

# Horsemen of the Apocalypse: The Mongol Empire and the Great Divergence

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# Outline

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  - Divergence
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# Motivation

## History

- Decline of the Asian Civilizations
- The Rise of Western Europe
- The timing of Great Divergence

## Economics

The transition out of the feudal economic system and the Malthusian Regime into Capitalism and sustained economic growth

## A missing link?

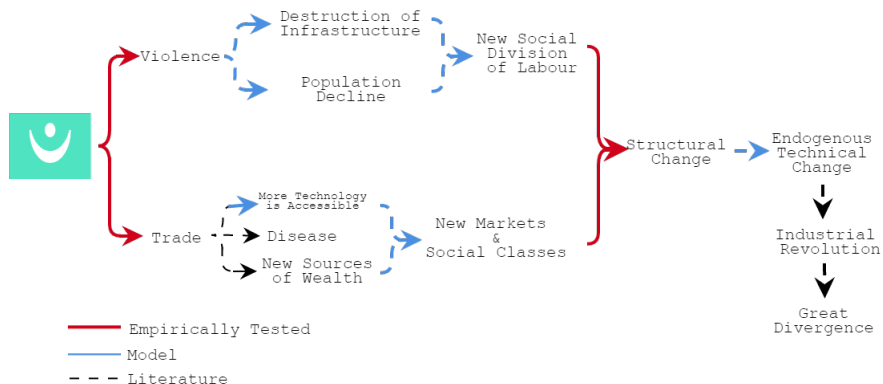
Economic History has omitted the study of the long-run effects of the Mongol Empire; while historians regard it as a key actor in the formation of the modern world.

# Research Question

## Research Question

Did the Mongol Conquests during the 13th century cause a persistent gap in development between the invaded and not invaded territories? If so, through which mechanisms?

# Hypothesis



# This paper

Assessment of the direct and the long-run effects of the 13th-century Mongol Conquests across Eurasia

## Theory

- Revision of Eurasian Medieval and Pre-Modern History
- Model: transition out of the Malthusian Regime into Sustained Economic Growth

# This paper

## Empirics

- Direct effect and persistence in economic growth rates: spatial RDD
- Direct effect and persistence in economic development: DiD
- Effect of Violence: Factorial Design & Local Rand. RDD
- Effect of Trade: Network Analysis and Geographic RDD
- Structural Change: correlations and stylized facts

# Preview of findings

- 1** The Economy of Mongol territories contracted and grew slower than unconquered territories'
- 2** The Effect of the Mongol Conquests lasted up to at least the 18th century
- 3** Mongol Violence had effects over long-run growth traceable up until the 18th century
- 4** Mongols increased trade relevance of cities outside their borders while in control of the Silk Road, relative to that of cities within the Empire
- 5** Eurasia experienced a general simultaneous decline of land share in income and rise of agrarian labor share during the 13th century such that agrarian wages are predicted to have grown larger outside the Empire than within it
- 6** There is an optimal region outside the Empire which maximizes economic growth, ranging between Iberia and the Northern Sea.



# Contribution I

## Historical Development

Acemoglu et al. (2001a), Acemoglu et al. (2001b), Ashraf and Galor (2011), Dell (2010), Voigtländer and Voth (2013)

## Why the Industrial Revolution happened in Europe, but not in China?

Acemoglu et al. (2008), Clark (2007), Clark and Cummins (2009), Pomeranz (2000), Parthasarathi and Pomeranz (2019), Parthasarathi and Pomeranz (2002), Allen (2009)

## Unified Growth Theory

Galor and Weil (2000), Galor and Moav (2002)

# Contribution II

## Great Divergence Debate

Pomeranz (2000), Parthasarathi and Pomeranz (2019), Broadberry and Gupta (2006)

## Cliodynamics

Turchin (2007), Turchin (2009)

## Novel Dataset

HYDE 3.2 2016, Reba et al. (2016)

# Data I

## Historical Development, population & Land Use

**HYDE 3.2:** Klein Goldewijk et al. (2011), Klein Goldewijk et al. (2016)

## Locations

**Historical Mongol Borders:** Onon (2001), Kennedy (2002), Anderson et al. (2009), Craughwell (2008), Pederson et al. (2014), McLynn (2015), May (2018)

**City Locations:** Reba et al. (2016)

## Geography

Natural Earth (North American Cartographic Information Society)

EarthEnv (NCEAS, NASA, NSF, and Yale University)

# Data II

## Trade Routes

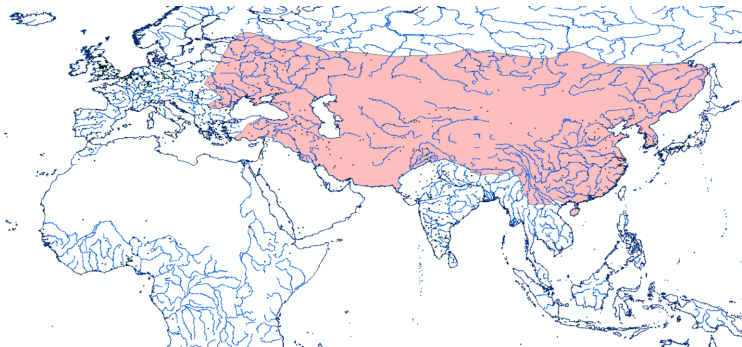
McCormick (2007), Andersen et al. (2013), Ciociltan (2012), Michalopoulos and Papaioannou (2014)

## Violence

**Battles:** Kitamura (2022)

# Treatment

Figure: Mongol Empire in 1279, at its maximum extend



**Data:**

**Limits:** Onon (2001), Kennedy (2002), Craughwell (2008), Anderson et al. (2009), Ciociltan (2012), Pederson et al. (2014), McLynn (2015), May (2018), and Che and Lan (2021)



# Long-run Effect On Development Levels

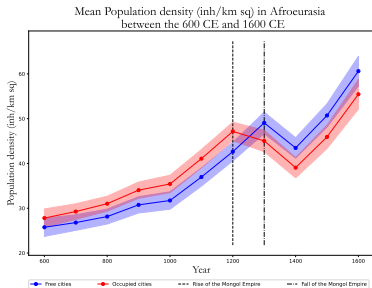
## Differences in Differences Model

$$Y_{it} = \theta_t + \eta_i + t \times X_{it} + \sum_{s=500, s \neq 1200}^{1700} \tau_s C_i \times \mathbb{I}[s = t] + \epsilon_i$$

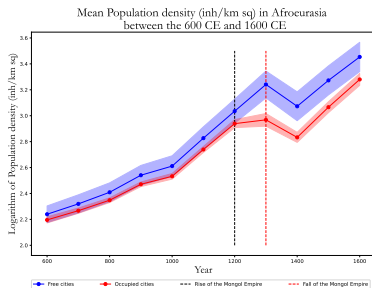
- $Y_{it}$ : - of city  $i$  in century  $t$
- $Y_{it}$ : Population Density;  $\ln(\text{Population Density})$
- $t \times X_{it}$ : control variables trend
- $\theta_t$ : Century fixed effects
- $\eta_i$ : City fixed effects
- $C_i$ : = 1 if Conquered by the Mongols
- $\epsilon_i$ : city-clustered standard error

# Long-run Effect On Development Levels

**Figure:** Trend evolution of population density (inh./sq km) among groups of Afroeurasian cities from 600 to 1600



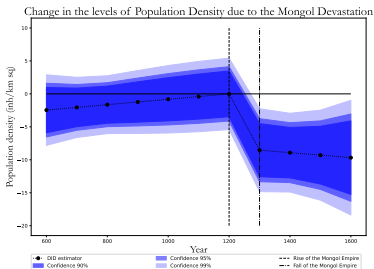
(a) Evolution of Population Densities



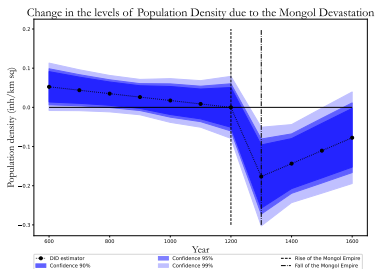
(b) Evolution of  $\ln(\text{population density})$

# Long-run Effect On Development Levels

**Figure:** Trend evolution of population density (inh./sq km) among groups of Afroeurasian cities from 600 to 1600



(a) Level Effect



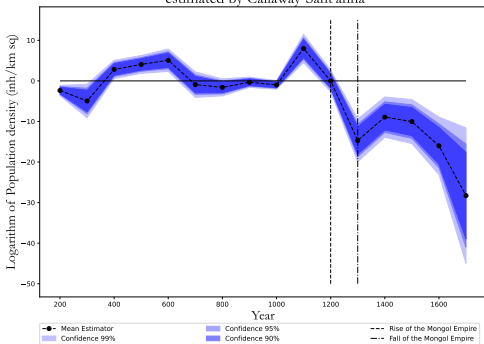
(b) Effect on Growth



# Long-run Effect On Development Levels

**Figure:** Trend evolution of population density (inh./sq km) among groups of Afroeurasian cities from 600 to 1600

Change in Population density (inh./km sq) in Afroeurasia between 200 CE and 1700 CE  
estimated by Callaway-Sant'anna



# Long-run Effect On Development Levels

## Spatial Regression Discontinuity Design

$$g_{iT} = \tau C_i + f(D_i, x_i, y_i) + \epsilon_{iT} \quad \text{if } |D_i| \leq \eta$$

- $y_{iT}$ :  $\ln$  of city  $i$  at fixed century;  $T \in \{13, 14, 15, 16, 17\}$
- $g_{iT}$ : change in  $\ln(\text{Population Density})$
- $C_i$ : = 1 if Conquered by the Mongols
- $D_i$ : distance to the 1279 Mongol frontier
- $x_i, y_i$ : latitude, longitude
- $\epsilon_{iT}$ : city-century error
- $\eta$ : bandwidth around the 1279 Mongol frontier

# The Long-Run Effect on Growth Rates

**Table:** Local Effect of the Mongol Devastation on Economic Growth Rates per Century

<i>Main Specification</i>						
	RD Estimate	BW (km)	N. Obs	Local Poly. Order	Mean	
Growth 1200-1300	-0.28*** (0.09)	1935	731	1	0.18	
Growth 1300-1400	-0.15*** (0.04)	1161	378	1	-0.11	
Growth 1400-1500	-0.12** (0.05)	836	226	1	0.17	
Growth 1500-1600	0.05 (0.05)	1281	415	1	0.19	
Growth 1600-1700	-0.19** (0.09)	1123	362	1	0.12	

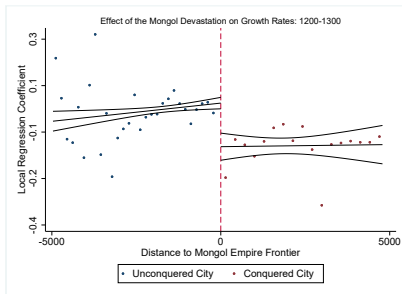
**Note:** Bias-corrected robust standard errors: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Specification:** Non-parametric RDD (Calonico et al., 2014). Running Var.: Geodesic distance to the Mongol Empire. Kernel: Epanechnikov. Linear Local Polynomial.

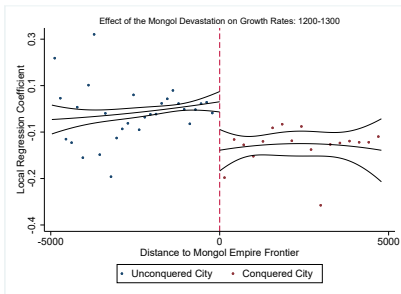


# The Long-Run Effect on Growth Rates

Figure: Effect of the Mongol Devastation on Afroeurasian growth rates per century



(a) Linear Local Polynomial



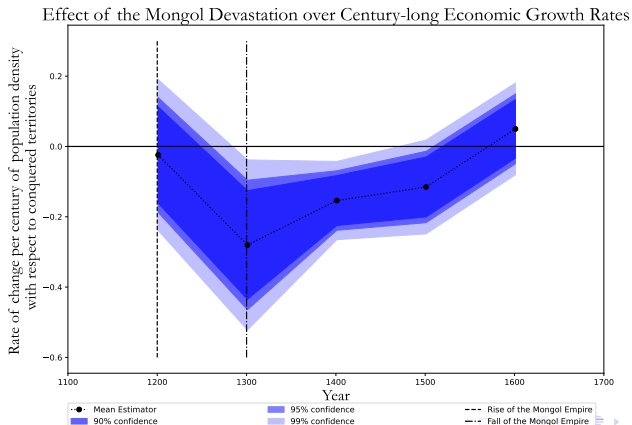
(b) Quadratic Local Polynomial

**Covariates:** latitude, longitude, elevation, slope, pop. density in baseline, battles in 12th century.

**Data:** HYDE 3.2 2016, Reba et al. (2016)

# The Long-Run Effect on Growth Rates

**Figure:** Persistence of growth rate gaps due to the Mongol Empire



# Mechanisms

# Mechanisms: the Effect of Violence

**Figure:** Extend of Mongol Empire and Occupation Attempts within the 13th Century

Mongol Empire in 1279 CE and Battle Events Before 1294 CE



# Violence

## Factorial Design Model

$$Y_{it} = \tau C_i + \alpha I_i + X_{it}\beta + \epsilon_j$$

- $·_{it}$ : - of city  $i$  in century  $t$
- $Y_{it}$ : change in  $\ln(\text{Population Density})$
- $X_{it}$ : control variables
- $C_i$ : = 1 if Conquered by the Mongols
- $I_i$ : = 1 if Invaded but not Conquered by the Mongols
- $\epsilon_j$ : city-clustered error



# Mechanisms: the Effect of Violence

**Table:** Effect of Mongol Violence: Factorial Design between Conquered, Invaded but Unconquered, and Non-Invaded Cities

<i>Violence</i>							
	$(\tau)$ Conquered	$(\alpha)$ Invaded Only	$(\tau - \alpha)$ Estimate Difference	N. Obs	Geo. Control	Land Control	Viol. Control
Growth 1200-1300	-0.2773*** (0.023)	-0.0645* (0.033)	-0.2128*** (0.0402)	1125	Yes	Yes	Yes
Cumulative Growth 1200-1400	-0.1921*** (0.0161)	0.1220*** (0.0258)	-0.3141*** (0.0503)	1125	Yes	Yes	Yes
Cumulative Growth 1200-1500	-0.1796*** (0.0193)	-0.0412 (0.0337)	-0.2208*** (0.0558)	1125	Yes	Yes	Yes
Cumulative Growth 1200-1600	-0.1952*** (0.0211)	-0.081 (0.0370)	-0.1872*** (0.0584)	1125	Yes	Yes	Yes
Cumulative Growth 1200-1700	-0.3327*** (0.0254)	-0.1128*** (0.0390)	-0.2200*** (0.0614)	1125	Yes	Yes	Yes

**Note:** Robust standard errors: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$



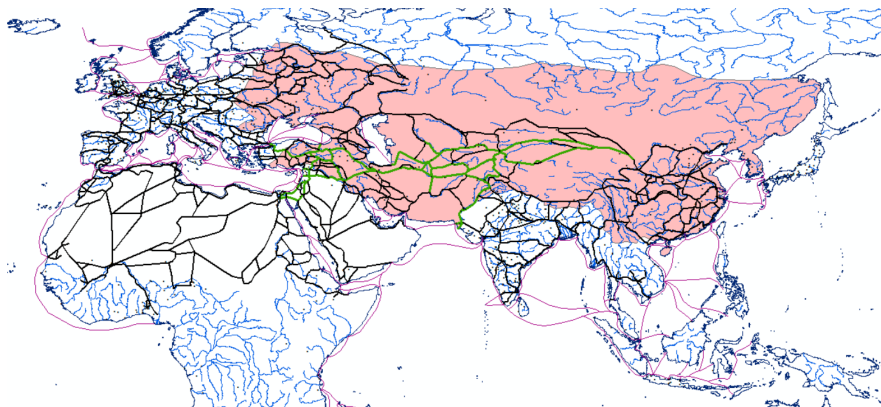
# Mechanisms: the Effect of Violence

**Figure:** Effect of the Mongol Invasions by Cattaneo et al. (2014) RD Random Inference

<i>Violence</i>							
<i>Conquered</i>				<i>Invaded Only</i>			
<i>vs</i>				<i>vs</i>			
<i>Invaded Only</i>				<i>Free Cities</i>			
	Local Rand RD Estimate	BW (km)	Obs.		Local Rand RD Estimate	BW (km)	Obs.
Growth	-0,3			Growth	-0,58***		
1200-1300 CE	(0,19)	240	97	1200-1300 CE	(0,19)	336	92
Growth	-0,2			Growth	-0,63***		
1300-1400 CE	(0,19)	240	97	1300-1400 CE	(0,2)	336	92
Growth	-0,2			Growth	-0,57***		
1400-1500 CE	(0,19)	240	97	1400-1500 CE	(0,2)	336	92
Growth	-0,2			Growth	-0,52***		
1500-1600 CE	(0,19)	240	97	1500-1600 CE	(0,19)	336	92
Growth	-0,15			Growth	-0,57***		
1600-1700 CE	(0,19)	240	97	1600-1700 CE	(0,19)	336	92

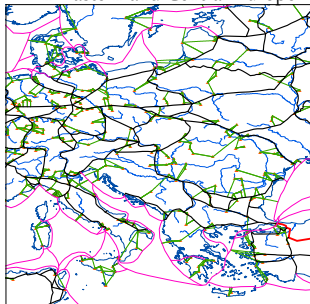
# Mechanisms: the Effect on Trade

Figure: Extend of Mongol Empire in the 13th Century and Medieval Trade Network



# Detail on Trade Network

## Detail of Trade Network Completion in Eastern and Central Europe



### Legend

- Cities
- Major River
- Coast
- Completed Route
- Main Route
- Main Sea Route
- Silk Road

# Mechanisms: the Effect on Trade

**Table:** Estimation of Non-Parametric RDD for the evolution of Trade Relevance between years 1200-1500

<i>Change in Commerce Index</i>				
	RD Estimate	BW (km)	N. Obs	Local Poly. Order
Change 1200-1300	-0.97** (0.5)	2599	775	1
	-1.22* (0.73)	2482	767	2
Change 1300-1400	-0.04 (0.11)	2844	799	1
	-0.34* (0.19)	2339	758	2
Change 1400-1500	-0.01 (0.07)	1712	539	1
	-0.12 (0.13)	2199	733	2

**Note:** Bias-corrected robust standard errors: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

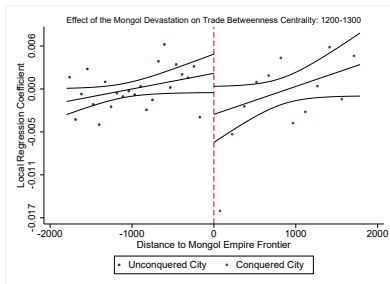
**Specification:** Non-parametric RDD (Calonico et al., 2014). Kernel: Epanechnikov. Local polynomials order: 1, 2.

**Main Data:** Natural Earth, EarthEnv, Klein Goldewijk et al. (2016)

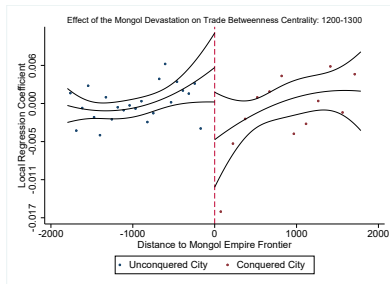
**Complementary Data:** McCormick (2007), Anderson et al. (2009), Ciociltan (2012) and Michalopoulos et al. (2018); Reba et al. (2016)

# Mechanisms: the Effect on Trade

Figure: Effect of the Mongol Empire on the Betweenness Centrality of Afroeurasian Cities



(a) Linear Local Polynomial



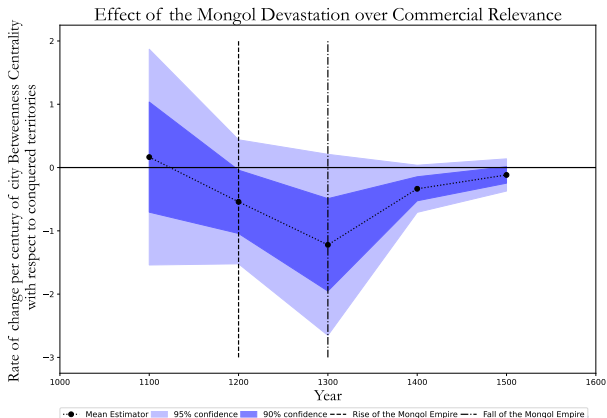
(b) Quadratic Local Polynomial

**Covariates:** latitude, longitude, elevation, slope, pop. density in baseline, battles in 12th century.

**Data:** HYDE 3.2 2016, Reba et al. (2016)

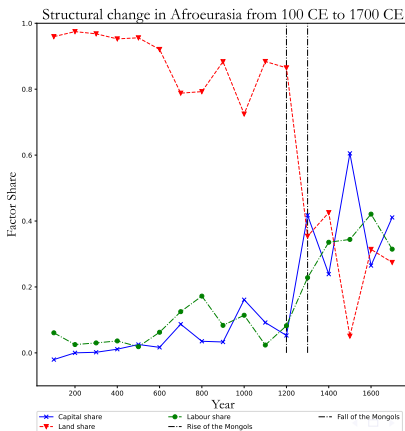
# Mechanisms: the Effect on Trade

Figure: Persistence of Mongol Empire Effect in Trade Relevance



# Structural Change

Figure: Estimated trends of factor shares from 100 CE to 1700 CE





# Structural Change I

- Assume the aggregated output ( $Y$ ) remunerates three factors: agrarian labour ( $L_A$ ), land ( $Z_A$ ), and capital ( $K$ )
- Proxy agrarian labour as the rural population count ( $\tilde{L}_A$ ), land as area density of crops ( $\tilde{Z}_A$ ), and capital as urban area density ( $\tilde{K}$ )
- Estimate the product elasticities  $\beta_{Ts}^F$  of each factor  $F \in \{L_A, Z_A, K\}$  in century  $T$  for cities in group  $s \in \{\text{Conquered, Unconquered, Afroeurasia}\}$ :

$$\ln[\tilde{Y}_{it}] = \beta_0 + \beta_t^L \ln[\tilde{L}_{A,it}] + \beta_t^Z \ln[\tilde{Z}_{A,it}] + \beta_t^K \ln[\tilde{K}_{it}] + \epsilon_{it} \quad \text{Given: } t = T$$

- Define the share ( $\alpha_{Ts}^F$ ) of factor  $F$  in century  $T$ , for sample  $s$ :

$$\alpha_{Ts}^F = \frac{\beta_{Ts}^F}{\sum_{f \in \{L_A, Z_A, K\}} \beta_{Ts}^f}$$



# Structural Change

## Land-to-Labour Ratio and Wages

$$\frac{\alpha_T^{\text{land}}}{\alpha_T^{\text{labour}}} \propto \Phi \left( \frac{Z_A}{L_A} \right) \propto \Psi(w_A)$$

## Implication

- Relative decline of agrarian wages within the Mongol territories
- Relatively richer agrarian workers in unconquered lands: urbanization and proto-industrialization (Voigtländer and Voth 2009, 2013)

## Which regions would diverge?

- Assume (as in the model) that economic growth  $g(D, x, y, X)$  is a smooth function in the relative distance to the 1279 Mongol Frontier ( $D$ ,  $> 0$  if Conquered,  $< 0$  if not.)
- Expand in a series and truncate to order 2 polynomial:

$$g \approx \beta_0 + \beta_1 D + \beta_2 D^2 + O(D^3) + f(x, y) + h(X)$$

- Estimate:

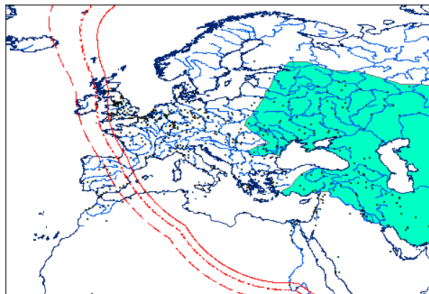
$$g_{iT} = \beta_0 + \beta_1 D_i + \beta_2 D_i^2 + X_{iT} \gamma + \epsilon_{iT}$$

- The Distance outside the Empire that maximizes growth is:

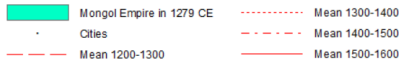
$$D^* = -\frac{\hat{\beta}_1}{2\hat{\beta}_2}$$

# Which regions would diverge?

Predicted region with maximum economic growth induced by the Mongol Devastation

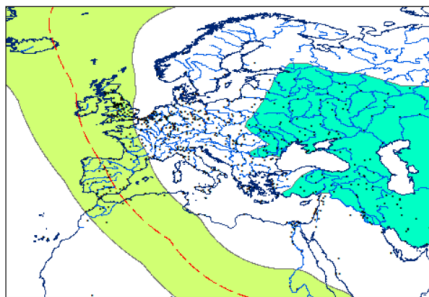


### Legend



# Regions with maximal growth: 1200 - 1300

Predicted region with maximum economic growth  
induced by the Mongol Devastation  
1200 CE - 1300 CE

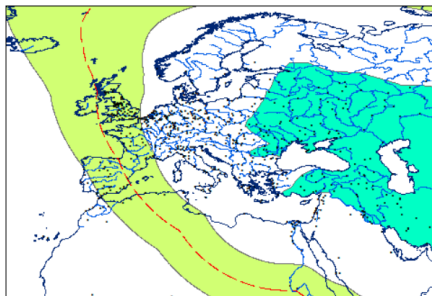


## Legend



# Regions with maximal growth: 1300 - 1400

Predicted region with maximum economic growth  
induced by the Mongol Devastation  
1300 CE - 1400 CE

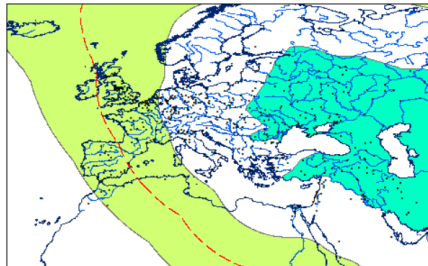


### Legend



# Regions with maximal growth: 1400 - 1500

Predicted region with maximum economic growth  
induced by the Mongol Devastation  
1400 CE - 1500 CE



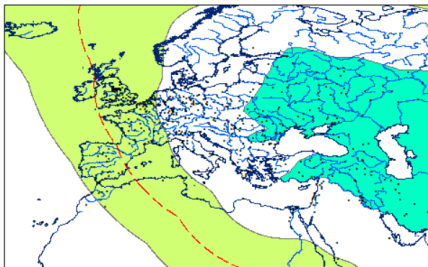
## Legend





# Regions with maximal growth: 1500 - 1600

Predicted region with maximum economic growth  
induced by the Mongol Devastation  
1500 CE - 1600 CE



### Legend



# Wrap-up

- The Economy of Mongol territories contracted and grew slower than unconquered territories'
- The Effect of the Mongol Conquests lasted up to at least the 18th century
- Mongol Violence had effects over long-run growth traceable up until the 18th century
- Mongols increased trade relevance of cities outside their borders while in control of the Silk Road, relative to that of cities within the Empire
- Eurasia experienced a general simultaneous decline of land share in income and rise of agrarian labor share during the 13th century such that agrarian wages are predicted to have grown larger outside the Empire than within it
- There is an optimal region outside the Empire which maximizes economic growth, ranging between Iberia and the Northern Sea.

# Concluding Remarks and Discussion I

## Remarks

- The Rise and Fall of the Mongol Empire is a key moment in world economic development, yet has not received enough attention from economic historians.
- The Mongol Devastation is a (quasi-) random event that links several explanations to the Rise of Europe and the Decline of Asia.

# Concluding Remarks and Discussion II

## Further Research

- Capital Accumulation and the Decline of the Feudal system before the Conquest of the Americas
- The development legacy of Mongol institutions
- How relevant were the Mongols perceived in Eurasian imagination in the centuries following Genghis Kahn
- Effects of the trade counter-shock of the Rise of the Ottoman Empire
- The Hunic Invasions and the formation of the Medieval World

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