The Geographical Origins of the Tower of Babel: The Economic Causes and Consequences of Linguistic Structures

Oded Galor, Ömer Özak and Assaf Sarid

AEA Meeting, January 2016

Culture and Development

- Geographic Origins of Culture

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  - Agricultural origin of time preference

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  - Reinforced by horizontal transmission

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  - Ethnic fractionalization $\Longleftrightarrow$ linguistic fractionalization

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  - Does linguistic structure affect the economy's future trajectory?

The Causes and Consequences of the Future Tense

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  - Contemporary economic outcomes at the individual level

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    - Partly reflects the effect of time preference

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    - Education

Structure of the presentation

1. Introduction
2. The Future Tense
3. Data
4. Empirical Analysis
5. Conclusions

The Future Tense

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    - Absence or non-compulsory use of the future tense

Example – Strong vs. Weak Future

- In English, no distinction between the two:
  1. I *am giving* a talk at the moment.
  2. I *am giving* a talk tomorrow.

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- In English, no distinction between the two:
  1. I *am giving* a talk at the moment.
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- In Spanish, the distinction between today and tomorrow is clear:
  1. Yo *estoy dando* una charla en este momento.
  2. Yo *daré* una charla mañana.

One more?

Time Preference and Future Tense

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      - Number of words for ice/snow among Eskimo-languages

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      - Case structure in all daughter languages of Latin

Future and Present – Pretty Close...

"Even though the future seems far away, it is actually beginning right now."

– Mattie Stepanek

"The future starts today, not tomorrow."

– Pope John Paul II

Linguistic Data – Existence of Future Tense

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- The variation in the existence of future tense exists:
  - across and within language families
  - across and within all regions on the globe

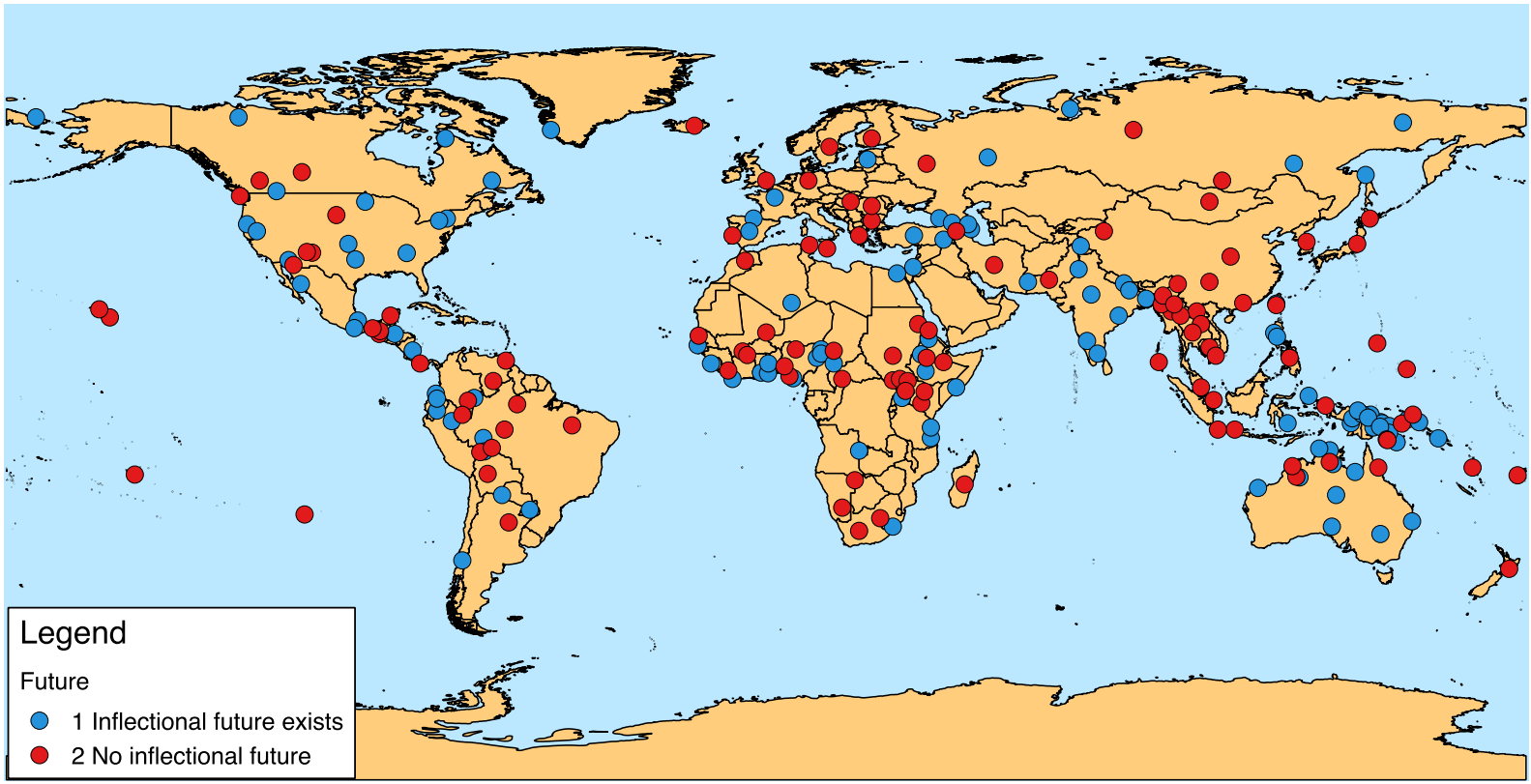
Future Tense in Different Regions in the World

Table: Summary Statistics by Region

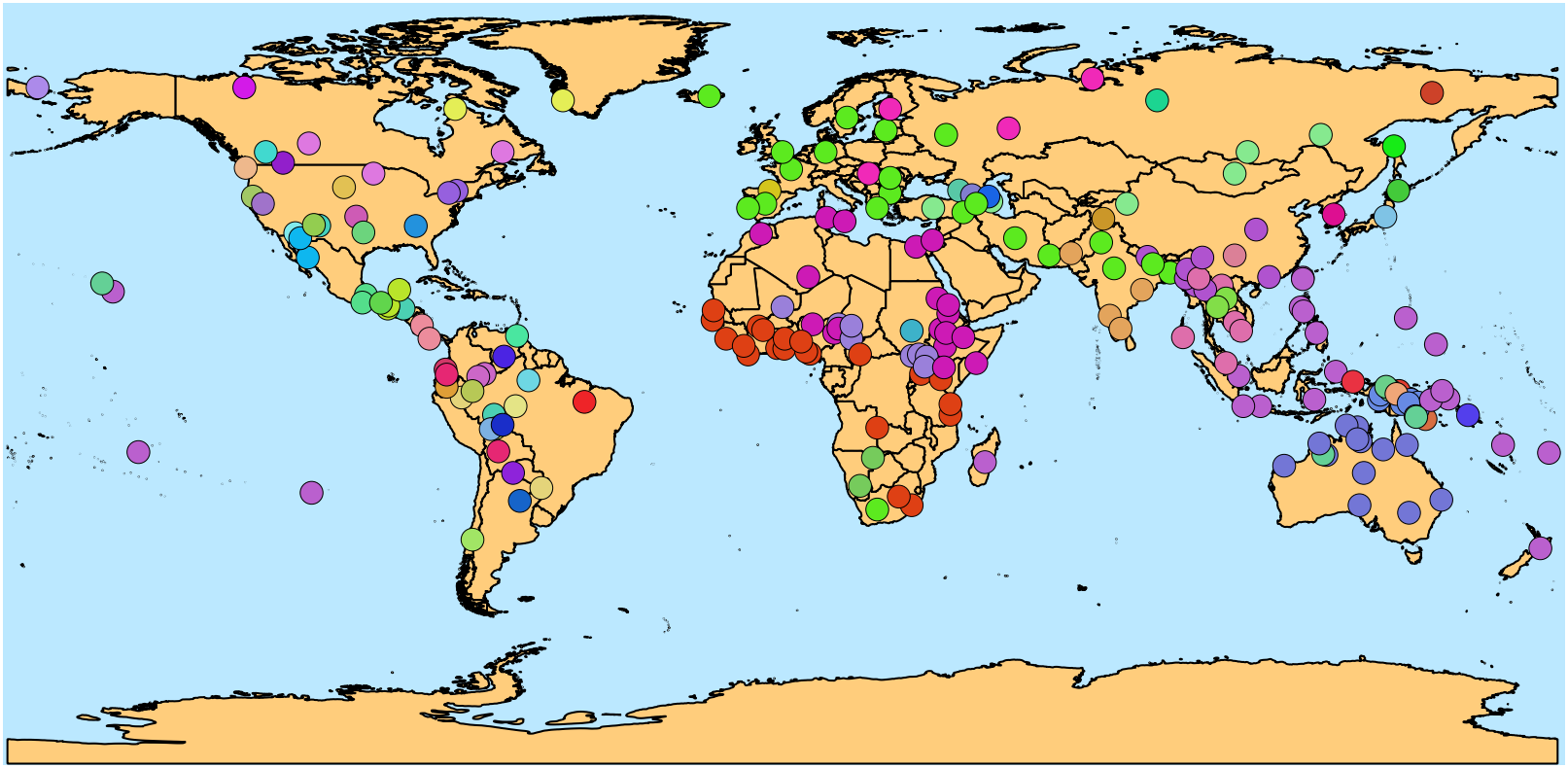
Region	Observations	Mean	Std. Dev.
Sub-Saharan Africa	44	0.455	0.504
Middle East and North Africa	7	0.429	0.535
Europe and Central Asia	27	0.519	0.509
South Asia	13	0.769	0.439
East Asia and Pacific	67	0.463	0.502
North America	21	0.619	0.498
Latin America	29	0.482	0.509
Total	208	0.505	0.501

Future = 1, No Future = 0

Global Distribution of the Presence of Future Tense



Global Distribution of Language Families



Pre-1500CE Crop Return Data

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- Reflecting early stages of development
- Unaffected by human intervention

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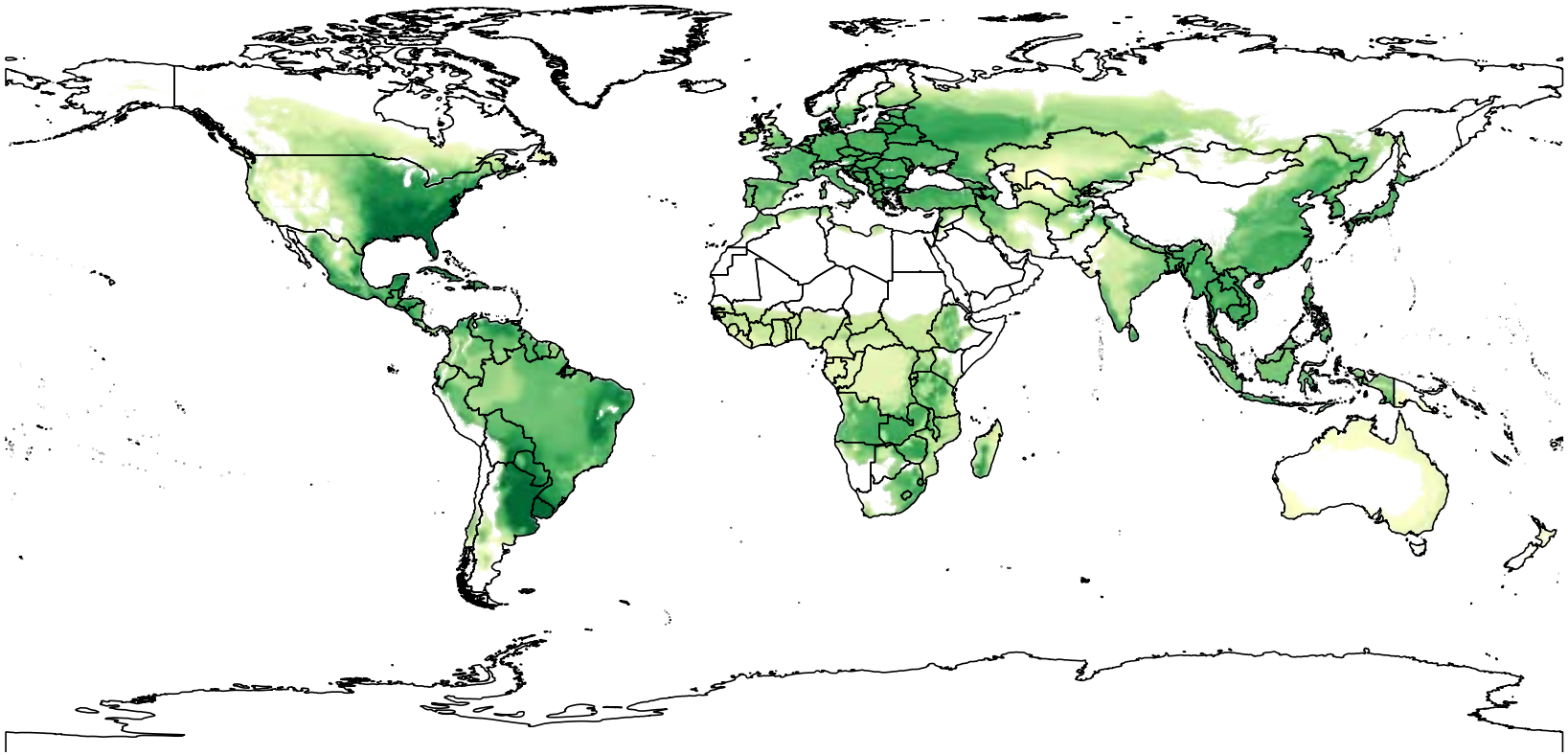
$$\text{Potential Crop Return} = \frac{\text{Potential Crop Yield}}{\text{Potential Crop Growth Cycle}}$$

Potential Crop Return Pre-1500CE



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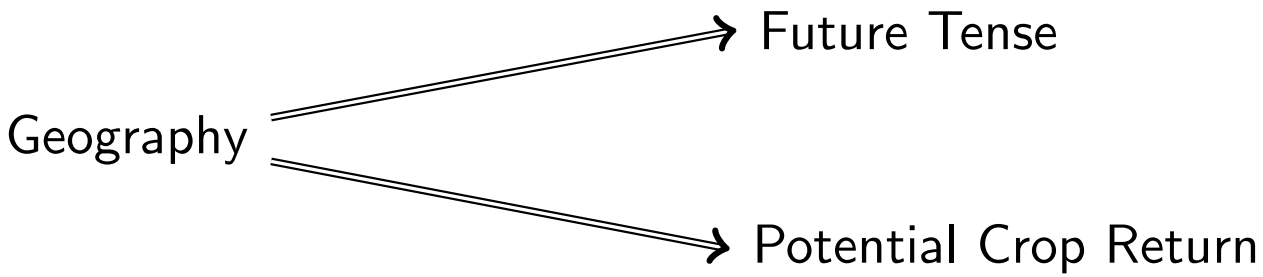

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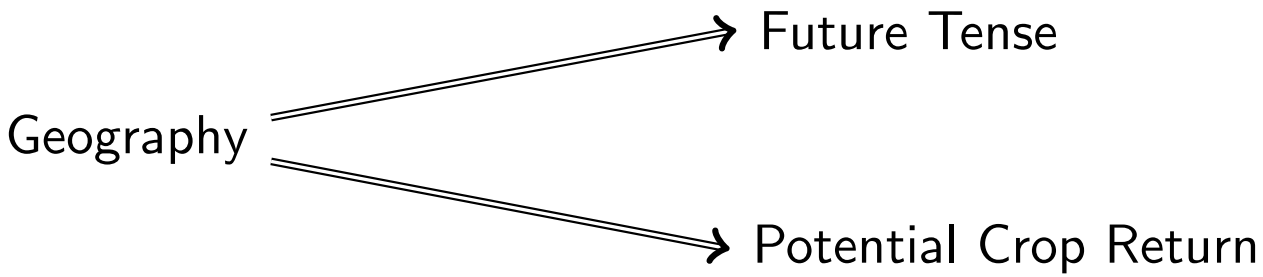

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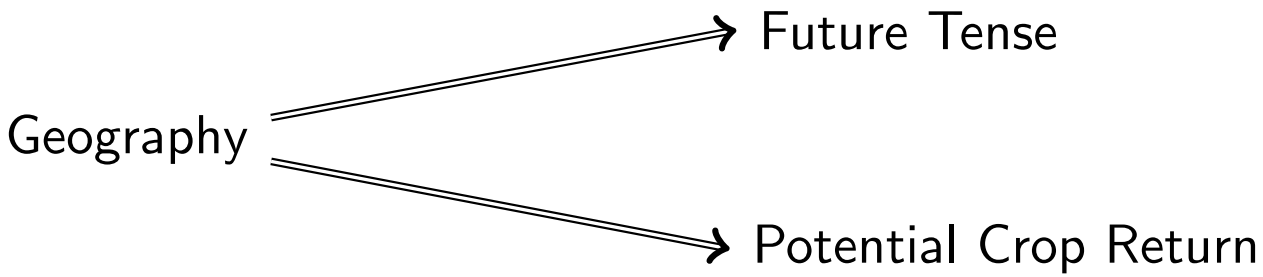

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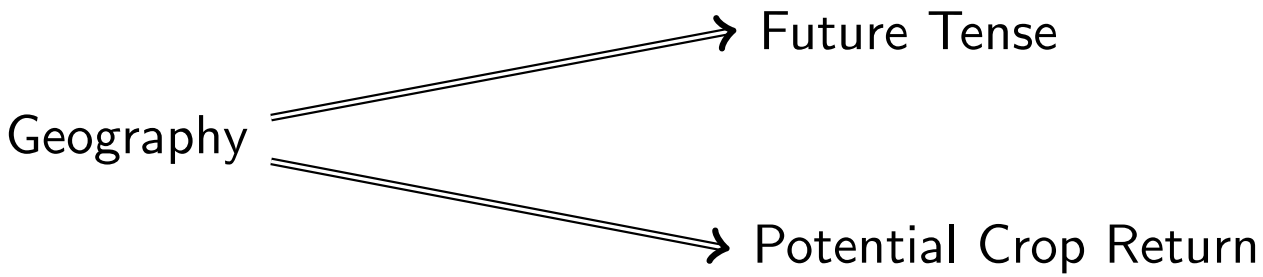

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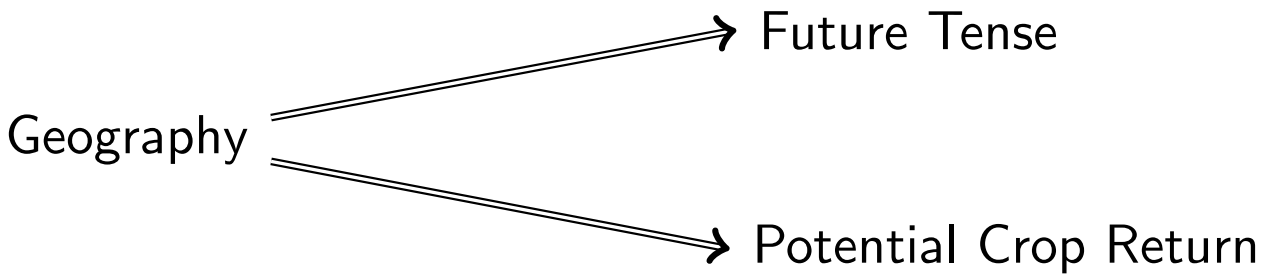

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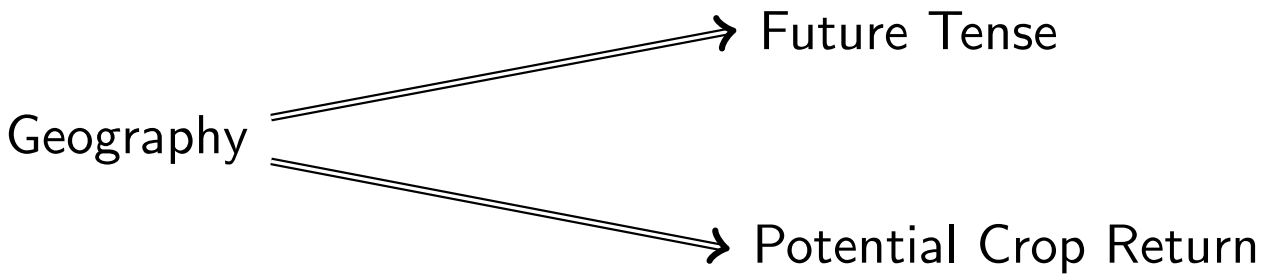

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  - Continental FEs

Empirical Specification

$$Future_i = \beta_0 + \beta_1 \text{crop return}_i + \beta_2 X_i + \delta_c \Delta_i + \epsilon_i,$$

- $Future_i \equiv$ Existence of future tense in language i
- $X_i \equiv$ Geographical controls
- $\Delta_i \equiv$ Continental FEs

Pre-1500CE Crop Return and Future Tense OLS

	Existence of Future Tense (Probit)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Crop Return (pre-1500CE)	-0.07**	-0.10**	-0.10***	-0.10***	-0.10***	-0.09**	-0.09**	-0.10**	-0.09**	-0.12***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Absolute Latitude			-0.13**	-0.13**	-0.13**	-0.10*	-0.11	-0.10	-0.15	-0.17
			(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.12)	(0.12)
Elevation				-0.02	-0.03	-0.04	-0.04	-0.02	-0.05	-0.04
				(0.03)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)
Ruggedness					0.02	0.01	0.02	0.00	0.02	0.03
					(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Coast Length						-0.12**	-0.11**	-0.09**	-0.08**	-0.09**
						(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
Precipitation							-0.02	0.01	0.01	0.00
							(0.05)	(0.08)	(0.08)	(0.08)
Precipitation (std)								-0.10***	-0.04	-0.04
								(0.04)	(0.06)	(0.06)
Precipitation Volatility								0.03	0.01	0.01
								(0.08)	(0.09)	(0.08)
Precipitation Spatial Correlation								-0.02	-0.83**	-0.79**
								(0.05)	(0.34)	(0.35)
Temperature									-0.04	-0.03
									(0.08)	(0.08)
Temperature (std)									-0.07	-0.07
									(0.05)	(0.05)
Temperature Volatility									0.08	0.10
									(0.10)	(0.10)
Temperature Spatial Correlation									0.81**	0.77**
									(0.34)	(0.35)
Crop Winter (pre-1500CE)										-0.07*
										(0.04)
Continental FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R^2	0.02	0.05	0.06	0.06	0.06	0.08	0.08	0.10	0.13	0.14
Observations	208	208	208	208	208	208	208	208	208	208

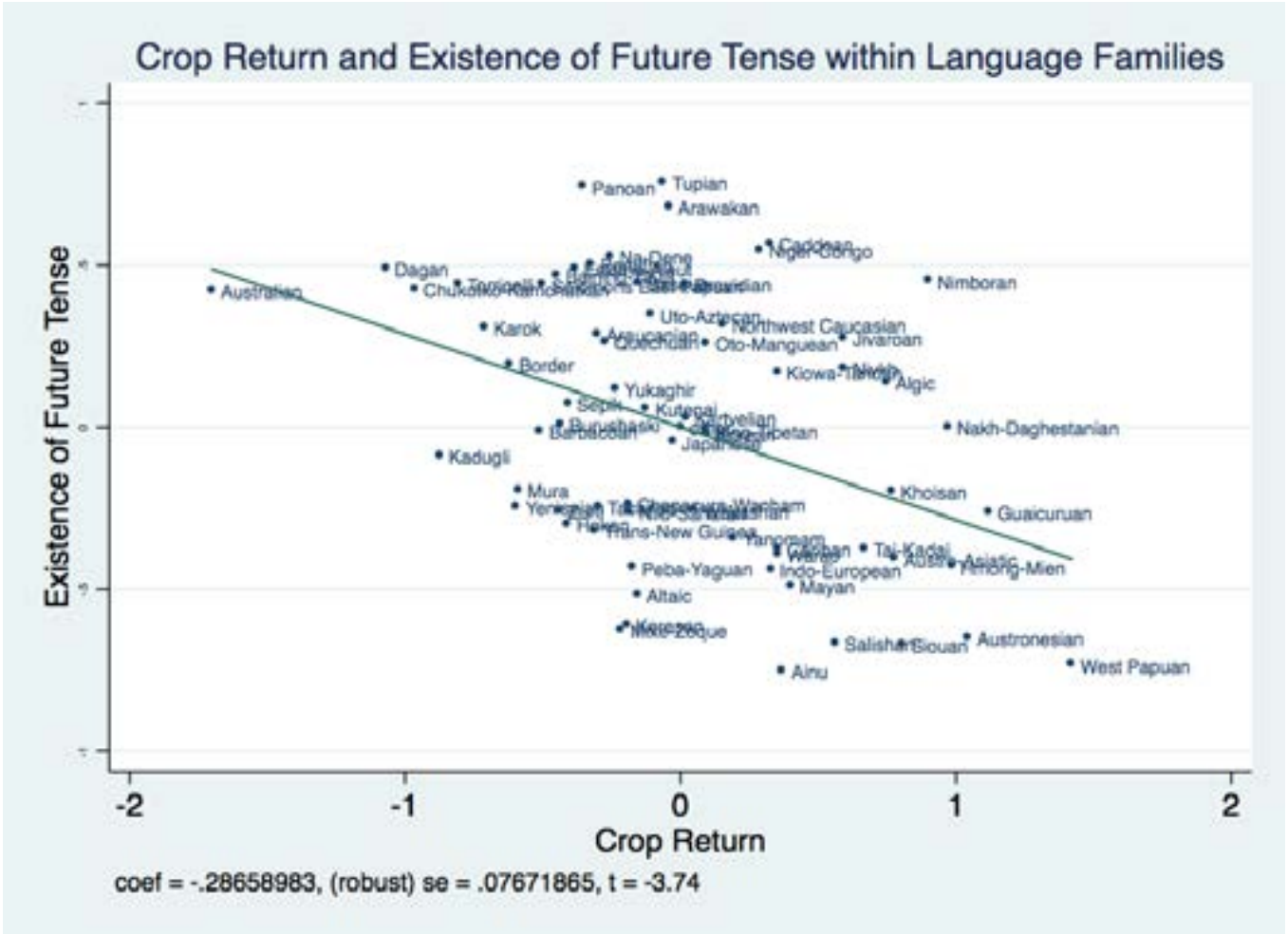
Crop Return and Other Linguistic Structures

	Linguistic Structure							
	Temporal Structures			Non-Temporal Structures				
	Future	Past	Perfect	Gender	Possessive	Evidentiality	Consonants	Colors
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Crop Return (pre-1500CE)	-0.12***	-0.06	0.06	0.04	-0.06	0.01	0.10	0.03
	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)	(0.06)	(0.36)
All Geographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Continental FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted-R^2	0.08	0.08	0.18	0.19	0.14	0.21	0.31	-0.04
Observations	208	208	208	233	216	377	515	113

Future Tense across Language Families

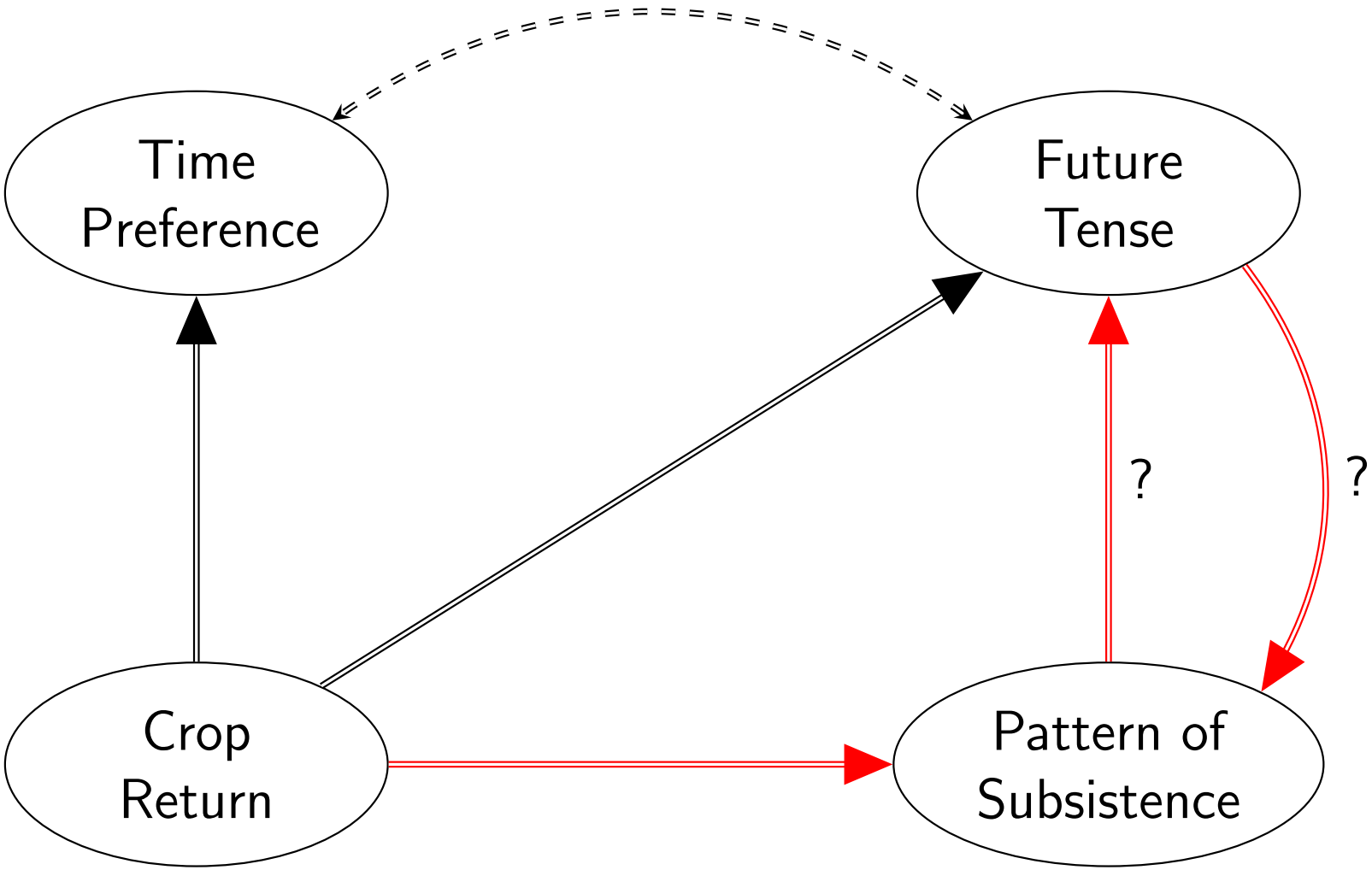
	Existence of Future Tense (median)						
	Full Sample					$\geq$ 2 Languages	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Crop Return (pre-1500CE)	-0.22***	-0.26***	-0.25***	-0.33***	-0.34***	-0.19**	-0.27**
	(0.05)	(0.05)	(0.05)	(0.06)	(0.07)	(0.08)	(0.10)
Continental FE	No	Yes	Yes	Yes	Yes	No	Yes
Main Geographical Controls	No	No	Yes	Yes	Yes	Yes	Yes
Precipitation Controls	No	No	No	Yes	Yes	No	No
Temperature Controls	No	No	No	No	Yes	No	No
Pseudo-R^2	0.12	0.18	0.21	0.26	0.46	0.10	0.25
Observations	68	68	68	68	68	27	27

Language Family Analysis – contd.



(a) All language families

Pre-1500CE Crop Return & Patterns of Subsistence



Ethnographic Subsistence Patterns

- Ethnic groups' subsistence strategies

Ethnographic Subsistence Patterns

- Ethnic groups' subsistence strategies
  - Hunting

Ethnographic Subsistence Patterns

- Ethnic groups' subsistence strategies
  - Hunting
  - Gathering

Ethnographic Subsistence Patterns

- Ethnic groups' subsistence strategies
  - Hunting
  - Gathering
  - Fishing

Ethnographic Subsistence Patterns

- Ethnic groups' subsistence strategies
  - Hunting
  - Gathering
  - Fishing
  - Animal Husbandry

Ethnographic Subsistence Patterns

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  - Gathering
  - Fishing
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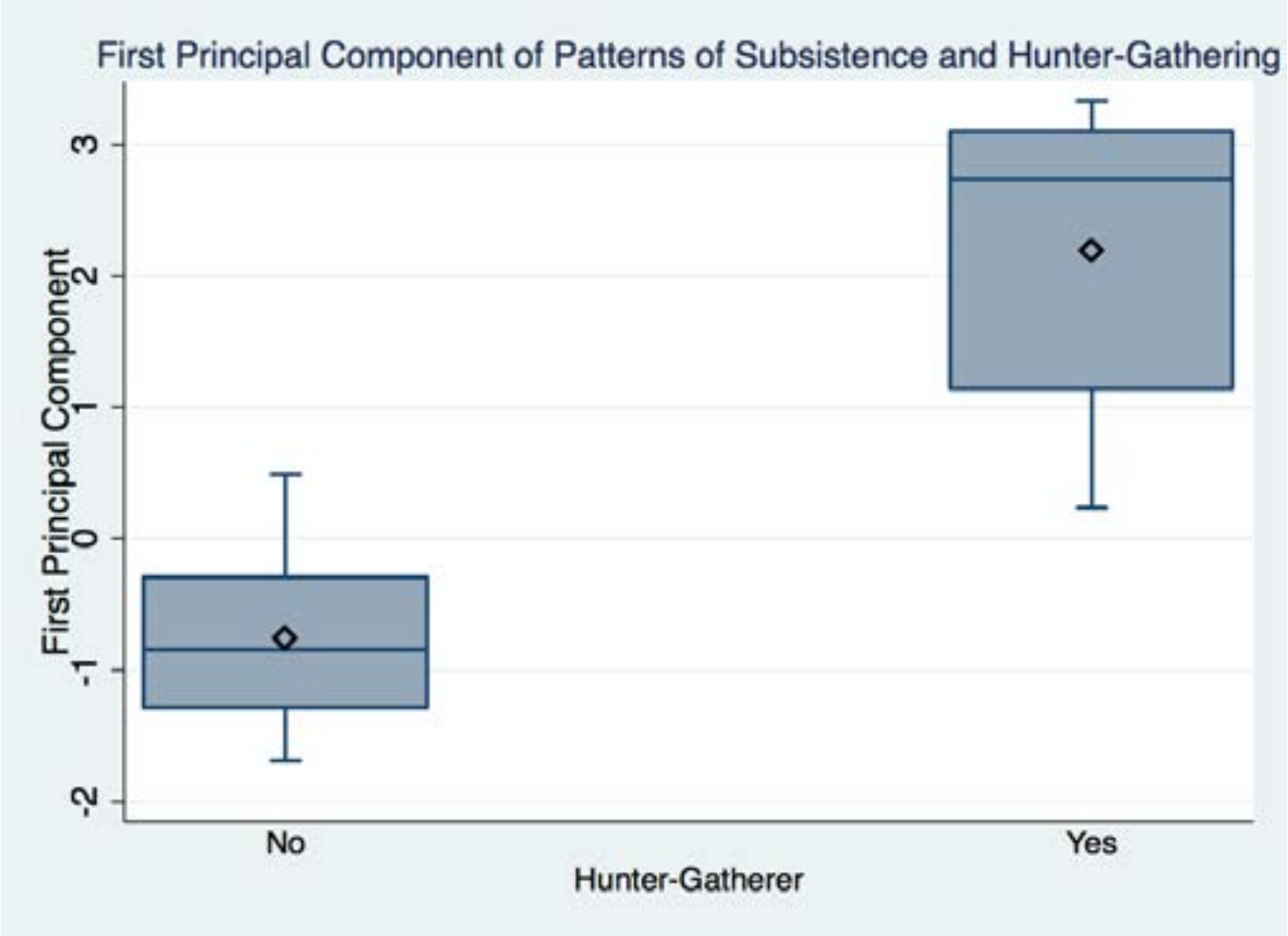
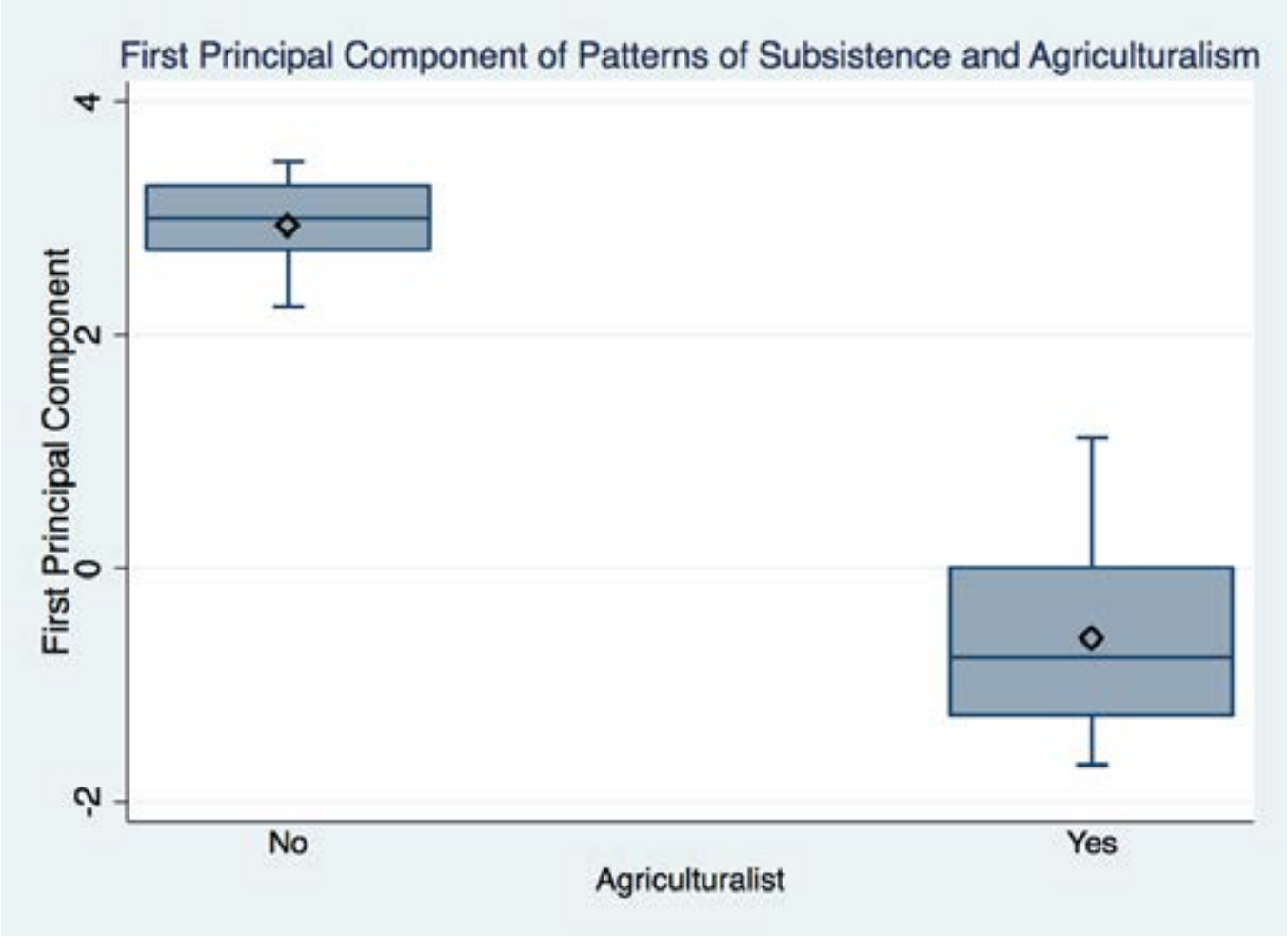
Principal Components of Subsistence Pattern

	Principal Components			
	Component 1	Component 2	Component 3	Unexplained
Gathering	0.45	0.13	0.58	0.00
Hunting	0.53	0.18	0.11	0.00
Fishing	0.38	-0.42	-0.68	0.00
Animal Husbandry	-0.34	0.73	-0.30	0.00
Agriculture	-0.50	-0.49	0.32	0.00
Eigenvalues	2.40	1.19	0.87	
Proportion Variance	0.48	0.24	0.17	
Observations	209			

Hunter-Gatherers – High First PC



Agriculturalists – Low First PC



Pre-1500CE Crop Return & Patterns of Subsistence

	Patterns of Subsistence								
	Agriculturalist			Hunter-Gatherer			First PC		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Crop Return	0.09***	0.09***	0.10***	-0.03**	-0.06***	-0.10***	-0.33***	-0.40***	-0.51***
(pre-1500CE)	(0.01)	(0.01)	(0.03)	(0.02)	(0.01)	(0.03)	(0.05)	(0.04)	(0.10)
Continental FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
All Geographic Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Adjusted-R^2	0.04	0.56	0.46	0.00	0.54	0.42	0.03	0.63	0.59
Observations	1288	1288	209	1288	1288	209	1288	1288	209

Patterns of Subsistence and Future Tense

	Existence of Future Tense								
	OLS	IV	OLS	IV	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
First Principal Component	0.06**	0.14**	0.05*	0.16*	0.05	0.20**	0.24***		
	(0.03)	(0.06)	(0.03)	(0.09)	(0.03)	(0.08)	(0.08)		
Agriculturalist								-1.25**	
								(0.52)	
Hunter Gatherer									1.25***
									(0.45)
Continental FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Main Geographical Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Precipitation Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Temperature Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		30.48		22.11		23.61	14.43	4.95	5.38
Hansen's J-statistic							1.47	0.70	0.45
J-stat p-value							0.23	0.40	0.50
Adjusted-R^2	0.06	0.03	0.08	0.02	0.11	0.00	-0.06	-0.30	-0.47
Observations	209	209	209	209	209	209	209	209	209

Crop Return, Future Tense and Contemporary Individual Behavior

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Crop Return, Future Tense and Contemporary Individual Behavior

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  - Saving

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  - Within-country and within age-gender-group variation

Crop Return, Future Tense and Savings

	Has the Family Saved Last Year											
	Basic Controls			Income			Education			Religion		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Crop Return (pre-1500CE)	0.02*		0.02**	0.03***		0.03***	0.03***		0.03***	0.03***		0.03***
	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)		(0.01)
Future Tense		-0.03***	-0.03***		-0.00	-0.01		0.00	-0.00		0.00	-0.00
		(0.01)	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)		(0.01)	(0.01)
Main Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gender FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Religion FE	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Adjusted-R^2	-0.02	-0.02	-0.02	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08
Observations	108213	108213	108213	108213	108213	108213	108213	108213	108213	108213	108213	108213

Crop Return, Future Tense and Education Level

	Education Level								
	Basic Controls			Income			Religion		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Crop Return (pre-1500CE)	0.18***		0.23***	0.18***		0.23***	0.25***		0.28***
	(0.04)		(0.04)	(0.04)		(0.04)	(0.04)		(0.04)
Future Tense		-0.43***	-0.47***		-0.40***	-0.44***		-0.25***	-0.30***
		(0.05)	(0.05)		(0.05)	(0.05)		(0.05)	(0.05)
Religion FE	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Income FE	No	No	No	No	No	No	Yes	Yes	Yes
Main Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gender FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted-R^2	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.09	0.09	0.09
Observations	108213	108213	108213	108213	108213	108213	108213	108213	108213

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  - The association between future tense and economic outcomes

The Geographical Origins of the Tower of Babel: The Economic Causes and Consequences of Linguistic Structures

Oded Galor, Ömer Özak and Assaf Sarid

AEA Meeting, January 2016

Basic Result – OLS

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	Existence of Future Tense									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Crop Return	-0.07**	-0.10***	-0.10***	-0.10***	-0.10***	-0.10**	-0.10**	-0.10**	-0.10**	-0.12***
(pre-1500CE)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Absolute Latitude			-0.13**	-0.13**	-0.13**	-0.10*	-0.12	-0.10	-0.17	-0.20
			(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.13)	(0.13)
Elevation				-0.02	-0.03	-0.04	-0.04	-0.02	-0.06	-0.06
				(0.03)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Ruggedness					0.02	0.01	0.02	0.00	0.03	0.03
					(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
Coast Length						-0.08***	-0.07***	-0.07***	-0.06***	-0.06**
						(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Precipitation							-0.02	0.02	0.02	0.00
(mm/month)							(0.05)	(0.09)	(0.09)	(0.09)
Precipitation								-0.10***	-0.04	-0.04
(mm/month) (std)								(0.03)	(0.06)	(0.06)
Precipitation								0.02	0.01	0.01
Volatility								(0.09)	(0.09)	(0.09)
Precipitation								-0.02	-0.86**	-0.84**
Spatial Correlation								(0.05)	(0.37)	(0.38)
Temperature (Daily									-0.06	-0.06
Mean)									(0.09)	(0.09)
Temperature (Daily									-0.07	-0.07
Mean) (std)									(0.05)	(0.05)
Temperature									0.09	0.12
Volatility									(0.11)	(0.11)
Temperature Spatial									0.84**	0.82**
Correlation									(0.37)	(0.38)
Crop Winter										-0.06
(pre-1500CE)										(0.04)
Continental FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted-R^2	0.02	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.08	0.08
Observations	208	208	208	208	208	208	208	208	208	208

Example – Strong vs. Weak Future

- In French, the distinction between today and tomorrow is clear:
  1. Il *fait* froid aujour d'hui.
  2. Il *fera* froid demain.
- In German, no distinction between the two:
  1. Heute *ist* es kalt.
  2. Morgen *ist* es kalt.

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