

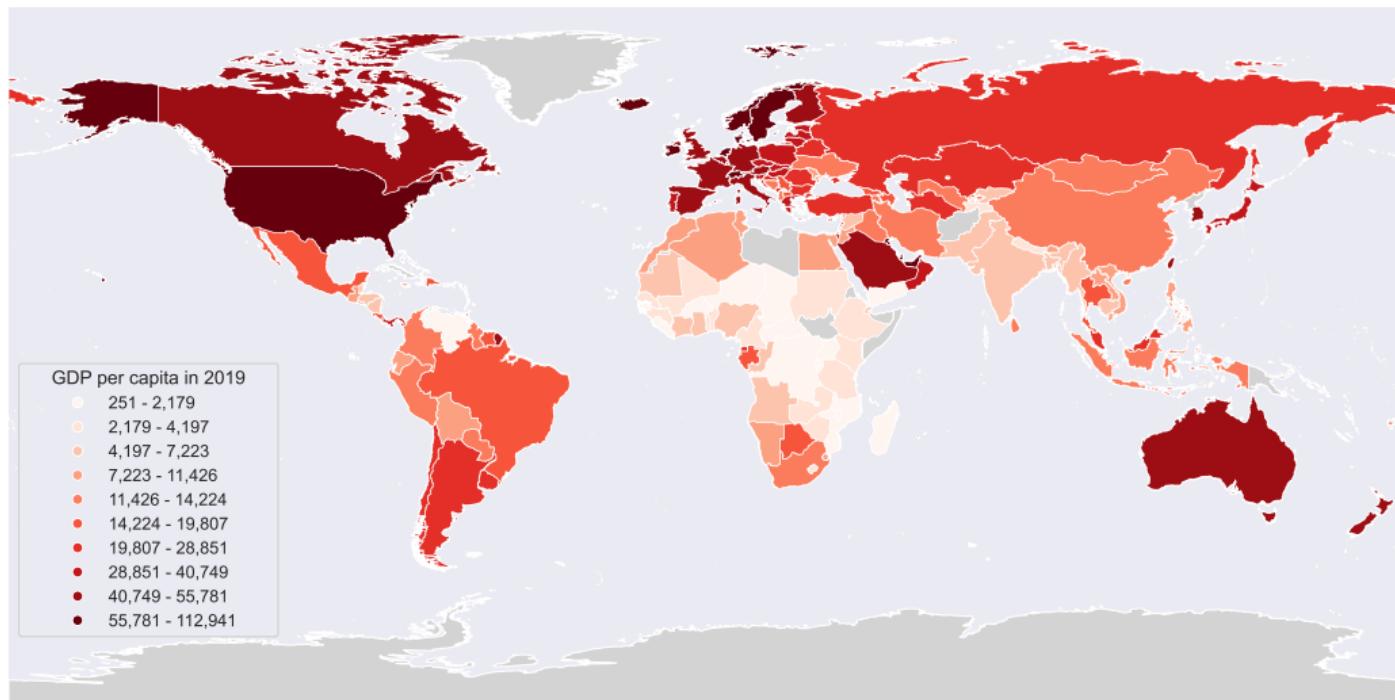
Geographical Roots and Consequences of the Coevolution of Cultural and Linguistic Traits

Ömer Özak

Department of Economics
Southern Methodist University

Economic Growth and Comparative Development

Culture and Economic Development



Research Agenda

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- Coevolution of culture and language in the development process

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 - Role of culture in the evolution of language

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 - Role of culture in the evolution of language
 - Role of language in cultural persistence

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- Causes and consequences of the evolution of language structures
 - Effect of the economic environment on language structures

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 - Effect of the economic environment on language structures
 - Effect of language structures on human behavior

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- Have language structures merely encoded existing cultural traits or have they influenced human behavior and values?
- What are the geographical roots of the coevolution of linguistic and cultural traits?
- Are the geographical origins of this evolutionary process critical for the understanding of the development process?

Main Hypotheses

- Variations in language structures reflect pre-historical variations in geographical characteristics across regions

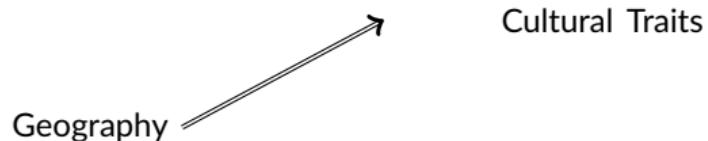
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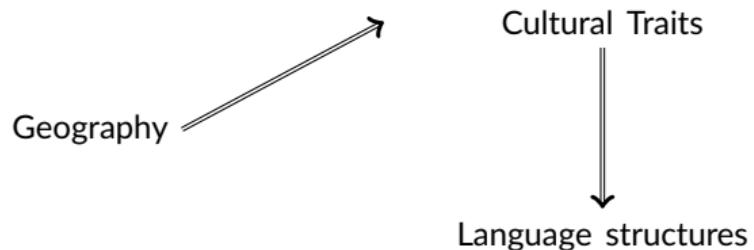
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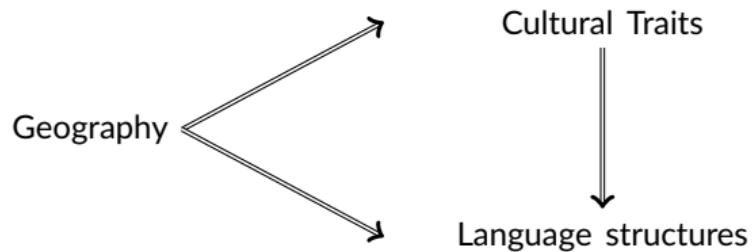
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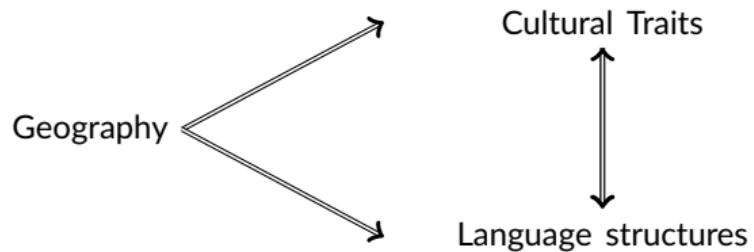
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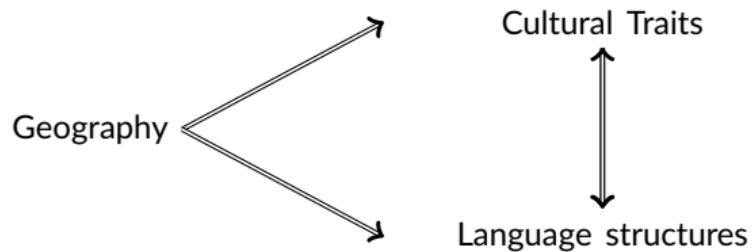
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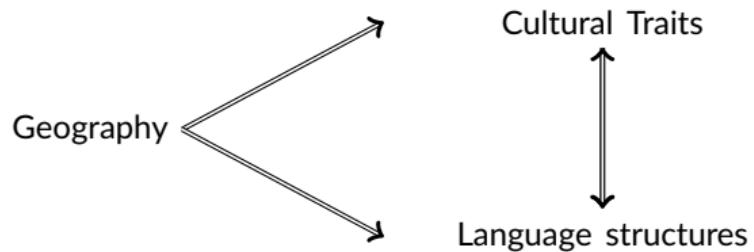
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- Variations in language structures are associated with differences in development outcomes

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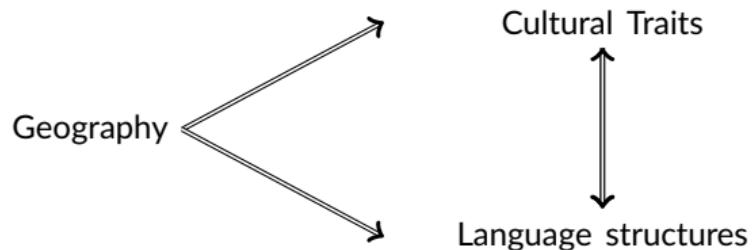
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Geography, Culture and Language Structures

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- Grammatical Gender ~ Gender roles

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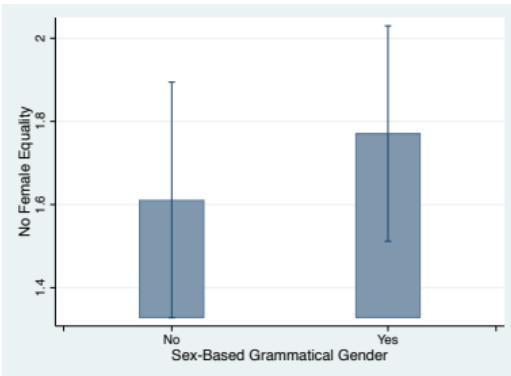
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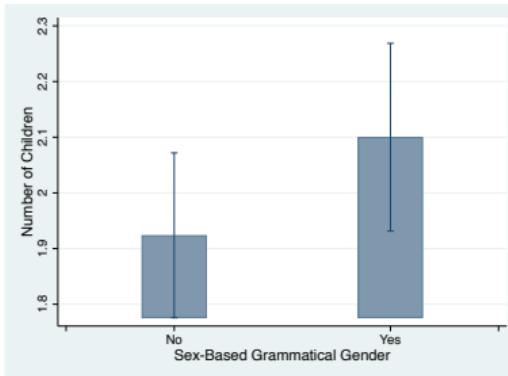
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 - Geographical origin: Natural return to agricultural investment

Motivation: Contemporary Cultural & Linguistic Traits

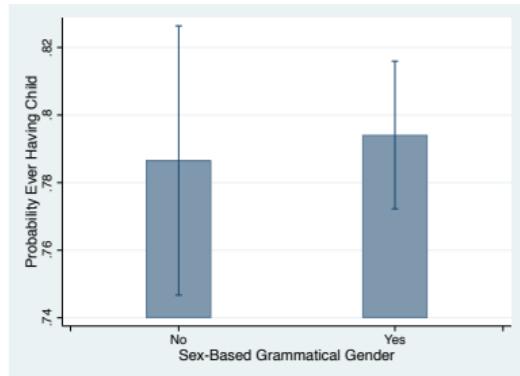
Gender Bias



(A1)



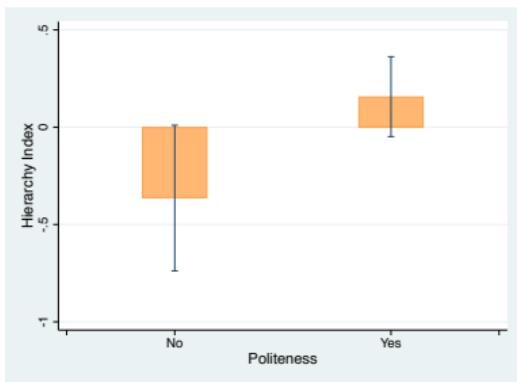
(A2)



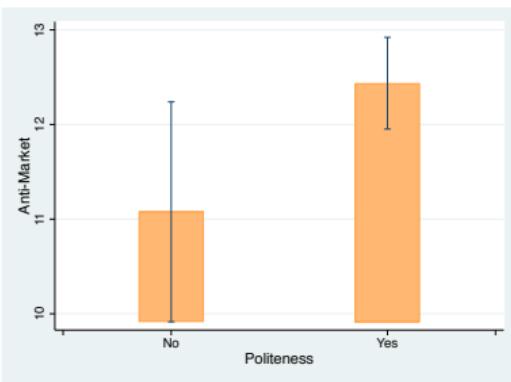
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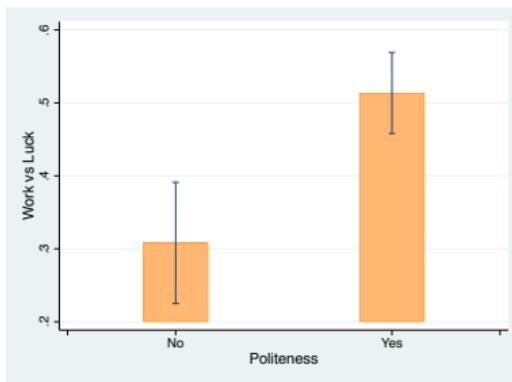
Hierarchy



(B1)



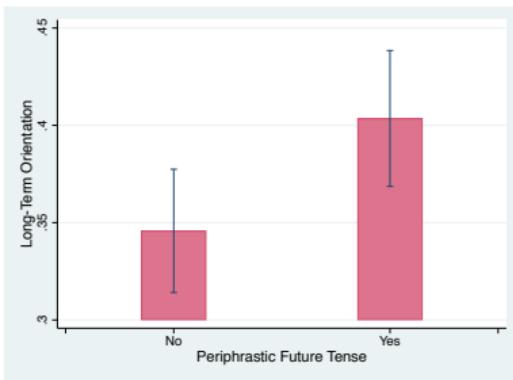
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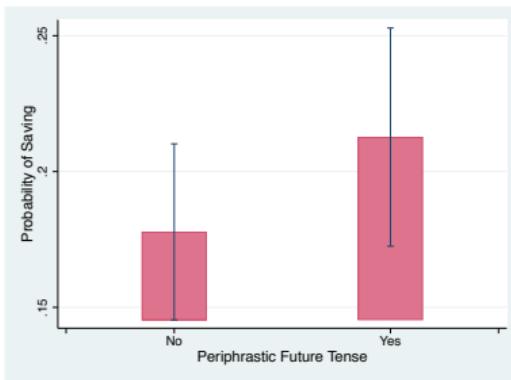
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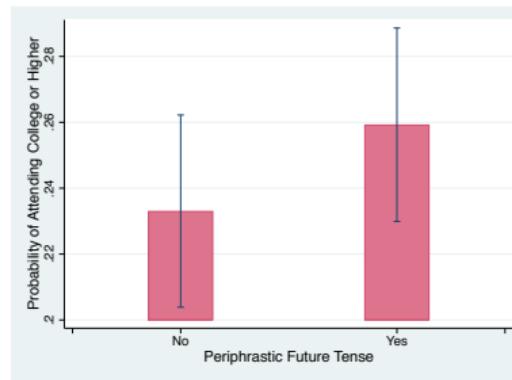
Future Orientation



(C1)



(C3)



(C2)

Data and Empirical Strategy

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- Periphrastic future tense

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- 275 indigenous languages

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 - Spoken by 72% of global population

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 - Spoken by 72% of global population
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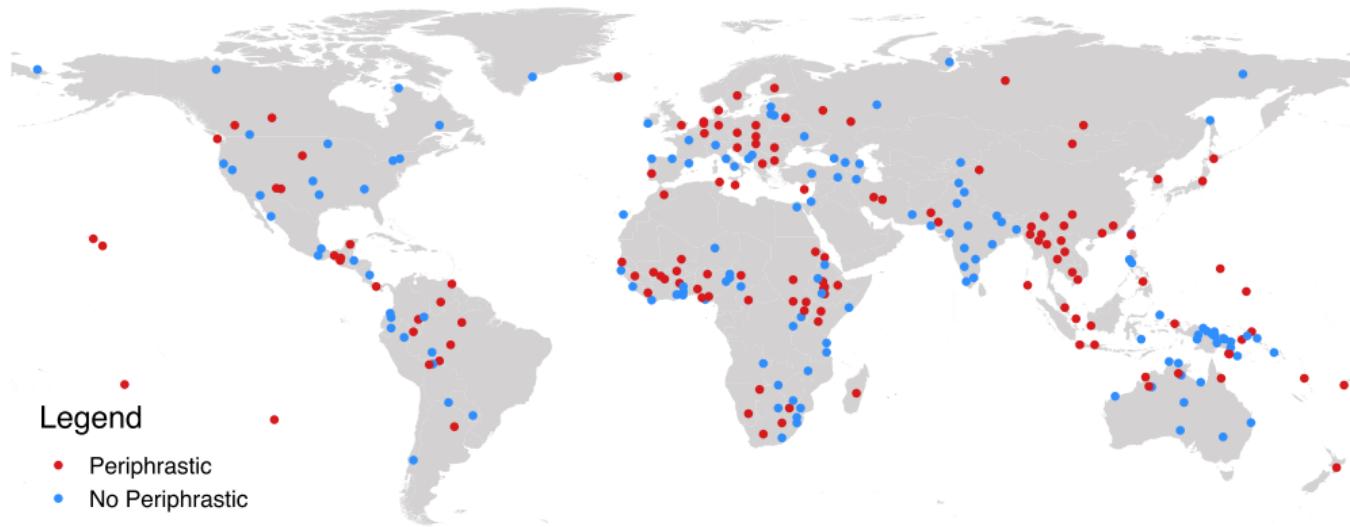
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- 76 language families

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 - Spanning 95% of languages in Ethnologue

Distribution of the Structure of the Future Tense



The Structure of Grammatical Gender

- Languages differ in the way nouns are classified into groups

The Structure of Grammatical Gender

- Languages differ in the way nouns are classified into groups
 - Sex-based gender systems

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 - Non-sex-based gender systems

The Structure of Grammatical Gender

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 - Non-sex-based gender systems
 - No gender systems

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Linguistic Data – Structure of Grammatical Gender

- 227 indigenous languages

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Linguistic Data – Structure of Grammatical Gender

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 - Spoken by 49% of global population
 - 100% of languages spoken by migrants to the US

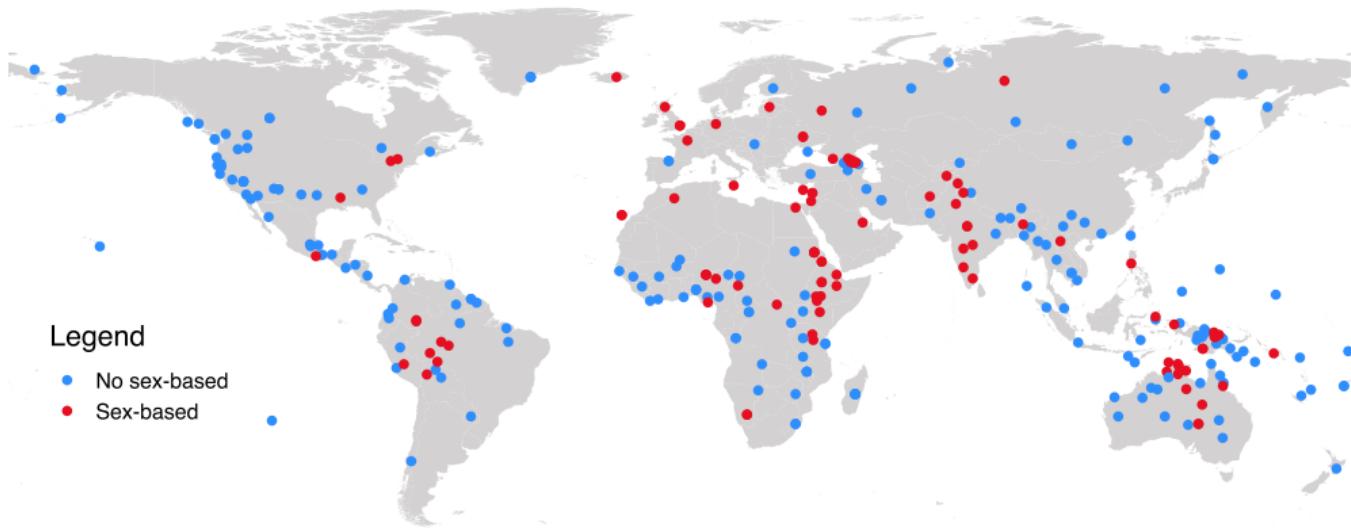
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- Belong to 76 language families

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 - Spanning 90% of languages in Ethnologue

Distribution of the Existence of Sex-Based Grammatical Gender



The Structure of Politeness Distinctions

- Languages differ in the structure of politeness distinctions

The Structure of Politeness Distinctions

- Languages differ in the structure of politeness distinctions
 - Politeness distinctions in pronouns (second person)

The Structure of Politeness Distinctions

- Languages differ in the structure of politeness distinctions
 - Politeness distinctions in pronouns (second person)
 - No distinctions

Politeness Distinctions in Pronouns (Second Person)

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 - English: *You*

Linguistic Data – Existence of Politeness Distinctions in Pronouns

- 207 indigenous languages

Linguistic Data – Existence of Politeness Distinctions in Pronouns

- 207 indigenous languages
 - Spoken by 57% of global population

Linguistic Data – Existence of Politeness Distinctions in Pronouns

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 - 100% of languages spoken by migrants to the US

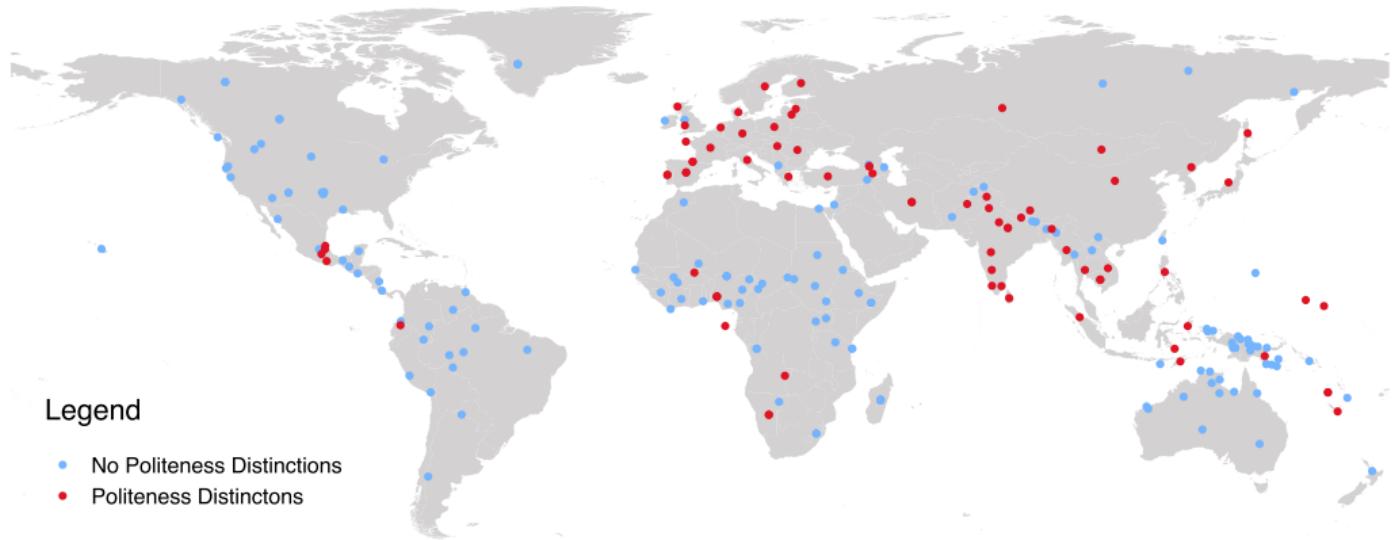
Linguistic Data – Existence of Politeness Distinctions in Pronouns

- 207 indigenous languages
 - Spoken by 57% of global population
 - 100% of languages spoken by migrants to the US
- 69 language families

Linguistic Data – Existence of Politeness Distinctions in Pronouns

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 - 100% of languages spoken by migrants to the US
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 - Spanning 94% of languages in Ethnologue

Distribution of the Existence of Politeness Distinctions



Pre-1500CE Crop Return Data

Caloric Suitability Index (CSI)

Pre-1500CE Crop Return Data

Caloric Suitability Index (CSI)

- Potential caloric yield and growth cycles

Pre-1500CE Crop Return Data

Caloric Suitability Index (CSI)

- Potential caloric yield and growth cycles
 - Potential Crop Yield

Pre-1500CE Crop Return Data

Caloric Suitability Index (CSI)

- Potential caloric yield and growth cycles
 - Potential Crop Yield
 - Calories per hectare per year for each crop

Pre-1500CE Crop Return Data

Caloric Suitability Index (CSI)

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Caloric Suitability Index (CSI)

- Potential caloric yield and growth cycles
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Pre-1500CE Crop Return Data

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- Potential caloric yield and growth cycles
 - Potential Crop Yield
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Pre-1500CE Crop Return Data

Caloric Suitability Index (CSI)

- Potential caloric yield and growth cycles
 - Potential Crop Yield
 - Calories per hectare per year for each crop
 - Potential Crop Growth Cycles
 - Average number of days elapsed from planting to harvesting for each crop
- Reflecting early stages of development
- Unaffected by human intervention

Pre-1500CE Crop Return Data

- Potential Crop Return

Pre-1500CE Crop Return Data

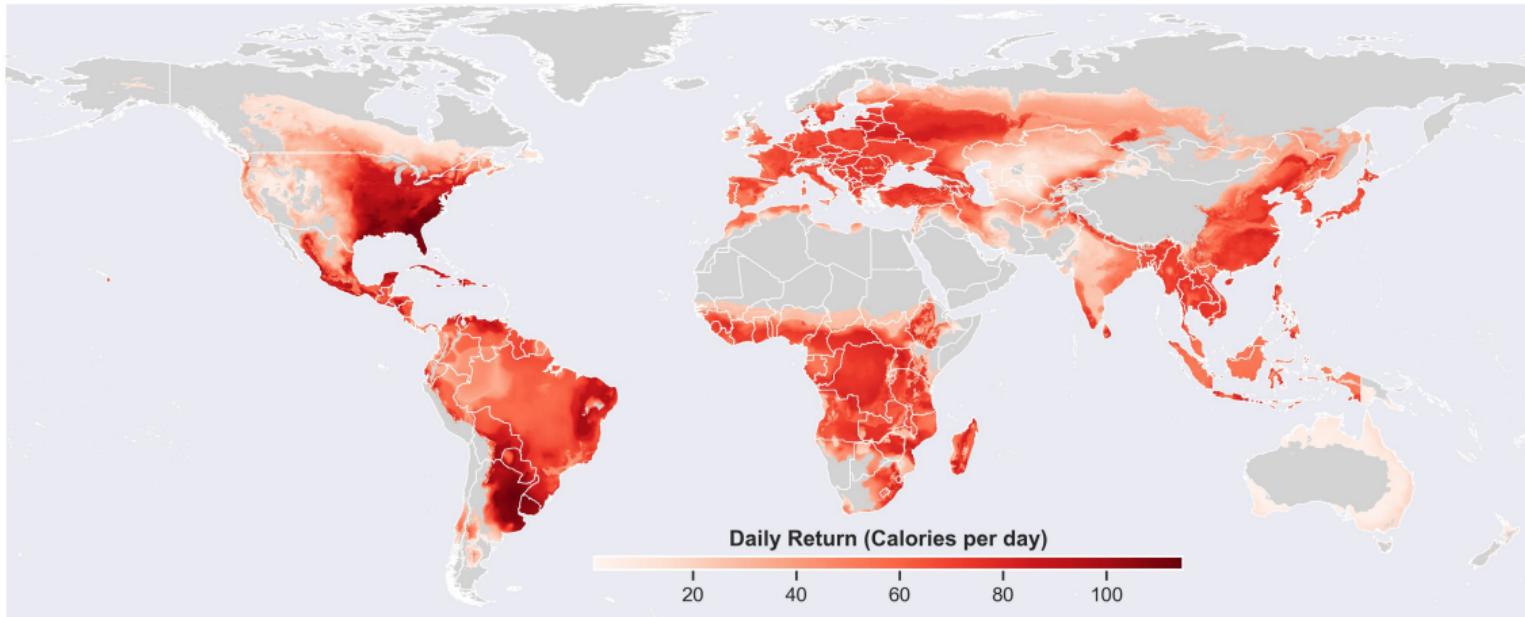
- Potential Crop Return
 - Calories per hectare per day of the most productive crop

Pre-1500CE Crop Return Data

- Potential Crop Return
 - Calories per hectare per day of the most productive crop

$$\text{Potential Crop Return} = \frac{\text{Potential Crop Yield}}{\text{Potential Crop Growth Cycle}}$$

Potential Crop Return (pre-1500CE)



Caloric Suitability Index & Plow Suitability

- Average Caloric Suitability (CSI)

Caloric Suitability Index & Plow Suitability

- Average Caloric Suitability (CSI)
- Plow positive crops

Caloric Suitability Index & Plow Suitability

- Average Caloric Suitability (CSI)
- Plow positive crops
 - Grains: wheat, barley, rye, buckwheat, teff, and wet rice

Caloric Suitability Index & Plow Suitability

- Average Caloric Suitability (CSI)
- Plow positive crops
 - Grains: wheat, barley, rye, buckwheat, teff, and wet rice
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- Average Caloric Suitability (CSI)
- Plow positive crops
 - Grains: wheat, barley, rye, buckwheat, teff, and wet rice
- Plow negative crops
 - Grains: sorghum, dry rice, and maize

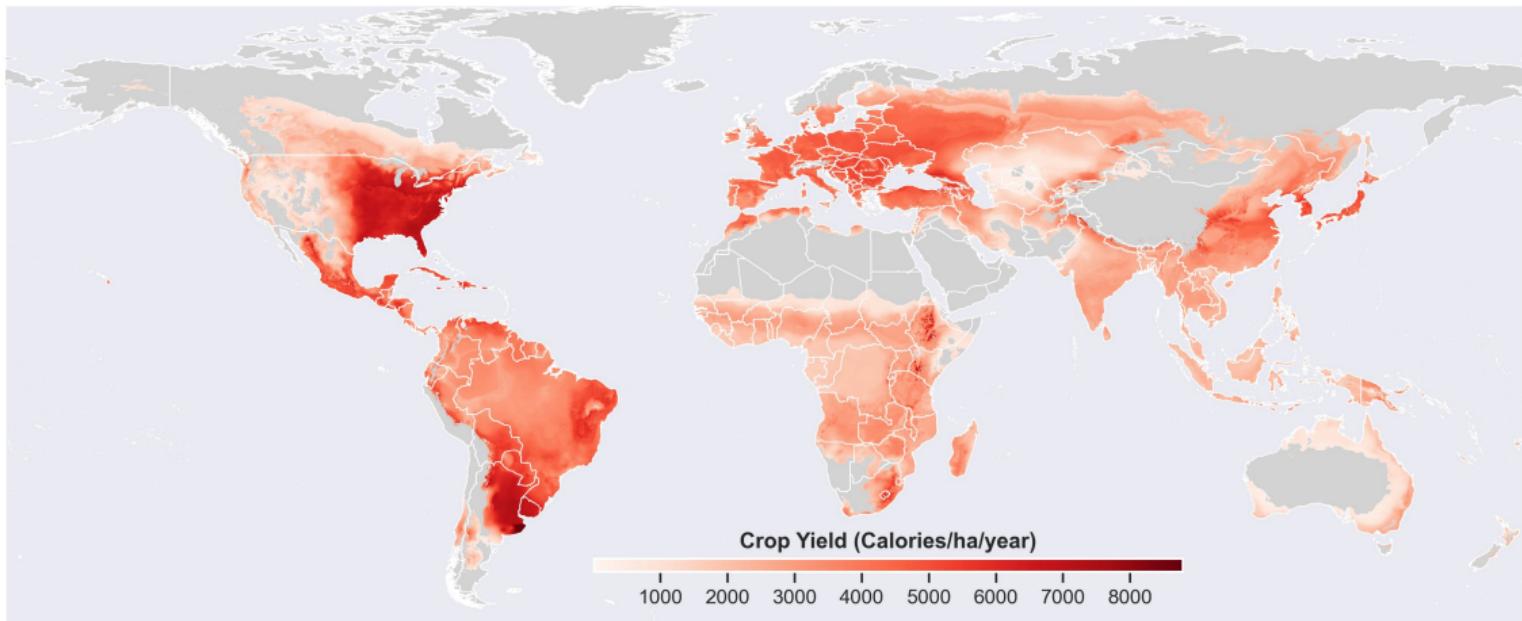
Caloric Suitability Index & Plow Suitability

- Average Caloric Suitability (CSI)
- Plow positive crops
 - Grains: wheat, barley, rye, buckwheat, teff, and wet rice
- Plow negative crops
 - Grains: sorghum, dry rice, and maize
 - All root crops

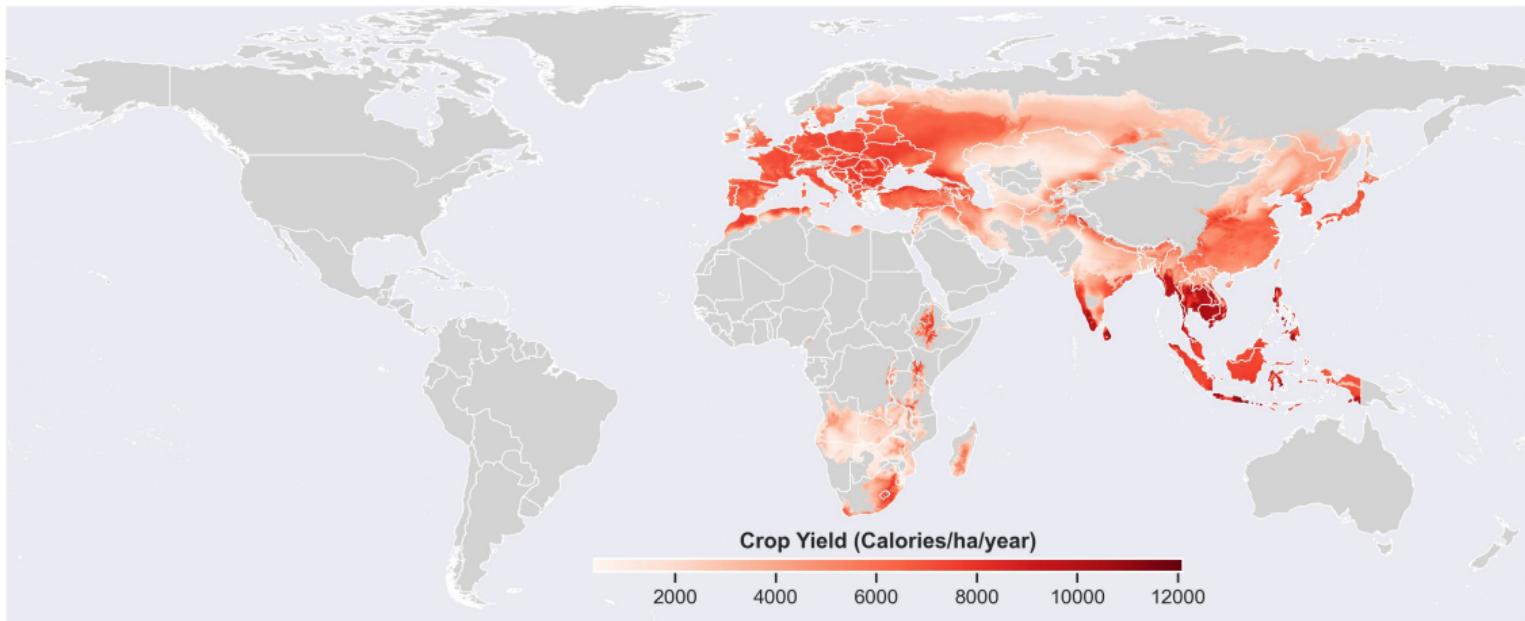
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 - All root crops
 - All tree crops

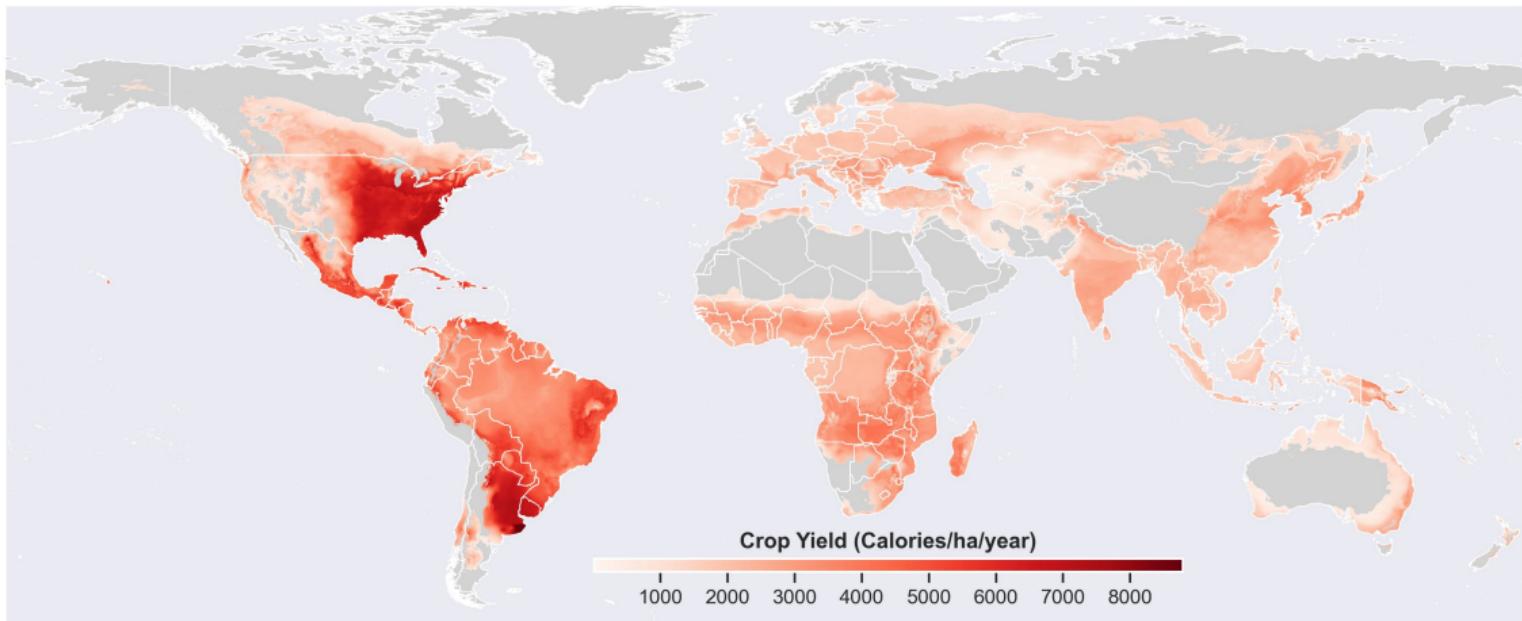
Global Distribution of CSI (pre-1500CE)



Global Distribution of Plow Positive CSI (pre-1500CE)



Global Distribution of Plow Negative CSI (pre-1500CE)



Ecological Diversity

- Ecological diversity: a Herfindahl index of the share of each territory that is occupied by different ecological zones

$$E_\ell = 1 - \sum_{j=1}^{16} (\theta_{\ell j})^2$$

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- E_ℓ : Ecological diversity in the homeland of language ℓ
- $\theta_{\ell j}$: Share of the homeland of language ℓ in ecological zone j

Empirical Specification

$$S_\ell = \beta_0 + \beta_1 D_{\ell S} + \sum_j \gamma_{0j} X_{\ell j} + \sum_c \gamma_c \delta_{\ell c} + \varepsilon_\ell$$

- S_ℓ \equiv Existence of structure S in language ℓ
- $D_{\ell S}$ \equiv Geographical determinant of structure S in the ancestral region of language ℓ
- $X_{\ell j}$ \equiv Geographical characteristic j in the ancestral region of language ℓ
- $\delta_{\ell c}$ \equiv Regional FE s

Geographical Origins of Sex-Based Grammatical Gender

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- Grammatical Gender ~ Gender bias

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 - Geographical origin: Predisposition for usage of the plow

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- Grammatical Gender ~ Gender bias

- Geographical origin: Predisposition for usage of the plow
- Mechanism: Effect of plow usage on gender roles (Boserup, 1970; Alesina et al., 2013)

The Geographical Origins of Politeness Distinctions

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- Politeness Distinctions ~ Obedience and power distance

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 - Geographical origin: Agricultural suitability & Ecological diversity

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- Politeness Distinctions ~ Obedience and power distance
 - Geographical origin: Agricultural suitability & Ecological diversity
 - Mechanism: The effect of agricultural productivity (Diamond, 1997) and ecological diversity (Fenske, 2015, Depetris & Özak, 2016) on the emergence of hierarchical societies

The Geographical Origins of the Periphrastic Future Tense

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- Periphrastic future tense ~ Future Orientation

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The Geographical Origins of the Periphrastic Future Tense

- Periphrastic future tense ~ Future Orientation
 - Geographical origin: Natural return to agricultural investment
 - Mechanism: Effect of natural return to agricultural investment on adoption of agriculture and evolution of future orientation (Galor & Özak, AER 2016)

Identification Strategy

Identification Strategy

- Potential Concerns:

Identification Strategy

- Potential Concerns:

- Reverse causality:

Identification Strategy

- Potential Concerns:

- Reverse causality:

Linguistic Trait (Cultural Value) \implies Actual Geographical Origin

Identification Strategy

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- Choice of crops

Identification Strategy

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Linguistic Trait (Cultural Value) \implies Actual Geographical Origin

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- Choice of crops
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- Remedy:

Identification Strategy

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Linguistic Trait (Cultural Value) \implies Actual Geographical Origin

- Choice of crops
 - Choice of technology

- Remedy:

- Exploit variation in potential (rather than actual) geographical origin

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- Reverse causality:

Sex-Based Grammatical Gender (Gender Bias) \implies Plow Use

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- Remedy:

- Exploit variation in potential (rather than actual) benefits of plow use

Identification Strategy

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Politeness Distinctions (Hierarchical Orientation) \implies Trade & Economic Specialization

Identification Strategy

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Politeness Distinctions (Hierarchical Orientation) \implies Trade & Economic Specialization

- Choice of crops
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- Remedy:

- Exploit variation in potential (rather than actual) agricultural and trade suitability

Identification Strategy

- Potential Concerns:

- Reverse causality:

Future Tense (Time Preference) \implies Actual Return to Agricultural Investment

Identification Strategy

- Potential Concerns:

- Reverse causality:

Future Tense (Time Preference) \implies Actual Return to Agricultural Investment

- Choice of crops

Identification Strategy

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Future Tense (Time Preference) \implies Actual Return to Agricultural Investment

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Identification Strategy

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Future Tense (Time Preference) \implies Actual Return to Agricultural Investment

- Choice of crops
 - Choice of technology

- Remedy:

- Exploit variation in potential (rather than actual) return to agricultural investment

Identification Strategy

- Potential Concerns:

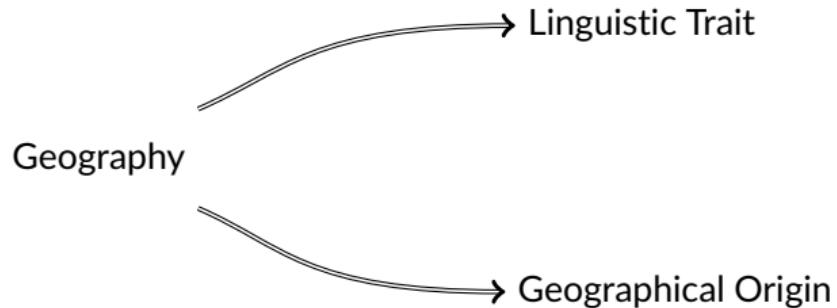
Identification Strategy

- Potential Concerns:
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Identification Strategy

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Identification Strategy

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Identification Strategy

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Identification Strategy

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(e.g., absolute latitude, elevation, ruggedness, temperature, precipitation, etc.)

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Identification Strategy

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 - Analysis of languages outside their family's ancestral homeland
 - Account for host region FEs

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 - Explore size and sign of potential bias
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 - Establish the persistent effect the geographical characteristics in the ancestral homeland of the language (rather than in current location)

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 - Establish the persistent effect the geographical characteristics in the ancestral homeland of the language (rather than in current location)
 - Similar to 2nd generation migrants

Identification Strategy

- Potential Concerns:

Identification Strategy

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 - Sorting

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- Individuals who spoke languages with a different linguistic trait could have sorted into complementary regions.

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 - Account for change in geographical origin due to demic diffusion
 - Constrain spatial diffusion
 - Constrain change in crop return

Results

Geographical Origins of Language Structures

	Existence of Language Structure								
	Gender			Politeness			Future		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Caloric Plow Suitability	0.13** (0.06)	0.29*** (0.06)	0.23*** (0.08)						
Ecological Diversity				0.13*** (0.03)	0.10** (0.04)	0.10** (0.04)			
Caloric Crop Return							0.06** (0.03)	0.09*** (0.03)	0.11*** (0.03)
Average Caloric Yield	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Geographical Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Precipitation Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Temperature Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Unproductive Period	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Regional FE	No	No	Yes	No	No	Yes	No	No	Yes
Adjusted- R^2	0.03	0.15	0.21	0.14	0.21	0.32	0.01	0.07	0.11
Observations	217	217	217	198	198	198	275	275	275

Robustness

- Results are robust to

Robustness

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 - Estimation method Probit

Robustness

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 - Clustering at Language-family/genus level

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Robustness

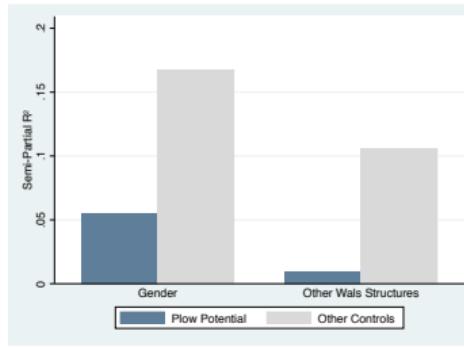
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 - Maximum Likelihood (Cliff-Ord)
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 - Altonji et al
 - Oster

Placebo - Associations with Other Language Structures

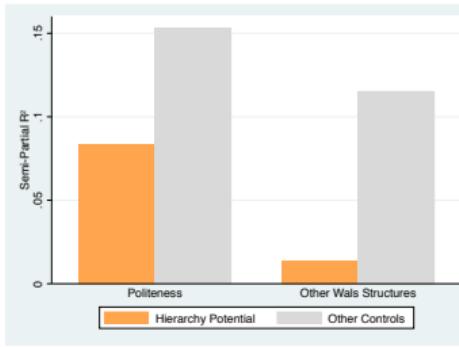
Placebo - Associations with Other Language Structures

	Language Structure					
	Temporal Structures			Non-Temporal Structures		
	Past	Perfect	Possessive	Evidentiality	Consonants	Colors
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Caloric Plow Suitability and Other Language Structures						
Caloric Plow Suitability	0.33*** (0.11)	0.09 (0.09)	-0.02 (0.10)	0.05 (0.07)	0.11 (0.14)	0.76 (0.83)
Adjusted- <i>R</i> ²	0.21	0.12	0.14	0.14	0.20	0.30
Panel B: Ecological Diversity and Other Language Structures						
Ecological Diversity	0.04 (0.04)	0.05 (0.04)	-0.03 (0.04)	0.01 (0.03)	-0.10* (0.05)	-0.49 (0.37)
Adjusted- <i>R</i> ²	0.07	0.14	0.14	0.20	0.31	-0.02
Panel C: Caloric Crop Return and Other Language Structures						
Caloric Crop Return	-0.06 (0.04)	0.05 (0.04)	-0.07* (0.04)	0.00 (0.03)	0.08 (0.06)	0.06 (0.34)
Adjusted- <i>R</i> ²	0.08	0.14	0.15	0.20	0.31	-0.03
All Geographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	218	218	224	387	542	117

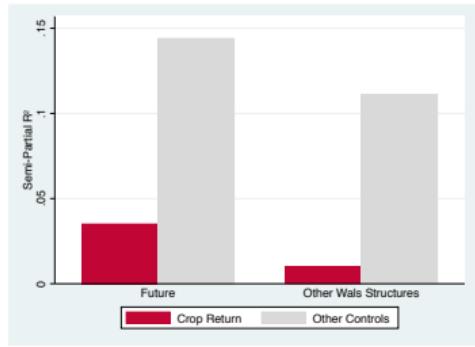
Placebo - Associations with Other Language Structures II



(a) Plow Suitability



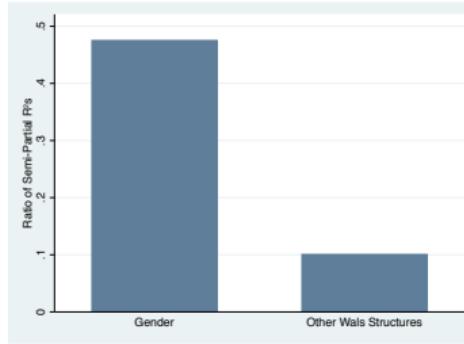
(b) Ecological Diversity



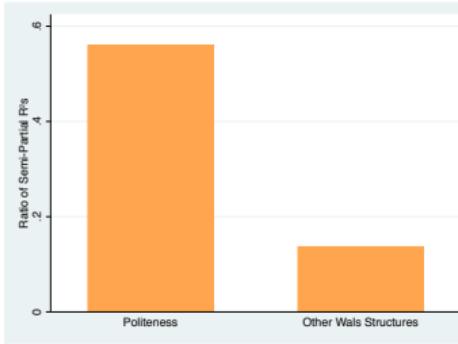
(c) Pre-1500 Crop Return

Figure: Semi-partial R^2

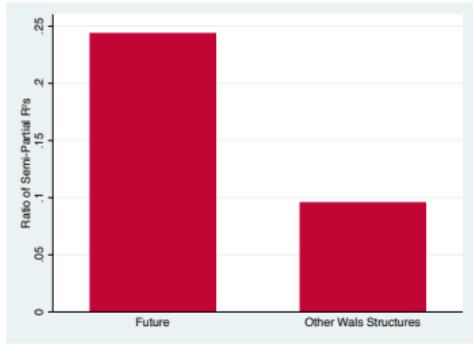
Placebo - Associations with Other Language Structures III



(a) Plow Suitability



(b) Ecological Diversity



(c) Pre-1500 Crop Return

Figure: Ratio of Semi-partial R^2 's

Persistence

How Deep are the Roots of Linguistic Traits?

- All languages within a language family descended from the same proto-language

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 - Linguistic traits in the daughter languages

How Deep are the Roots of Linguistic Traits?

- All languages within a language family descended from the same proto-language
 ⇒ Geographical origin in the ancestral homeland (the proto-language's Urheimat) may affect
 - Linguistic traits in the daughter languages
 - Share of daughter languages with linguistic trait

Persistent Effect of Urheimat Characteristics – Languages Outside Urheimat

	Existence of Language Structure					
	Migratory Distance to Urheimat					
	Any Distance			At Least 1 Week		
	Gender	Politeness	Future	Gender	Politeness	Future
	(1)	(2)	(3)	(4)	(5)	(6)
Homeland's Caloric Plow Suitability	0.11 (0.07)			0.13** (0.05)		
Urheimat's Caloric Plow Suitability	0.31*** (0.10)			0.47** (0.21)		
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Homeland Geographical Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Urheimat Geographical Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.41	0.41	0.17	0.50	0.49	0.15
Observations	195	180	255	131	126	195
Language Families	57	54	59	29	28	32

Persistent Effect of Urheimat Characteristics – Languages Outside Urheimat

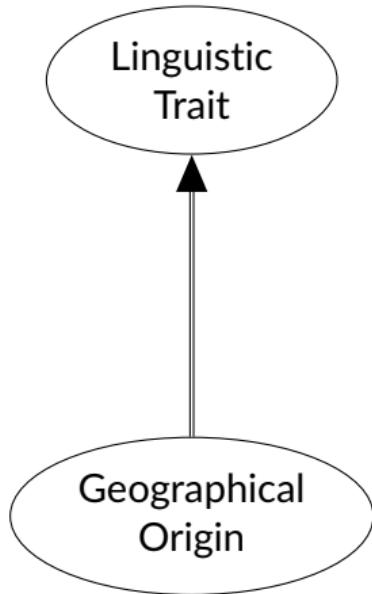
	Existence of Language Structure					
	Migratory Distance to Urheimat					
	Any Distance			At Least 1 Week		
	Gender	Politeness	Future	Gender	Politeness	Future
	(1)	(2)	(3)	(4)	(5)	(6)
Homeland's Ecological Diversity		0.07*			0.10***	
		(0.04)			(0.02)	
Urheimat's Ecological Diversity		0.05			0.07	
		(0.03)			(0.05)	
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Homeland Geographical Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Urheimat Geographical Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.41	0.41	0.17	0.50	0.49	0.15
Observations	195	180	255	131	126	195
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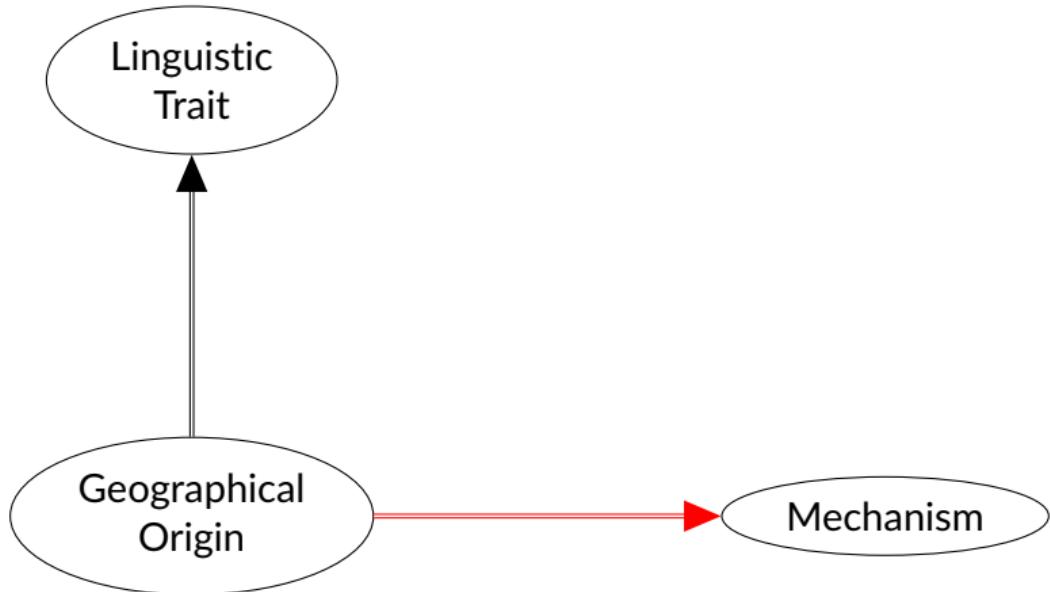
	Existence of Language Structure					
	Migratory Distance to Urheimat					
	Any Distance			At Least 1 Week		
	Gender	Politeness	Future	Gender	Politeness	Future
	(1)	(2)	(3)	(4)	(5)	(6)
Homeland's Caloric Crop Return			0.01 (0.05)			-0.01 (0.06)
Urheimat's Caloric Crop Return			0.17** (0.08)			0.24** (0.09)
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Homeland Geographical Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Urheimat Geographical Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.41	0.41	0.17	0.50	0.49	0.15
Observations	195	180	255	131	126	195
Language Families	57	54	59	29	28	32

Mechanisms

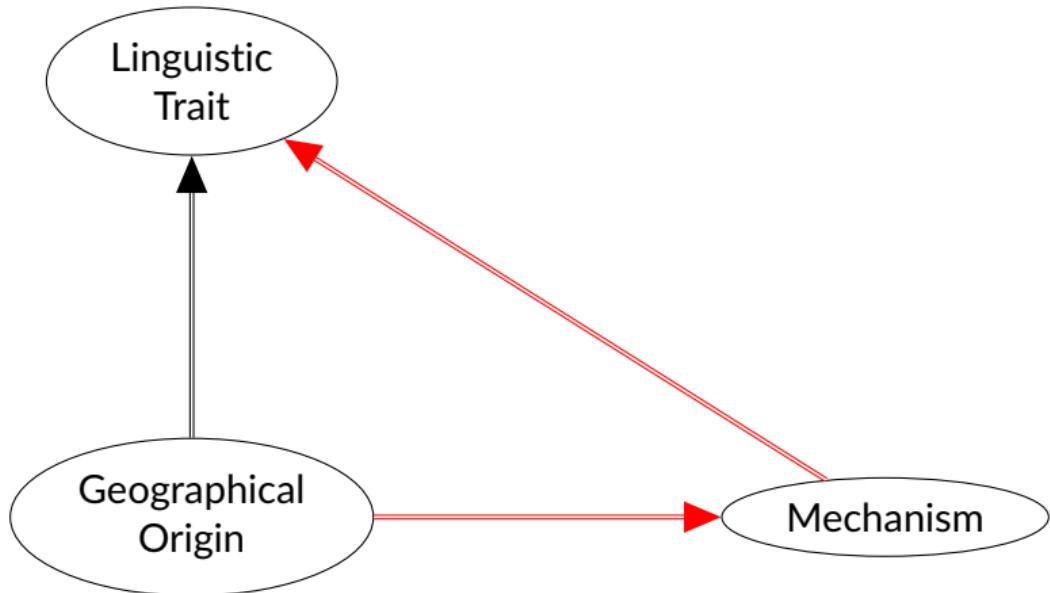
Mechanisms



Mechanisms



Mechanisms



Ethnographic Data

- Ethnic groups

Ethnographic Data

- Ethnic groups
 - Plow Cultivation

Ethnographic Data

- Ethnic groups
 - Plow Cultivation
 - Aboriginal

Ethnographic Data

- Ethnic groups
 - Plow Cultivation
 - Aboriginal
 - Absent

Ethnographic Data

- Ethnic groups
 - Plow Cultivation
 - Aboriginal
 - Absent
 - Statehood

Ethnographic Data

- Ethnic groups
 - Plow Cultivation
 - Aboriginal
 - Absent
 - Statehood
 - Jurisdictional Hierarchy Beyond Local Community (4 levels)

Ethnographic Data

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 - Aboriginal
 - Absent
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 - Jurisdictional Hierarchy Beyond Local Community (4 levels)
 - Subsistence Strategies/Patterns

Ethnographic Data

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 - Aboriginal
 - Absent
 - Statehood
 - Jurisdictional Hierarchy Beyond Local Community (4 levels)
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 - Hunting

Ethnographic Data

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 - Aboriginal
 - Absent
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 - Jurisdictional Hierarchy Beyond Local Community (4 levels)
 - Subsistence Strategies/Patterns
 - Hunting
 - Gathering

Ethnographic Data

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 - Hunting
 - Gathering
 - Fishing

Ethnographic Data

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 - Statehood
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 - Subsistence Strategies/Patterns
 - Hunting
 - Gathering
 - Fishing
 - Animal Husbandry

Ethnographic Data

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 - Hunting
 - Gathering
 - Fishing
 - Animal Husbandry
 - Farming

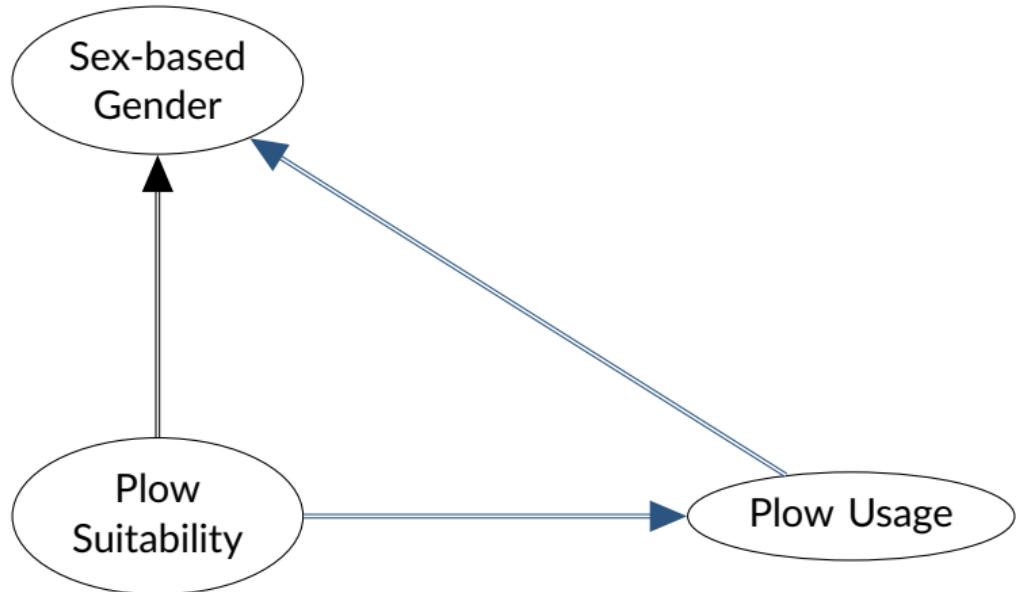
Ethnographic Data

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 - Gathering
 - Fishing
 - Animal Husbandry
 - Farming
 - Measure of Agricultural Intensity:

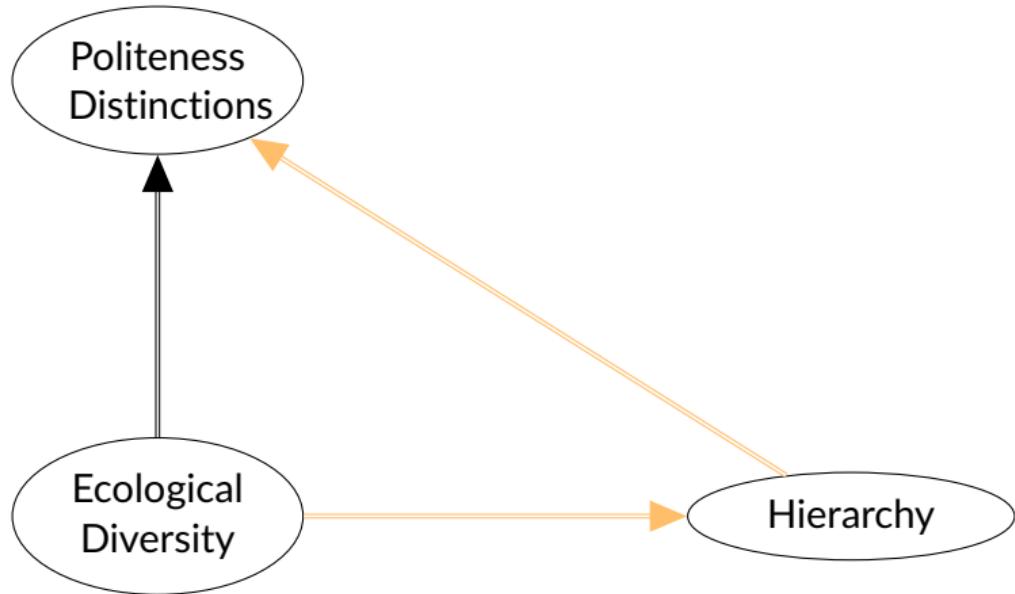
Ethnographic Data

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 - Gathering
 - Fishing
 - Animal Husbandry
 - Farming
 - Measure of Agricultural Intensity:
 - Shares of subsistence associated with agriculture (farming + animal husbandry)

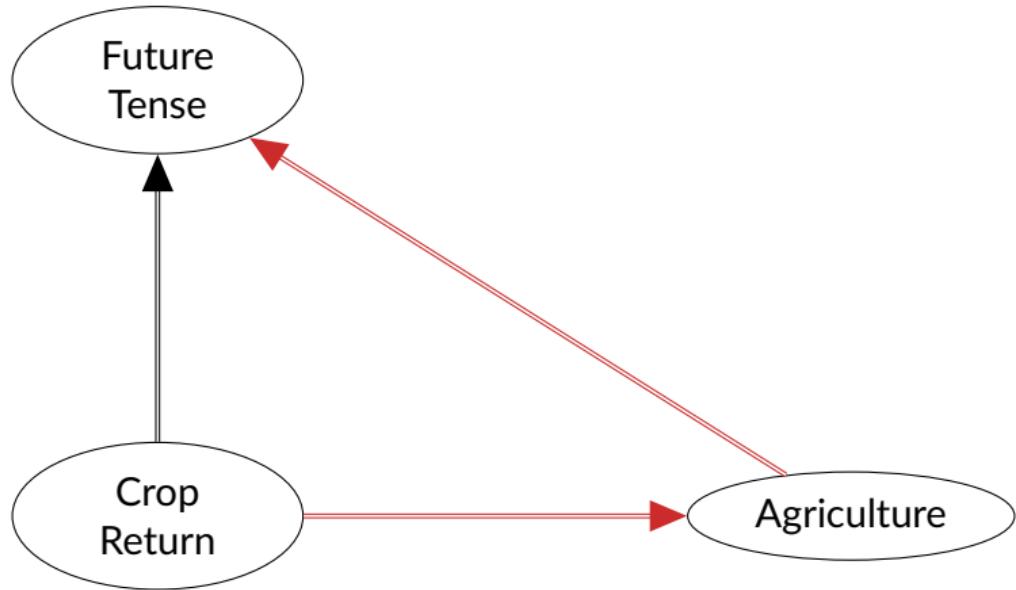
Mechanisms



Mechanisms



Mechanisms



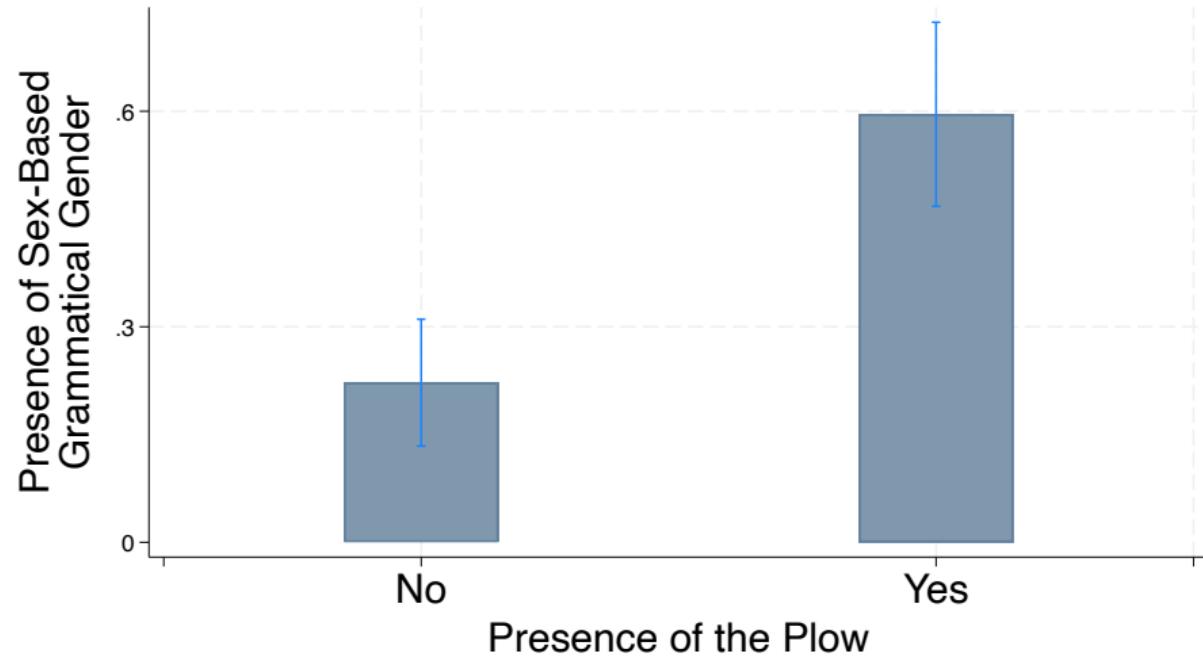
Geographic Origins of Mechanism and Language Structure

	Mechanism			Language Structure		
	Plow	Hierarchy	Agr.Intensity	Gender	Politeness	Future
	(1)	(2)	(3)	(4)	(5)	(6)
Caloric Plow Suitability	0.06** (0.02)					
Ecological Diversity		0.12*** (0.03)				
Caloric Crop Return			0.24*** (0.03)			
All Geographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.47	0.32	0.64	0.31	0.48	0.17
Observations	1175	1154	1303	145	139	263

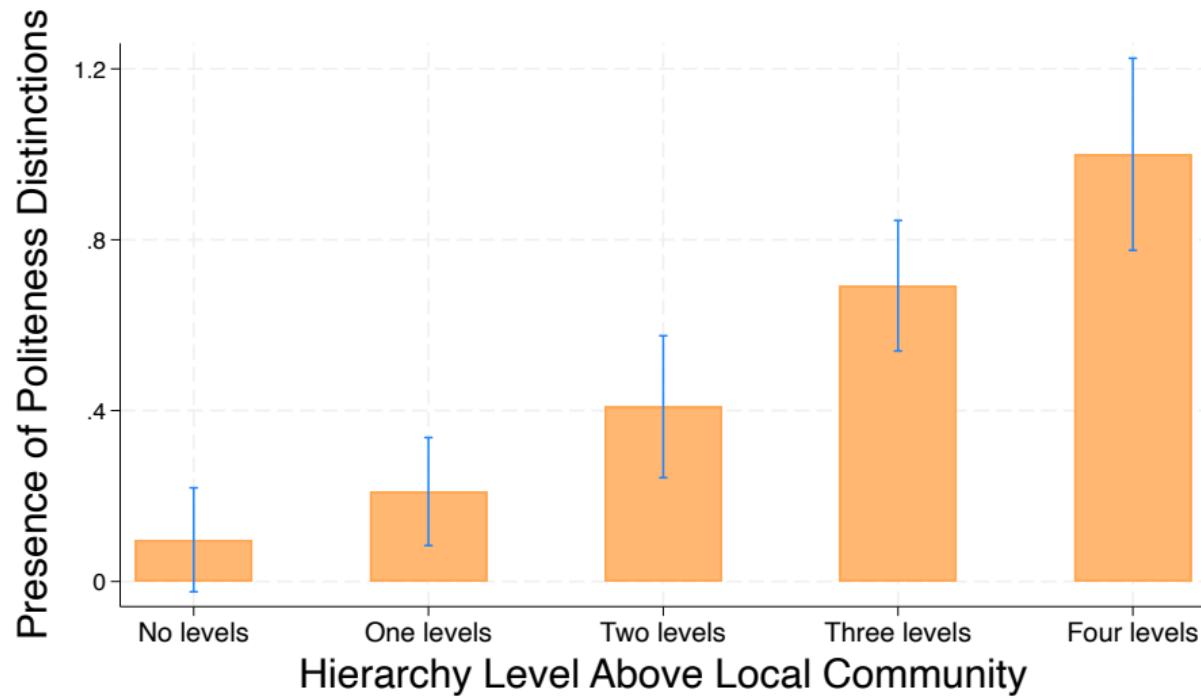
Geographic Origins of Mechanism and Language Structure

	Mechanism			Language Structure		
	Plow	Hierarchy	Agr.Intensity	Gender	Politeness	Future
	(1)	(2)	(3)	(4)	(5)	(6)
Aboriginal Plow	0.23** (0.11)					
Jurisdictional Hierarchy	0.16*** (0.03)					
Intensity of Agriculture	0.08* (0.04)					
All Geographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- <i>R</i> ²	0.47	0.32	0.64	0.31	0.48	0.17
Observations	1175	1154	1303	145	139	263

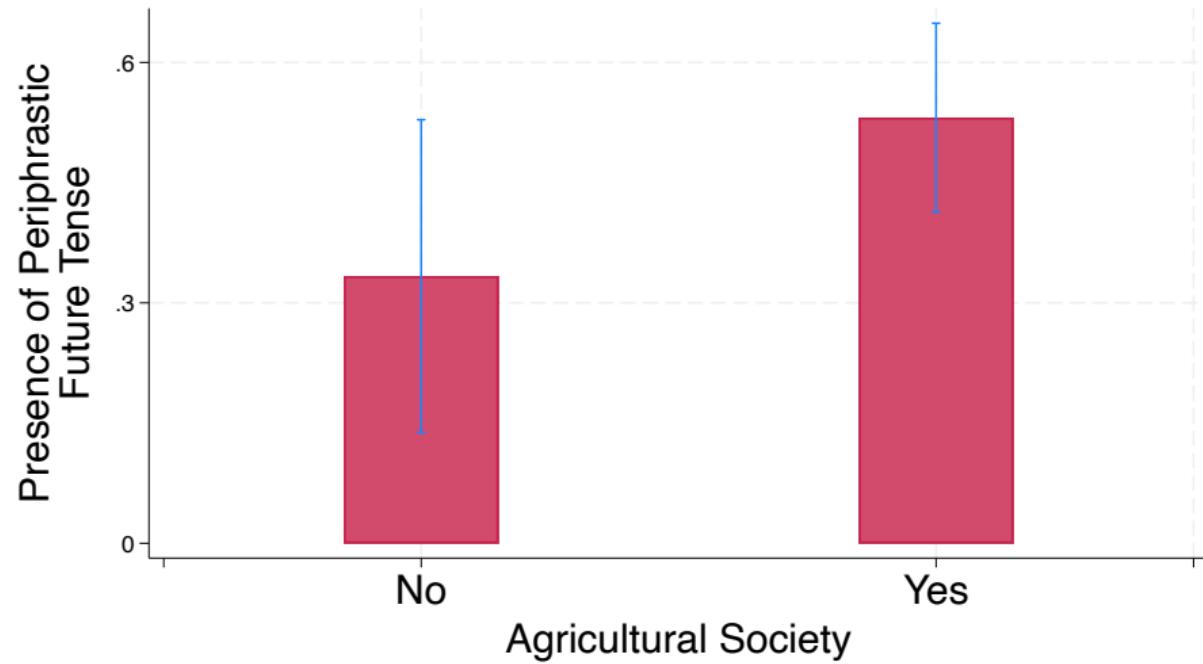
Plow and Sex-Based Grammatical Gender



Statehood and Politeness Distinctions

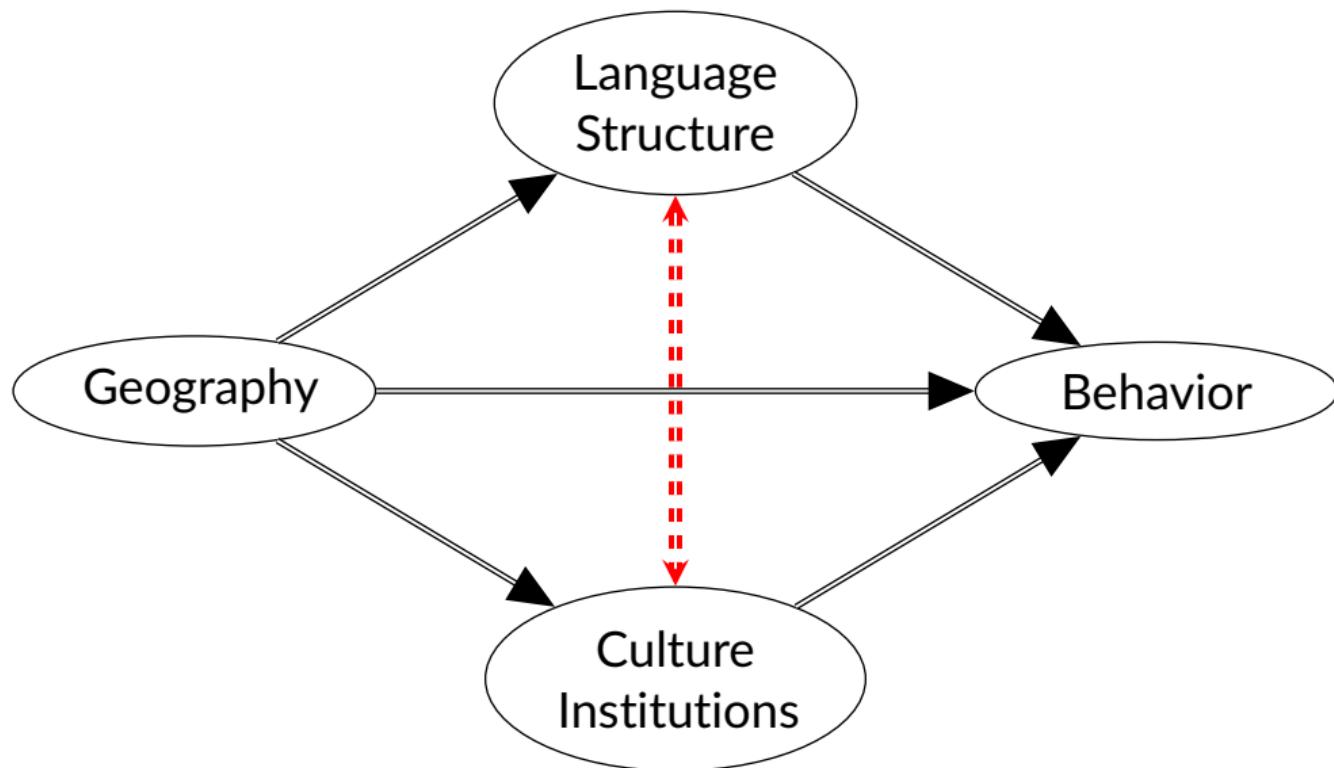


Agricultural Intensity and Future Tense



Consequences

Geography, Language & Contemporary Behavior



Main Identification Challenge

Main Identification Challenge

- Isolate the effects of Language from

Main Identification Challenge

- Isolate the effects of Language from
 - Other Cultural Characteristics

Main Identification Challenge

- Isolate the effects of Language from
 - Other Cultural Characteristics
 - Institutions

Main Identification Challenge

- Isolate the effects of Language from
 - Other Cultural Characteristics
 - Institutions
 - Geography

Identification Strategy

Identification Strategy

- Conventional (Imperfect) Approach – The Epidemiological Approach

Identification Strategy

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 - Analyze migrants and their descendants

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(geography, institutions, culture)

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 - Post-2000 (Census + ACS)

Identification Strategy

- Conventional (Imperfect) Approach – The Epidemiological Approach
 - Analyze migrants and their descendants
 - Account for location FEs
(geography, institutions, culture)
 - Account for individual characteristics
(e.g., age, gender, marital status, etc.)
 - Account for year FE
- Migrants and their descendants in US Census
 - Post-2000 (Census + ACS)
 - Large sample

Major Concern in the Epidemiological Approach

Potential Concerns:

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography
 - Institutions

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography
 - Institutions
 - Other Cultural Characteristics

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography
 - Institutions
 - Other Cultural Characteristics

Remedy:

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography
 - Institutions
 - Other Cultural Characteristics

Remedy:

- Account for Ancestral FE

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography
 - Institutions
 - Other Cultural Characteristics

Remedy:

- Account for Ancestral FE
 - Major methodological contribution to the epidemiological approach

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography
 - Institutions
 - Other Cultural Characteristics

Remedy:

- Account for Ancestral FE
 - **Major methodological contribution to the epidemiological approach**
 - Exploit variations in spoken languages across individuals with same ancestral origin

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography
 - Institutions
 - Other Cultural Characteristics

Remedy:

- Account for Ancestral FE
 - **Major methodological contribution to the epidemiological approach**
 - Exploit variations in spoken languages across individuals with same ancestral origin
 - Migrants from Belgium who speak Flemish, French or other languages

Major Concern in the Epidemiological Approach

Potential Concerns:

- Omitted Ancestral Characteristics
 - Geography
 - Institutions
 - Other Cultural Characteristics

Remedy:

- Account for Ancestral FE
 - **Major methodological contribution to the epidemiological approach**
 - Exploit variations in spoken languages across individuals with same ancestral origin
 - Migrants from Belgium who speak Flemish, French or other languages
 - Accounts for variations due to (cultural) differences across countries of origin

Identification Strategy

Potential Concerns:

Identification Strategy

Potential Concerns:

- Omitted Parental Characteristics

Identification Strategy

Potential Concerns:

- Omitted Parental Characteristics
 - Preferences

Identification Strategy

Potential Concerns:

- Omitted Parental Characteristics
 - Preferences
 - Background

Identification Strategy

Potential Concerns:

- Omitted Parental Characteristics
 - Preferences
 - Background

Remedy:

Identification Strategy

Potential Concerns:

- Omitted Parental Characteristics
 - Preferences
 - Background

Remedy:

- Account for parental characteristics

Identification Strategy

Potential Concerns:

- Omitted Parental Characteristics
 - Preferences
 - Background

Remedy:

- Account for parental characteristics
 - Education

Identification Strategy

Potential Concerns:

- Omitted Parental Characteristics
 - Preferences
 - Background

Remedy:

- Account for parental characteristics
 - Education
 - English proficiency

Identification Strategy

Identification Strategy

Potential Concerns:

Identification Strategy

Potential Concerns:

- Selective Ethnic Attrition

Identification Strategy

Potential Concerns:

- Selective Ethnic Attrition
 - Second Generation and Higher Migrant Sample is based on Self-reported Ancestry

Identification Strategy

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 - Second Generation and Higher Migrant Sample is based on Self-reported Ancestry
 - Self-identification varies by

Identification Strategy

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Identification Strategy

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 - Education

Identification Strategy

Remedy:

Identification Strategy

Remedy:

- Second Generation Migrants

Identification Strategy

Remedy:

- Second Generation Migrants
 - Perfect identification of ancestry by parental country of birth

Identification Strategy

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 - Live with parents \implies Parental controls

Identification Strategy

Remedy:

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 - Perfect identification of ancestry by parental country of birth
 - Live with parents \implies Parental controls
- One-Half-Generation Migrants [Figure](#)

Identification Strategy

Remedy:

- Second Generation Migrants
 - Perfect identification of ancestry by parental country of birth
 - Live with parents \implies Parental controls
- One-Half-Generation Migrants [Figure](#)
 - Perfect identification of ancestry by country of birth

Identification Strategy

Remedy:

- Second Generation Migrants
 - Perfect identification of ancestry by parental country of birth
 - Live with parents \implies Parental controls
- One-Half-Generation Migrants [Figure](#)
 - Perfect identification of ancestry by country of birth
 - Individuals that do not necessarily live with parents

Periphrastic Future Tense and College Education of Children of Migrants

	College Attendance						
	All			Parental		No English	No Spanish
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Periphrastic Future Tense	0.232*** (0.057)	0.226*** (0.057)	0.053*** (0.020)	0.038*** (0.012)	0.035*** (0.012)	0.053** (0.024)	0.029* (0.015)
Mom's Education Level (HS+)				0.132*** (0.011)	0.134*** (0.011)	0.116*** (0.016)	0.127*** (0.015)
Dad's Education Level (HS+)				0.133*** (0.012)	0.136*** (0.011)	0.125*** (0.018)	0.130*** (0.014)
Mom's English Level					0.015*** (0.001)	0.016*** (0.001)	0.010*** (0.002)
Dad's English Level					0.010*** (0.002)	0.009*** (0.001)	0.012*** (0.003)
Geographical Controls (Language Homeland)	Yes						
State & Year FE	Yes						
Age, Gender, & Marital Status FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Parental Country of Origin FE	No	No	Yes	Yes	Yes	Yes	Yes
R ²	0.05	0.13	0.16	0.21	0.21	0.23	0.24
Observations	735482	735482	735482	164722	164722	96738	96614

Robustness

- The analysis is robust to

Robustness

- The analysis is robust to
 - Accounting for Other Language Structures [Table](#)

Robustness

- The analysis is robust to
 - Accounting for Other Language Structures [Table](#)
 - Sample selection

Robustness

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 - One and a half generation migrants [Table](#)

Robustness

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 - Second generation and higher migrants [Table](#)

Robustness

- The analysis is robust to
 - Accounting for Other Language Structures [Table](#)
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 - Second generation and higher migrants [Table](#)
 - Bias due to local labor market conditions

Robustness

- The analysis is robust to
 - Accounting for Other Language Structures [Table](#)
 - Sample selection
 - One and a half generation migrants [Table](#)
 - Second generation and higher migrants [Table](#)
 - Bias due to local labor market conditions
 - Analysis with county FE [Table](#)

Interpretation

- In the absence of parental origin FE

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 - The effect of the future tense is indistinguishable from the effect of other ancestral cultural characteristics associated with LTO

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- Individuals that speak a language with future tense have a 20% higher probability of attending college

Interpretation

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 - The effect of the future tense is indistinguishable from the effect of other ancestral cultural characteristics associated with LTO
 - Individuals that speak a language with future tense have a 20% higher probability of attending college
- Accounting for parental origin FE

Interpretation

- In the absence of parental origin FE
 - The effect of the future tense is indistinguishable from the effect of other ancestral cultural characteristics associated with LTO
 - Individuals that speak a language with future tense have a 20% higher probability of attending college
- Accounting for parental origin FE
 - Isolates the effect of the future tense from the effect of other ancestral cultural characteristics associated with LTO

Interpretation

- In the absence of parental origin FE
 - The effect of the future tense is indistinguishable from the effect of other ancestral cultural characteristics associated with LTO
 - Individuals that speak a language with future tense have a 20% higher probability of attending college
- Accounting for parental origin FE
 - Isolates the effect of the future tense from the effect of other ancestral cultural characteristics associated with LTO
 - Individuals that speak a language with future tense have a 5% higher probability of attending college

Interpretation

- In the absence of parental origin FE

- The effect of the future tense is indistinguishable from the effect of other ancestral cultural characteristics associated with LTO
- Individuals that speak a language with future tense have a 20% higher probability of attending college

- Accounting for parental origin FE

- Isolates the effect of the future tense from the effect of other ancestral cultural characteristics associated with LTO
- Individuals that speak a language with future tense have a 5% higher probability of attending college
- Future tense per se accounts for 25% of the effect of ancestral culture

Interpretation

- In the absence of parental origin FE

- The effect of the future tense is indistinguishable from the effect of other ancestral cultural characteristics associated with LTO
- Individuals that speak a language with future tense have a 20% higher probability of attending college

- Accounting for parental origin FE

- Isolates the effect of the future tense from the effect of other ancestral cultural characteristics associated with LTO
- Individuals that speak a language with future tense have a 5% higher probability of attending college
- Future tense per se accounts for 25% of the effect of ancestral culture
- Large effect: $\approx 29\%$ of having college educated parent

Sex-Based Grammatical Gender and Female College Education of Children of Migrants

	College Attendance						
	All			Parental		No English	No Spanish
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Existence of Sex-Based Gender System	-0.240*** (0.065)	-0.230*** (0.060)	-0.055** (0.024)	-0.059*** (0.019)	-0.053** (0.020)	-0.086* (0.047)	-0.046** (0.018)
Mom's Education Level (HS+)				0.125*** (0.010)	0.128*** (0.009)	0.111*** (0.016)	0.122*** (0.016)
Dad's Education Level (HS+)				0.122*** (0.011)	0.124*** (0.011)	0.119*** (0.019)	0.117*** (0.012)
Mom's English Level					0.017*** (0.002)	0.019*** (0.002)	0.007*** (0.002)
Dad's English Level					0.009*** (0.002)	0.008*** (0.001)	0.015*** (0.003)
Geographical Controls (Language Homeland)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age, Gender, & Marital Status FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Parental Country of Origin FE	No	No	Yes	Yes	Yes	Yes	Yes
R ²	0.05	0.13	0.16	0.20	0.20	0.20	0.25
Observations	345778	345778	345778	66267	66267	38323	34731

Conclusions

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Research finds supportive evidence for

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- Coevolution of culture, language and development

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- Causes and consequences of the evolution of languages

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- Causes and consequences of the evolution of languages
 - Effect of the economic environment on languages

Conclusions

Research finds supportive evidence for

- Coevolution of culture, language and development
 - Association between culture and language
 - Role of language in cultural persistence
- Causes and consequences of the evolution of languages
 - Effect of the economic environment on languages
 - Effect of languages on human behavior

Geographical Roots and Consequences of the Coevolution of Cultural and Linguistic Traits

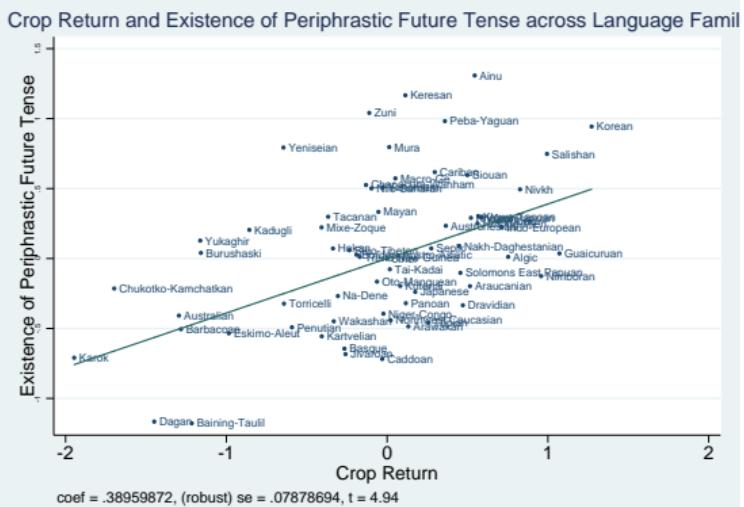
Ömer Özak

Department of Economics
Southern Methodist University

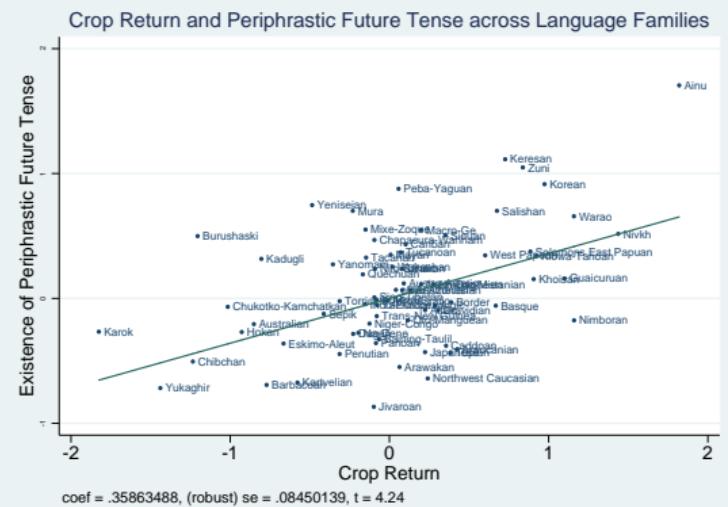
Economic Growth and Comparative Development

	Existence of Periphrastic Future Tense					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Probit						
Crop Return (pre-1500CE)	0.06** (0.03)	0.06** (0.03)	0.06** (0.03)	0.07** (0.03)	0.09*** (0.03)	0.12*** (0.03)
Geographical Controls	No	Yes	Yes	Yes	Yes	Yes
Regional FE	No	No	No	No	No	Yes
Pseudo- R^2	0.01	0.03	0.04	0.08	0.10	0.14
Observations	275	275	275	275	275	275
Panel B: OLS - Spatial-Autocorrelation, Clustering and Selection On Unobservables						
Crop Return (pre-1500CE)	0.06** (0.03) {[0.04]} [0.04] {0.03}	0.06** (0.03) {[0.04]} [0.04] {0.03}	0.07** (0.03) {[0.03]} [0.03] {0.03}	0.07** (0.03) {[0.03]} [0.03] {0.03}	0.09*** (0.03) {[0.03]} [0.03] {0.03}	0.11*** (0.03) {[0.03]} [0.03] {0.03}
Altonji et al						-2.09
δ						-2.84
β -Oster						0.13
R^2	0.01	0.04	0.06	0.10	0.12	0.17

Language Family Level Analysis Figures [Back](#)



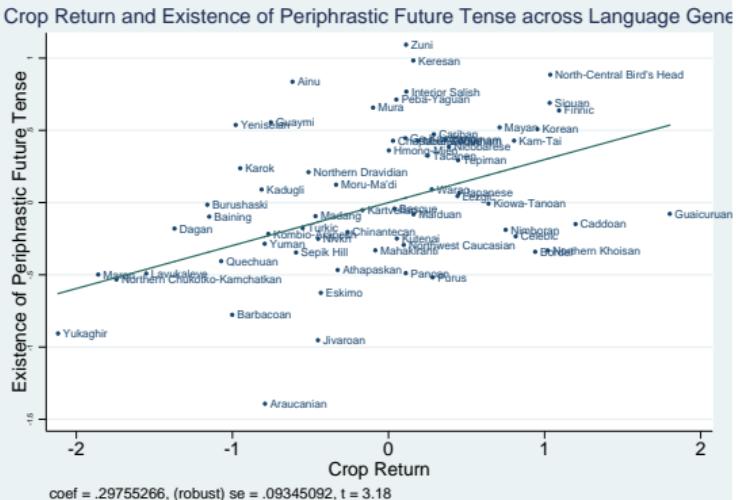
(a) Median



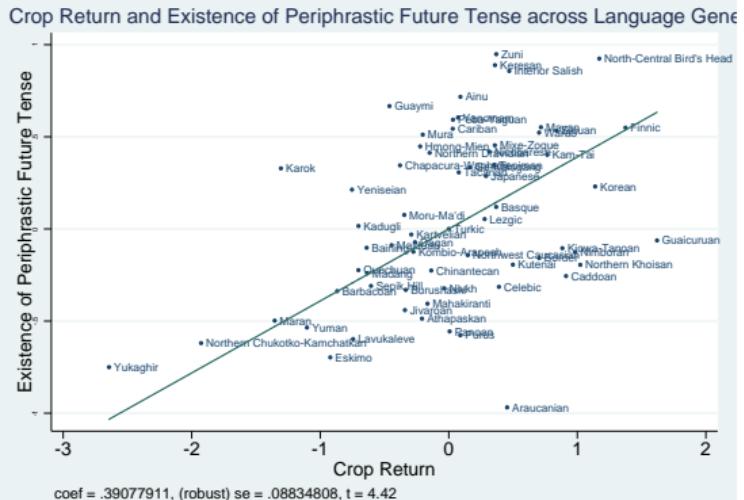
(b) Mean

Genus Level Analysis Figures

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(c) Median



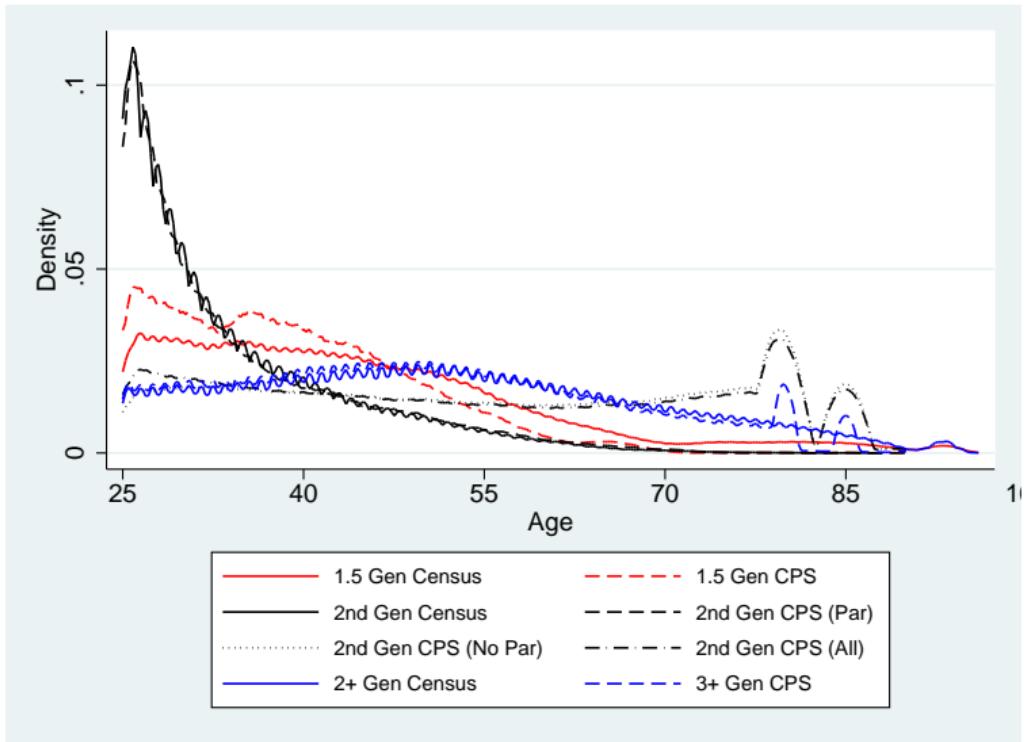
(d) Mean

Age, Gender, Marital Status and Education Attendance

	Means							
	1.5 Generation		2nd Generation				2+ Generations	
	Census	CPS	Census	CPS (living with Parents)	CPS (not living with Parents)	CPS (All)	Census	CPS (3+ Generation)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education Level (HS+)	0.596*** (0.001)	0.648*** (0.001)	0.552*** (0.001)	0.600*** (0.002)	0.568*** (0.000)	0.571*** (0.000)	0.535*** (0.000)	0.572*** (0.000)
Age	43.742*** (0.022)	38.625*** (0.024)	33.913*** (0.022)	34.092*** (0.032)	55.963*** (0.017)	54.376*** (0.017)	51.685*** (0.004)	50.133*** (0.004)
Gender	1.518*** (0.001)	1.518*** (0.001)	1.457*** (0.001)	1.462*** (0.002)	1.537*** (0.000)	1.531*** (0.000)	1.526*** (0.000)	1.527*** (0.000)
Marital Status	2.702*** (0.003)	2.737*** (0.005)	4.933*** (0.004)	5.099*** (0.005)	2.597*** (0.002)	2.779*** (0.002)	2.524*** (0.000)	2.489*** (0.001)
Observations	429372	174094	181099	94331	1205633	1299964	20596324	14180541

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Age Density Distribution of All Samples



2nd Generation Migrants – Accounting for Other Language Structures [Back](#)

	College Attendance						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Periphrastic Future Tense	0.050*** (0.006)	0.055*** (0.007)	0.046*** (0.007)	0.032*** (0.011)	0.048*** (0.007)	0.048*** (0.006)	0.050*** (0.006)
Crop Return (pre-1500CE)	0.009*** (0.002)	0.008*** (0.002)	0.006*** (0.002)	-0.005 (0.003)	0.006** (0.003)	0.009*** (0.002)	0.009*** (0.002)
Past Tense		0.011 (0.011)					
The Perfect				-0.022*** (0.006)			
Existence of Gender System					-0.046*** (0.015)		
Evidentiality						0.022*** (0.007)	
Consonant Inventories							0.005 (0.006)
Consonant-Vowel Ratio							0.002 (0.003)
Geographical Controls (Language Homeland)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age, Gender, & Marital Status FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental Country of Origin FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental Education	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.14	0.14	0.14	0.14	0.14	0.14	0.14
R^2	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Observations	204261	202885	202885	199388	202552	204261	204261

Periphrastic Future Tense and College Education of One-and-a-half Generation Migrants

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	College Attendance							
	All			Parental			No English	No Spanish
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Periphrastic Future Tense	0.228*** (0.062)	0.224*** (0.061)	0.065** (0.025)	0.068*** (0.017)	0.078*** (0.018)	0.073*** (0.017)	0.082*** (0.026)	0.056* (0.030)
Mom's Education Level (HS+)					0.129*** (0.013)	0.132*** (0.013)	0.112*** (0.020)	0.123*** (0.021)
Dad's Education Level (HS+)					0.130*** (0.012)	0.130*** (0.013)	0.123*** (0.022)	0.124*** (0.015)
Mom's English Level						0.015*** (0.002)	0.014*** (0.002)	0.008** (0.003)
Dad's English Level						0.010*** (0.004)	0.007** (0.003)	0.020*** (0.006)
Geographical Controls (Language Homeland)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age, Gender, & Marital Status FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental Country of Origin FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- R^2	0.06	0.10	0.14	0.16	0.19	0.19	0.21	0.18
R^2	0.06	0.15	0.19	0.26	0.29	0.29	0.31	0.31
Observations	513028	513028	513028	30104	30104	30104	19664	17187

Periphrastic Future Tense and College Education of Second Generation Migrants

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	College Attendance							
	All			Parental			No English	No Spanish
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Periphrastic Future Tense	0.224*** (0.054)	0.221*** (0.052)	0.027** (0.011)	0.026** (0.010)	0.027*** (0.010)	0.025** (0.010)	0.047* (0.024)	0.027** (0.013)
Mom's Education Level (HS+)					0.130*** (0.011)	0.132*** (0.011)	0.115*** (0.016)	0.125*** (0.014)
Dad's Education Level (HS+)					0.134*** (0.012)	0.137*** (0.011)	0.125*** (0.019)	0.130*** (0.014)
Mom's English Level						0.015*** (0.001)	0.016*** (0.000)	0.009*** (0.002)
Dad's English Level						0.010*** (0.001)	0.009*** (0.001)	0.009*** (0.003)
Geographical Controls (Language Homeland)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age, Gender, & Marital Status FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental Country of Origin FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted- <i>R</i> ²	0.05	0.08	0.12	0.13	0.17	0.17	0.18	0.17
<i>R</i> ²	0.05	0.13	0.17	0.18	0.21	0.21	0.22	0.24
Observations	214374	214374	214374	131057	131057	131057	74968	76206

Periphrastic Future Tense and College Education of Children of Migrants Accounting for Local Labor Market Conditions

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	College Attendance						
	All			Parental		No English	No Spanish
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Periphrastic Future Tense	0.224*** (0.053)	0.217*** (0.053)	0.054*** (0.019)	0.034** (0.013)	0.031** (0.012)	0.042 (0.030)	0.026 (0.020)
Mom's Education Level (HS+)				0.131*** (0.012)	0.134*** (0.012)	0.114*** (0.015)	0.129*** (0.017)
Dad's Education Level (HS+)				0.129*** (0.011)	0.132*** (0.011)	0.121*** (0.017)	0.126*** (0.014)
Mom's English Level					0.015*** (0.001)	0.016*** (0.001)	0.009*** (0.002)
Dad's English Level					0.011*** (0.002)	0.010*** (0.001)	0.013*** (0.003)
Geographical Controls (Language Homeland)	Yes						
County & Year FE	Yes						
Age, Gender, & Marital Status FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Parental Country of Origin FE	No	No	Yes	Yes	Yes	Yes	Yes
Adjusted- <i>R</i> ²	0.05	0.09	0.13	0.17	0.17	0.18	0.17
<i>R</i> ²	0.05	0.14	0.18	0.23	0.23	0.26	0.24
Observations	678969	678969	678969	152991	152991	89363	88465

Sex-Based Grammatical Gender and Female College Education of Children of Migrants Accounting for Local Labor Market Conditions

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	College Attendance						
	All			Parental		No English	No Spanish
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Existence of Sex-Based Gender System	-0.225*** (0.063)	-0.216*** (0.060)	-0.051** (0.025)	-0.068*** (0.022)	-0.062*** (0.021)	-0.122*** (0.042)	-0.065*** (0.021)
Mom's Education Level (HS+)				0.125*** (0.011)	0.128*** (0.011)	0.108*** (0.014)	0.123*** (0.016)
Dad's Education Level (HS+)				0.114*** (0.011)	0.116*** (0.011)	0.112*** (0.016)	0.112*** (0.012)
Mom's English Level					0.018*** (0.002)	0.019*** (0.002)	0.007*** (0.002)
Dad's English Level					0.011*** (0.002)	0.009*** (0.001)	0.015*** (0.004)
Geographical Controls (Language Homeland)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age, Gender, & Marital Status FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Parental Country of Origin FE	No	No	Yes	Yes	Yes	Yes	Yes
Adjusted- <i>R</i> ²	0.05	0.09	0.12	0.14	0.14	0.15	0.15
<i>R</i> ²	0.05	0.14	0.18	0.22	0.22	0.24	0.25
Observations	318194	318194	318194	61278	61278	35129	31561