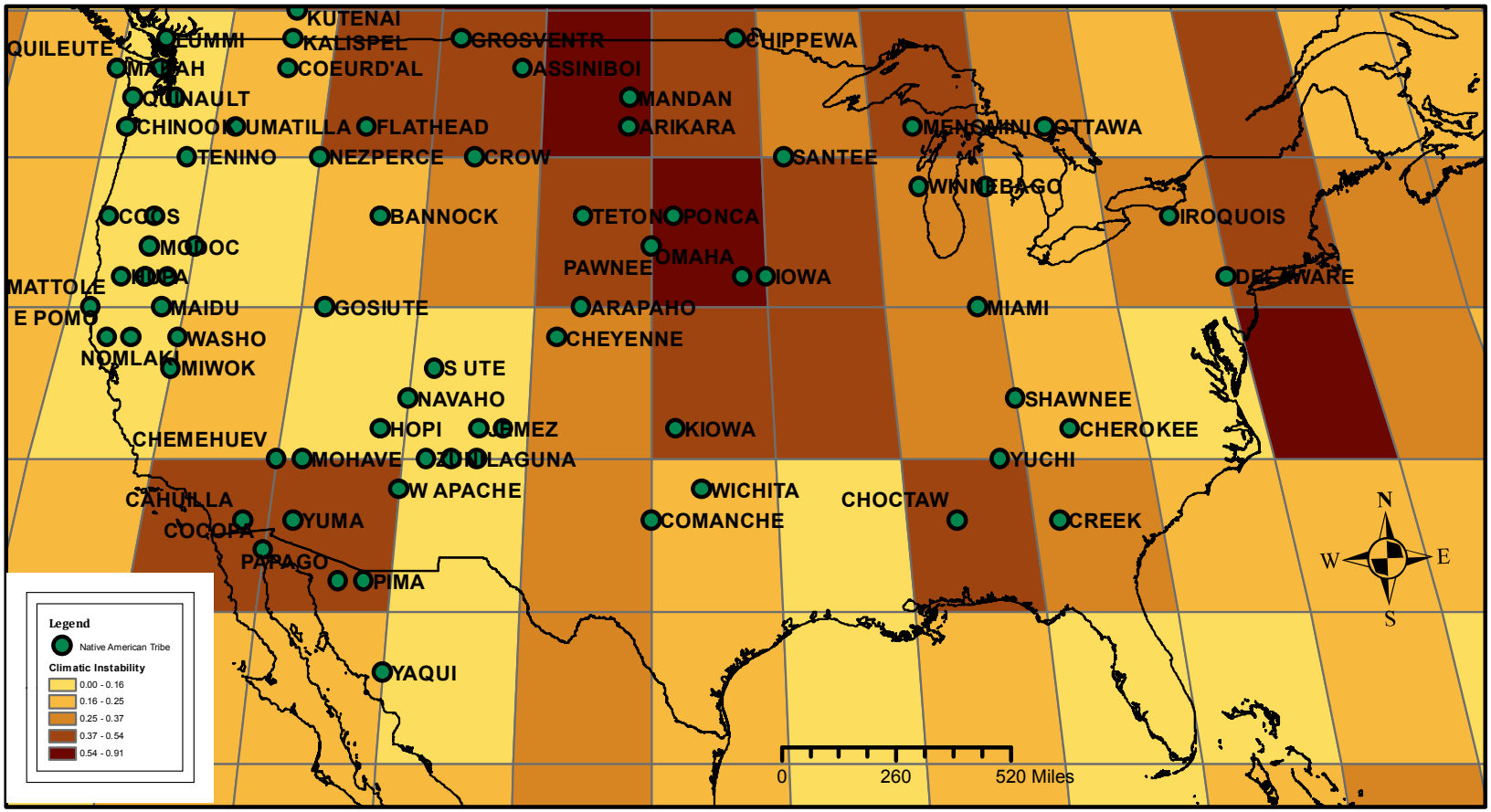


Figure: Map of climatic instability and the historical locations of Indigenous populations that are in the *Ethnographic Atlas* and in the *U.S. Census*.

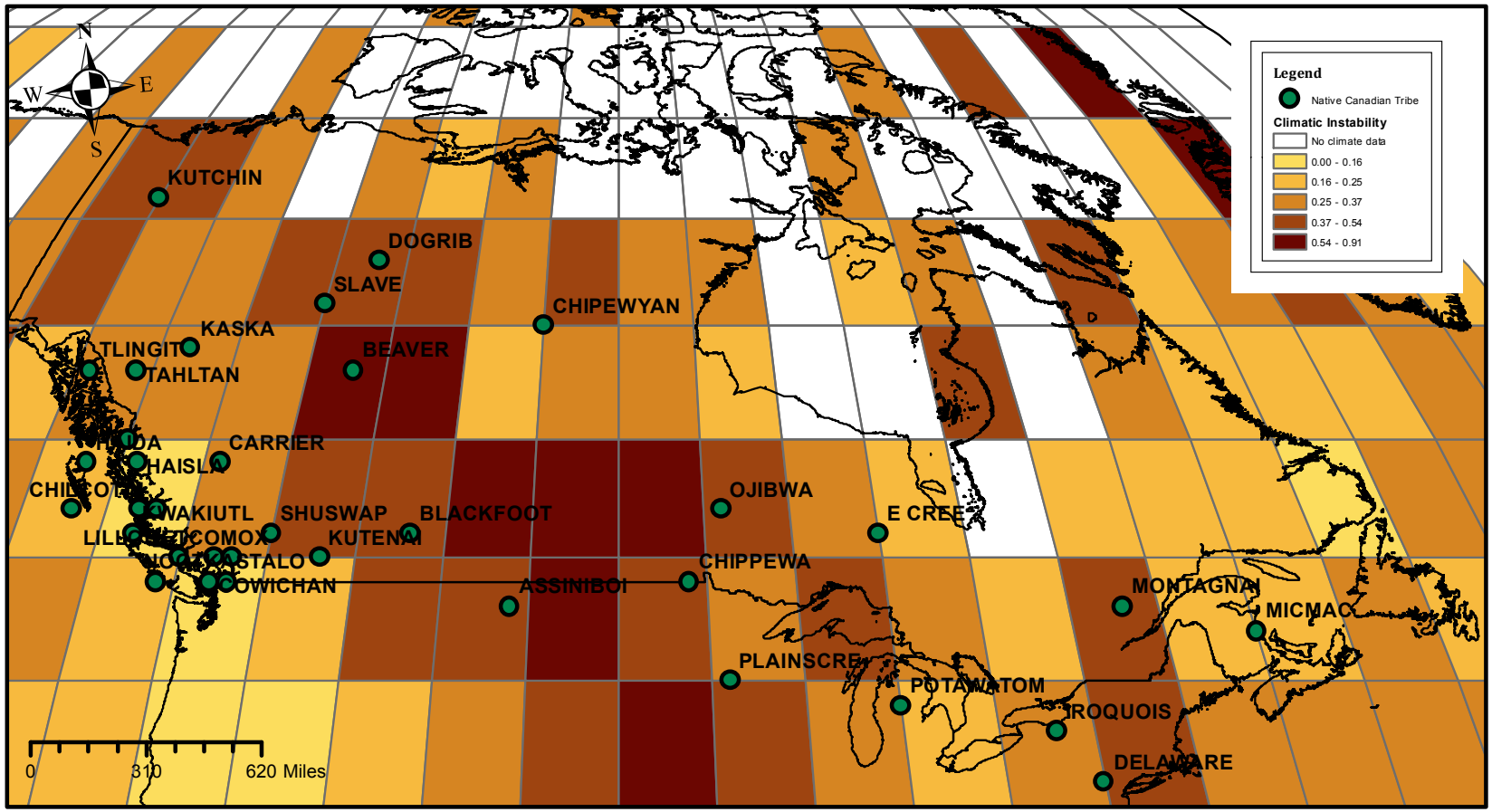


Figure: Map of climatic instability and the historical location of Indigenous populations that are in the *Ethnographic Atlas* and in the *Canadian Aboriginal Census*.

Examining Indigenous North American populations: Individual-level estimates

$$I_{i,e,k}^{NativeLanguage} = \alpha_k + \beta\, Climatic\ Instability_e + \mathbf{X}_e\mathbf{\Pi} + \mathbf{X}_i\mathbf{\Phi} + \varepsilon_{i,e,k}$$

- i denotes an individual, e denotes an ethnicity, and k a location (i.e., an MSA).
- α_k denote location fixed effects.
- $I_{i,e}^{NativeLanguage}$ is an indicator that equals one if the individual i reports speaking an Indigenous language.
- $Climatic\ Instability_e$ is the environmental instability in the location of the ancestors of ethnic group e.

Table: Speaking an Indigenous language at home, from the 1930, 1990, and 2000 U.S. Censuses

	(1)	(2)	(3)	(4)	(5)
	Dep variable: Indicator for speaking an Indigenous language at home				
		Not living with	Living with parents		
	All individuals	parents	All ages	18 or younger	Over 18
Climatic instability	**-1.097*** **	**-1.195*** **	**-0.946*** **	**-0.856*** **	**-1.323*** **
	(0.358)	**(0.400)**	**(0.300)**	**(0.288)**	**(0.352)**
Ethnicity-level controls:					
Distance from equator	-0.008**	-0.009**	-0.007**	-0.006*	-0.010**
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)
Economic complexity	-0.022	-0.024	-0.020*	-0.018*	-0.026
	(0.014)	(0.016)	(0.011)	(0.010)	(0.016)
Political hierarchies	-0.118**	-0.132**	-0.097**	-0.088**	-0.137***
	(0.046)	(0.049)	(0.042)	(0.042)	(0.044)
Individual controls	yes	yes	yes	yes	yes
Number of ethnic groups	83	83	79	78	67
Number of clusters (grid cells)	40	40	40	40	40
Mean (st. dev.) of dependent variable	0.18 (0.39)	0.20 (0.40)	0.15 (0.36)	0.13 (0.34)	0.25 (0.43)
Observations	128,005	79,235	48,770	39,800	8,970
R-squared	0.334	0.373	0.289	0.250	0.424

Notes : OLS estimates are reported with standard errors clustered at the level of the climatic grid cell in parentheses. The unit of observation is a person who identifies him/herself as a Native American. The dependent variable is an indicator that equals one if the person speaks an indiginous (i.e., Native American) language at home. All specification include the following covariates: a quadratic in age, a gender indicator, employment status fixed effects, an indicator for being married, metropolitan area fixed effects, an indicator for whether the individual has any education. The mean (and standard deviation) of Climatic instability is 0.27 (0.11).

Examining Indigenous North American populations: Ethnicity-level estimates

$$\textit{Frac Native Language}_{e,k} = \alpha_k + \beta\, \textit{Climatic Instability}_e + \mathbf{X}_e\mathbf{\Pi} + \varepsilon_{e,k},$$

- e denotes an ethnicity, and k a location (e.g. an MSA in the U.S.).
- α_k denote location fixed effects.
- $\textit{Frac Native Language}_{e,k}$, is the proportion of individuals from ethnic group e and living in location k that speak their traditional language.
- $\textit{Climatic Instability}_e$ is the environmental instability in the location of the ancestors of ethnic group e.

Table: Whether the traditional language is spoken by Indigenous populations in the U.S. and Canada

	(1)	(2)	(3)	(4)	(5)
	United States	**Canada**			**U.S. & Canada**
	Indigenous language is spoken at home	Indigenous language is mother tongue	Indigenous language is spoken at home	Conversational in Indigenous language	Indigenous language is spoken at home
Climatic instability	**-4.879****	**-2.486*****	**-2.394*****	**-1.957*****	**-4.668****
	(2.116)	**(0.754)**	**(0.890)**	**(0.623)**	**(1.889)**
Ethnicity-level controls:					
Distance from the equator	0.000	0.054***	0.058***	0.035***	0.003
	(0.023)	(0.010)	(0.012)	(0.009)	(0.020)
Economic complexity	-0.185***	-0.264***	-0.285***	-0.166***	-0.181***
	(0.072)	(0.048)	(0.068)	(0.033)	(0.067)
Political hierarchies	-0.069	0.058	-0.061	-0.002	-0.060
	(0.227)	(0.111)	(0.132)	(0.098)	(0.209)
Location FE	yes	yes	yes	yes	yes
Survey year FE	yes	yes	yes	yes	yes
Number of ethnic groups	83	36	36	36	108
Number of clusters (grid cells)	40	24	24	24	52
Mean (st. dev.) of dependent variable	0.039 (0.14)	0.29 (0.25)	0.25 (0.26)	0.34 (0.26)	0.07 (0.18)
Observations (ethnicity-year-location)	3,564	546	546	546	4110

Notes : Poisson estimates are reported with standard errors clustered at the grid cell level in parentheses. The unit of observation is an Indigenous ethnic group (from the U.S. and/or Canada), living in a location, and observed in a census survey. The dependent variables are different measures of the fraction of people that can speak their traditional language. The American sample includes data from the 1930, 1990, and 2000 Censuses. The Canandian sample includes data from the 2001, 2006, and 2011 Censuses. The mean (and standard deviation) of Climatic instability is 0.30 (0.11). ***,** and * indicate significance at the 10, 5 and 1% levels.

Conclusions

- Have examined one determinant of cultural persistence: ancestral climatic instability.
  - We observe less persistence and a weaker importance placed on tradition among groups with a less stable environment historically.
- A contribution of the study is that it provides a test of a set of models that form the core of evolutionary anthropology.
- We considered one source of instability. Do others yield similar findings?
  - E.g., like economic growth, international trade, nomadic populations.