The rise of universities and economic development in medieval and early modern Europe (700–1800)

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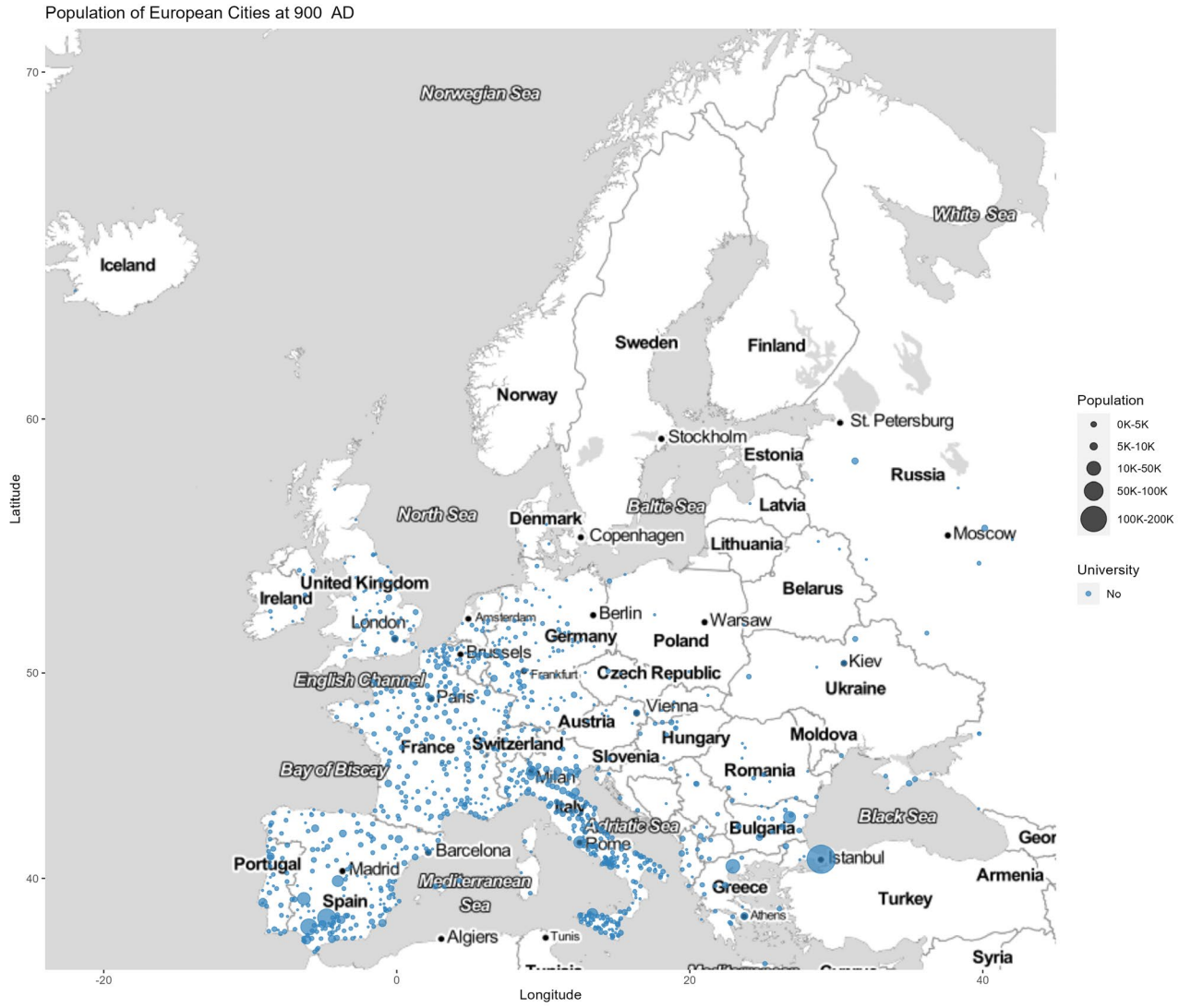
Introduction

European cities population growth over time

Significant increase of European cities' population over time

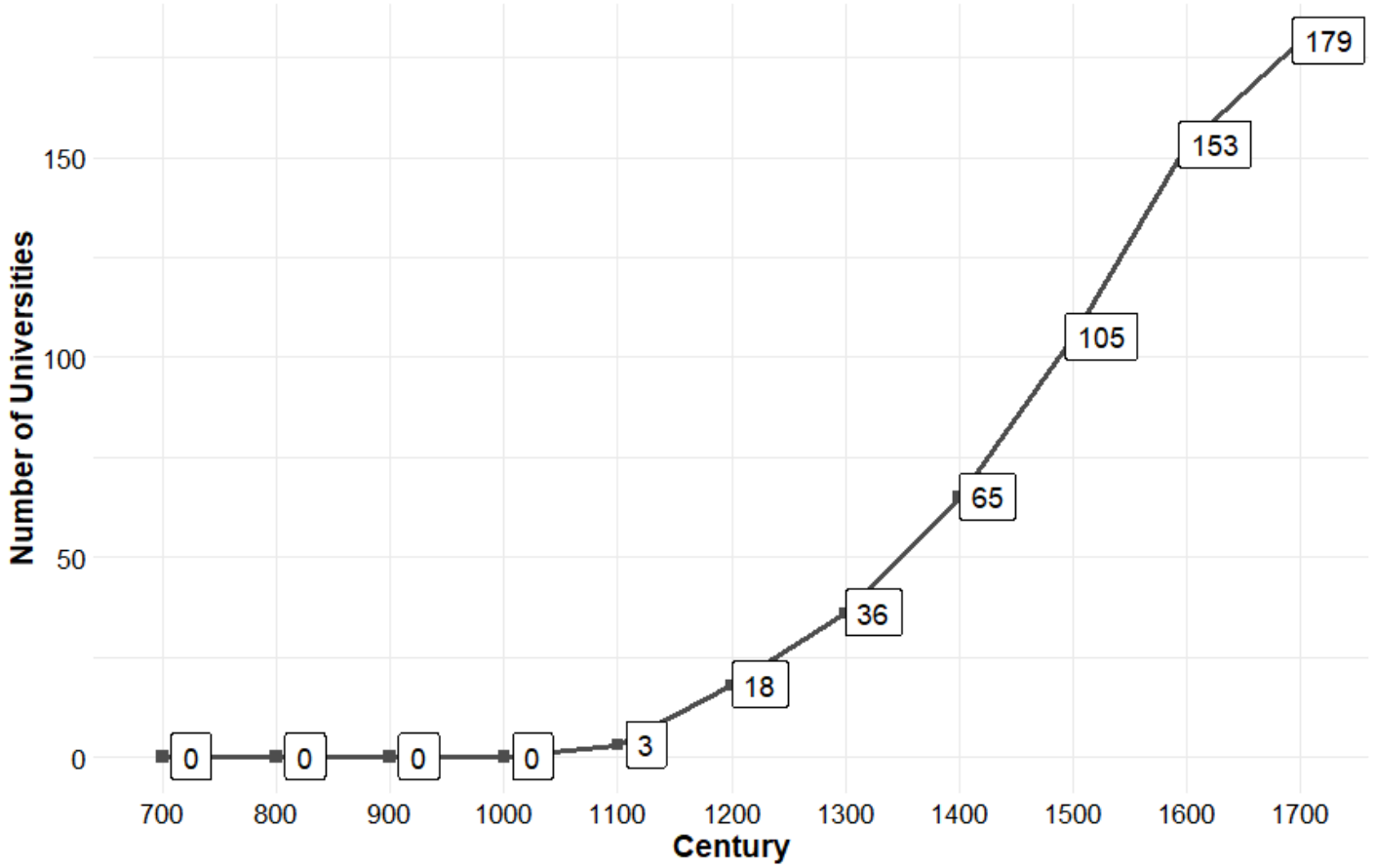
- **Research question**

  Explore the long-term impact of medieval and early modern European universities on urban growth, as a proxy for economic development



European Universities by cohort 700-1800

Cohort	Universities
700-1099	0
1100-1199	3
1200-1299	18 (15)
1300-1399	36 (18)
1400-1499	65 (29)
1500-1599	105 (40)
1600-1699	153 (48)
1700-1799	179 (26)



- 2168 cities in total
- Operation threshold set to 50-years within a century
- University of Bologna(1088), Paris (1150), and Oxford (1096) are excluded from the analysis due to their unique historical roles and significant influence

Aim and innovation

➢ **Investigate the impact of Universities on economic development (proxied by European cities' population)**

❑ Innovation

- **Extensive examination of the impact of Universities on ALL European cities for the first time**
  - Only studies focusing on specific regions/countries/areas (e.g., Cantoni and Yuchtman, 2014)
- **Unique dataset on cities' characteristics from 700-1800**
- **Cutting edge estimation methodology (Wooldridge, 2021;2023)**

Motivation

Cities and Human Development

- Universities in cities: catalyst for legal institutions, state systems (Cantoni & Yuchtman, 2014)
- Middle Ages: rise of fairs, city expansion, book output, population growth (Bairoch et al., 1988; Buringh & van Zanden, 2009; Epstein, 2000; McEvedy & Jones, 1979; Verhulst, 1999)

Human Capital and Development

- Liberal arts skills: mathematics, rhetoric, logic for business, trade (Mokyr, 1990)
- Universities' impact on economic activity through legal institutions (North, 2000; Coing, 1964)

Urbanization and Human Capital Formation

- Universities reduced cost of education, expanded access (Cantoni & Yuchtman, 2014)
- More individuals acquired university training (Bosker & van Zanden, 2008)

History's Impact on Modern Outcomes

- Causal effect of university establishment on economic activity (Morris, 2010)

Findings

- **Significant positive impact of universities in early centuries** (1200-1499)
- **Positive not significant impact afterwards** (1500-1800)
- **Robust findings** when:
  - include time invariant cov. interacted with time dummies and NUTS1/NUTS2 linear time trends
  - alter operation threshold to 30-years
  - exclude suspended universities
  - include the first three universities —Bologna, Paris, Oxford—
  - spatial error at 100km

Relevant literature

Literature Review – Urban development

Bosker, Buringh, and van Zanden, 2013 (RESTAT)

- Urban development in Europe - Islamic world (800-1800)
- Focus on geography, political institutions, religious interactions
- European advantage in long-distance trade due to focus on water-based trade, technological innovation in ship design, sailing, and navigation techniques
- Dominant role of the state in Islamic world; capital cities dominating urban landscape
- Dominance of capital cities after 1600 in Europe

Accetturo and Mocetti, 2019 (J. Regional Sci.)

- Historical evolution of Italian cities (1950-2000)
- Role of geography in explaining spatial population distribution
- Significant rural to urban and South to North migration during 1950s, 1960s

Literature Review – Human capital and universities role

Cantoni and Yuchtman, 2014 (QJE)

- Causal effect of universities on economic activity in medieval Germany, focus on the establishment of Germany's first universities due to papal schism
- Significant positive break in the trend of market establishment in 1386, when Germany's first university was established
- Universities may have affected trade through several channels
- The role of universities in legal and administrative institutions was important

Amendola, Barra and Zotti,2019 (J. Regional Sci.)

- Degree production of universities affects economic development of corresponding regions (2011-2015)
- Beneficial effect of universities on local economic development through human capital

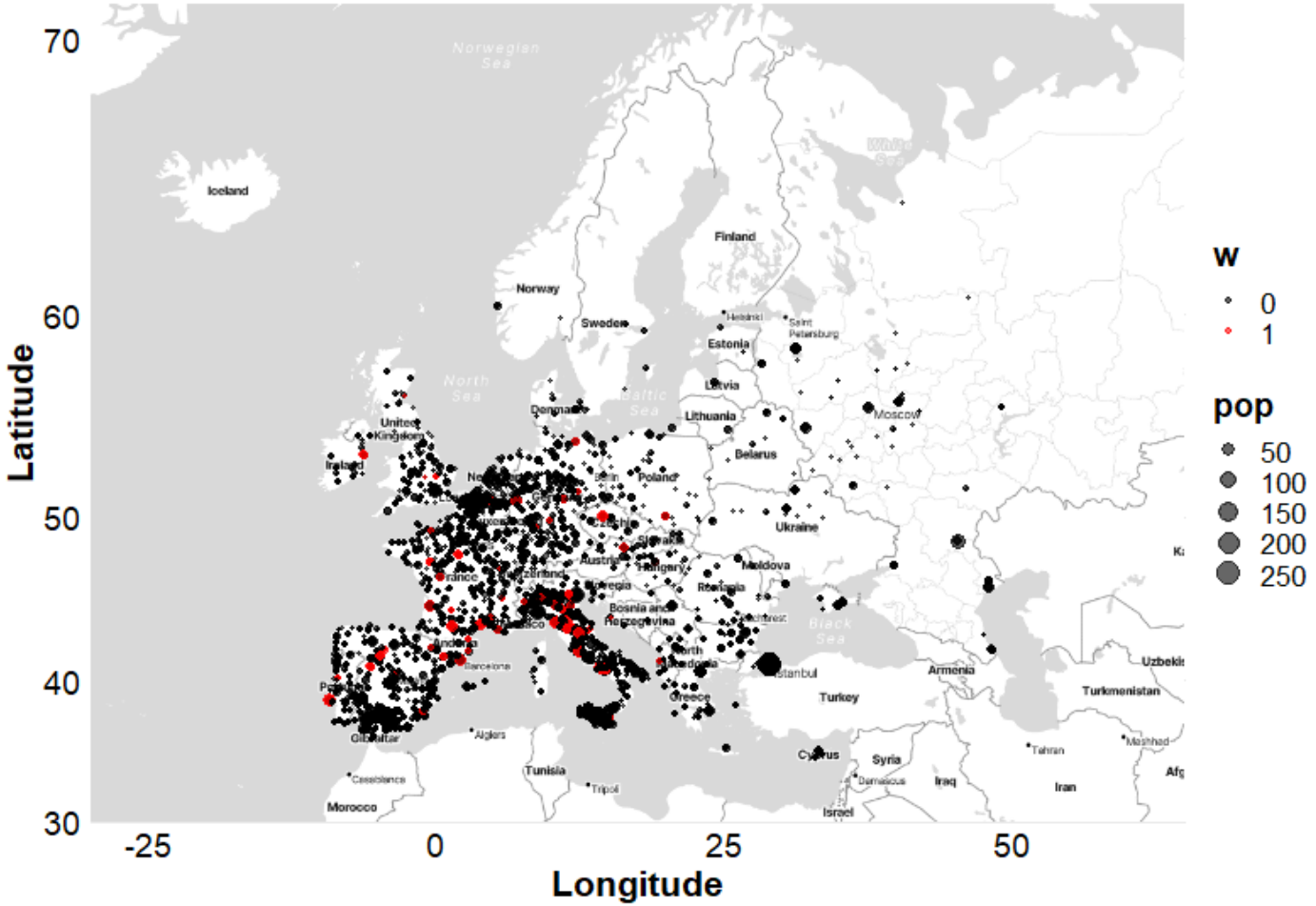
Valero and John Van Reenen, 2019 (Econ. Educ. Rev.)

- World sample 1950-2010
- 10% increase in universities -> 0.4% higher GDP per capita
- University benefits spill over to neighbouring regions
- Universities promote democracy

Historical background

Universities and economic development—1200 to 1499—Medieval Period

- Universities played vital role in fostering population growth (Cipolla, 1965)
- Universities' expansion accompanied by increased trade - urban centres becoming economic hubs
- Individuals seeking knowledge and economic opportunities ➡ migration towards cities (Wickham, 2005)
- Social mobility and opportunities to attain higher status - rise of a new merchant class
- Intellectual and cultural environment ➡ growth and prosperity



Universities in Europe until 1499 AD.
Source: Authors' elaborations

Universities and economic development—1500 to 1800—Early Modern Period

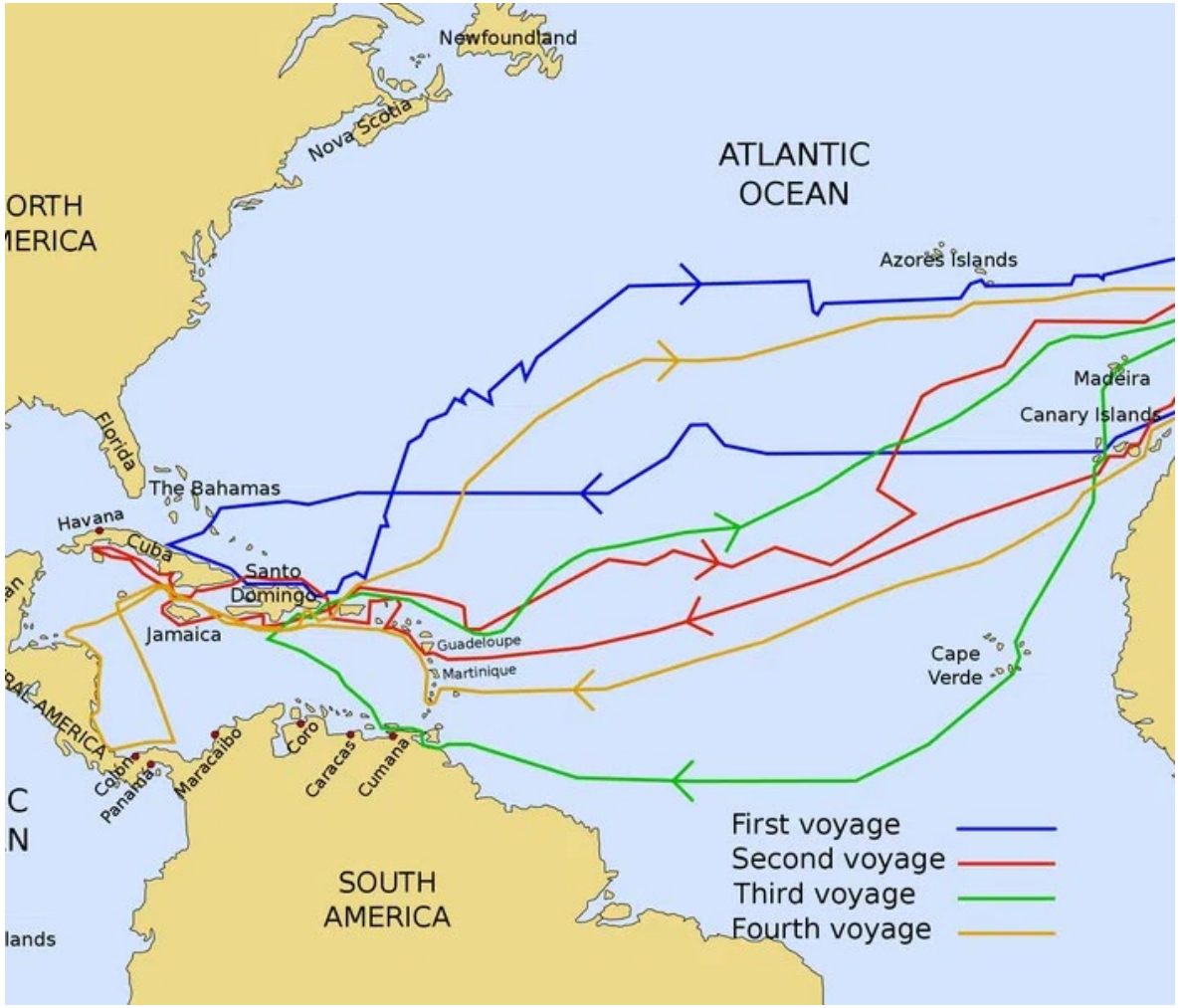
- impact on population growth became less significant (Kwiek, 2006)
- Social discipline and religious homogenization
- Rise of centralized states, merchant capitalism, centralized government (Braudel, 1986)
- Letterpress printing ➡ universities not unique source of education (Eisenstein, 1979)
- Significant changes: New World discoveries, growth of commerce, protestant reformation
- Universities' institutional roles linked to government and Church (Buringh and van Zanden, 2009)
- Emphasis on training of specific professions, mainly labor-based i.e., smiths (versus intellectual and cultural development)

Europe Main Map at the Beginning of the Year 1500
Source: https://www.euratlas.net/

Universities and economic development—1700 to 1799—17th Century Resurgence

Impact of universities on population growth re-emerged

- Scientific Revolution and demand for skilled labour
- Increased funding, international collaboration, and changing perceptions of higher education
- traditional curricula at established universities continued to attract a broad student base
- aftermath of the Black Death and migration to the New World

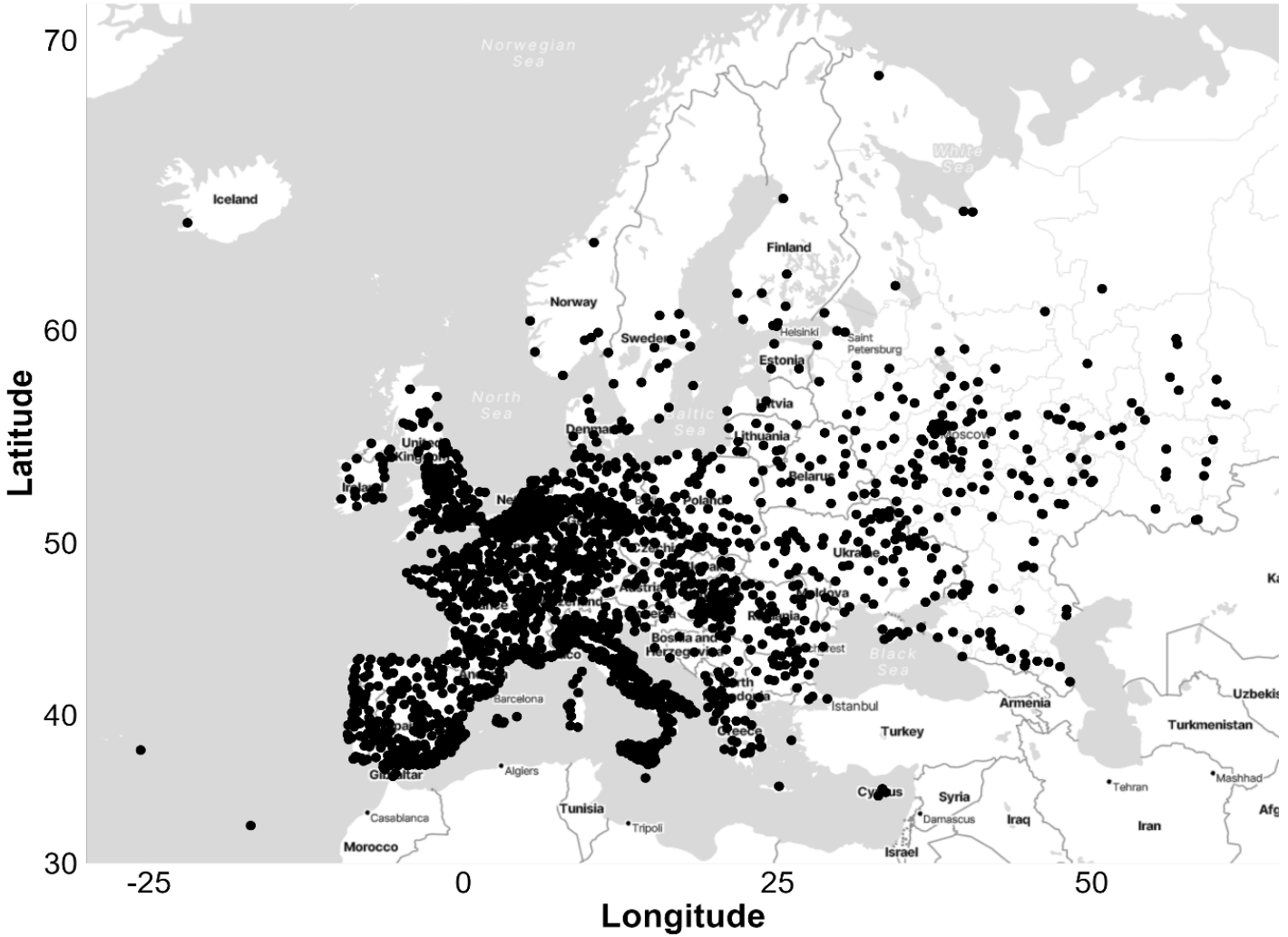


Christopher Columbus's travel routes between 1492 to 1504
Source: https://commons.wikimedia.org/wiki/User:Phirosiberia

Data

Definition of a city in the sample

Human settlements in Europe between the years 700 and 1800, with more than 1,000 inhabitants at certain point in time (Buringh, 2021)



Source: Authors elaborations based on Buringh, E. (2021). The population of European cities from 700 to 2000: Social and economic history. Research Data Journal for the Humanities and Social Sciences, 6(1), 1-18.

Fundamental variables

Cities' coordinates

Cities' Population

Presence of a university

Century of University establishment

Fundamental variables

- Distance from the Atlantic Ocean
- Distance from the coast
- Distance from rivers
- Distance from roman roads
- Distance from the Mainz

- Distance from Wittenberg

- Distance from thermae or baths
- Distance from bridges or pontes
- Distance from castles or chateaux

Methodological framework

Basic modelling assumptions

Staggered DiD framework (Wooldridge, 2021;2023) -estimation of Poisson regression model

Only entry no exit

Inclusion of heterogenous linear time trends by cohort of entry to deal with possible violations of the parallel trend assumption (Wooldridge, 2023).

The effect may vary by cohort and time period (century)

Correct for spatial autocorrelation (cutoff at 50 km)

Operation threshold set to 50-year with a century

Methodological framework

Baseline model specification (extended Wooldridge, 2021)

DiD

$$E(y_{it}|d_i f_i) = exp(\eta + \sum_{q=700}^{1700} \lambda_q w_{iq} d_{iq} f_{iq} + \sum_{r=700}^{1700} \omega_r f_{ir} + \sum_{s=700}^{1700} \omega_s f_{is} + \sum_{u=700}^{1700} \theta_u d_{iu} t_t + \mu_c)$$

η : constant term

d_{iq}: binary variable for different cohorts

f_i : Century time dummies

w_{iq}: treatment dummy

X : the set of all demeaned time invariant covariates

t_t : Heterogenous linear time trends

$\lambda_q, \tau_r, \omega_s, \theta_u$: coefficients to be estimated

μ_c :city fixed effects

Additional specifications

Include NUTS1/NUTS2 linear time trends

Include time-invariant covariates interacted with century dummies

Robustness checks

Alter operation threshold to 30-years

Exclude suspended universities

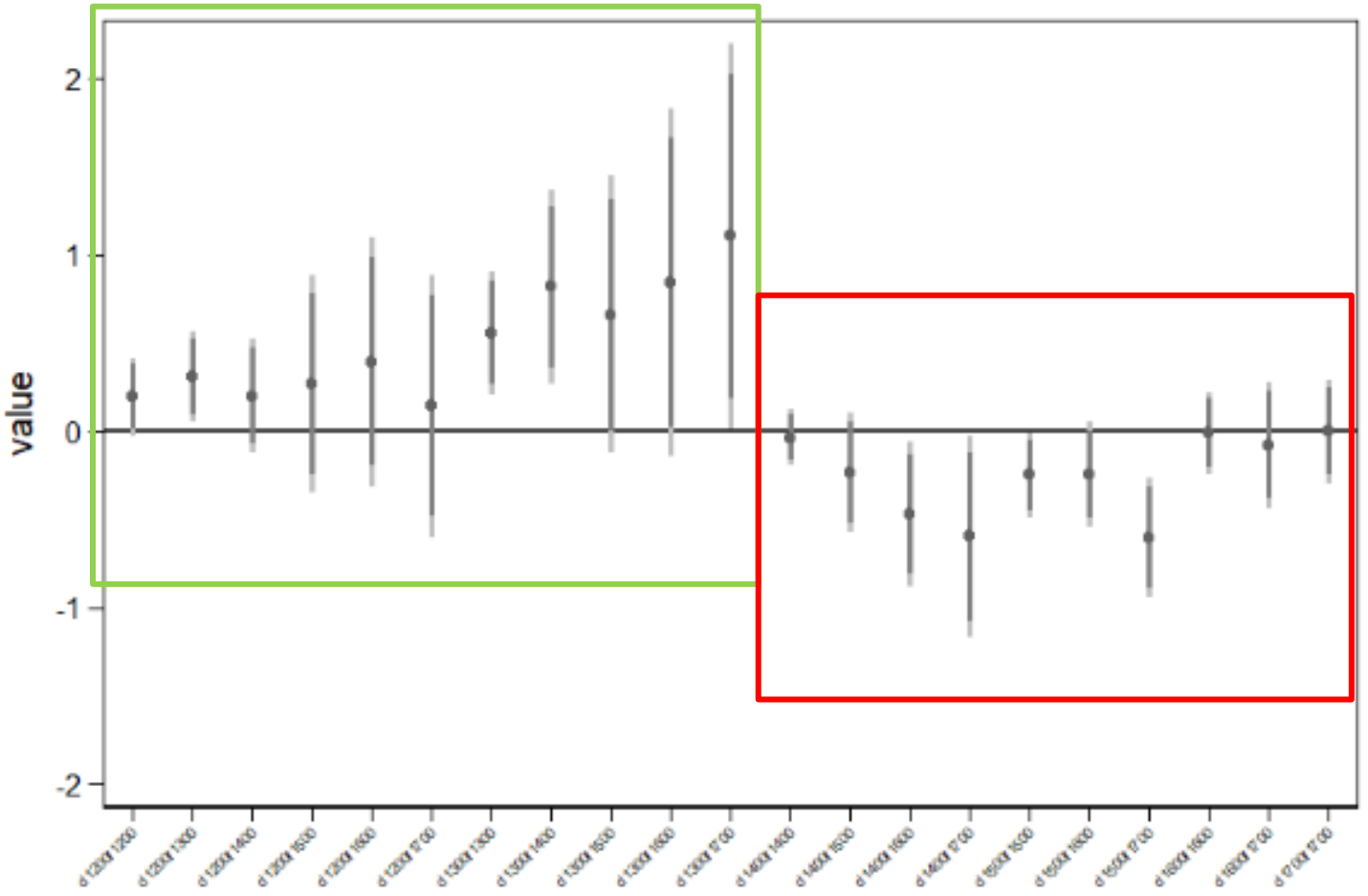
Correct for spatial autocorrelation (cutoff at 100 km)

Include the first three universities —Bologna, Paris, Oxford—

Results

ATT by cohort and century – Baseline specifications

- Positive trend for early cohorts
- Zero-negative afterwards



Model 3b. Coefficients by cohort and century (only time invariant cov.)

ATT by century – Baseline specifications

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	0.212 (0.135)	0.242 (0.148)	**0.195 (0.117) ***	0.180 (0.122)	0.157 (0.115)	0.142 (0.116)
By century						
1200-1299	**0.108 (0.062) ***	0.269 (0.208)	**0.125 (0.062) ****	0.227 (0.139)	**0.129 (0.061) ****	**0.195 (0.112) ***
1300-1399	**0.323 (0.104) ****	**0.438 (0.157) ****	**0.395 (0.10) *****	**0.471 (0.124) *****	**0.385 (0.10) *****	**0.432 (0.113) *****
1400-1499	**0.256(0.097) ****	**0.344 (0.134) ****	**0.320 (0.103) ****	**0.364 (0.119) ****	**0.291 (0.103) ****	**0.329 (0.114) ****
1500-1599	0.154 (0.144)	0.202 (0.160)	0.135 (0.130)	0.146 (0.139)	0.095 (0.129)	0.113 (0.134)
1600-1699	0.286 (0.179)	0.266 (0.167)	0.212 (0.146)	0.147 (0.138)	0.157 (0.144)	0.103 (0.135)
1700-1799	0.149 (0.191)	0.129 (0.175)	0.104 (0.148)	0.034 (0.136)	0.060 (0.145)	-0.004 (0.131)
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

ATT by centuries of exposure – Baseline specifications

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
By centuries of exposure						
0	**0.101(0.071) *** **	**0.147(0.073) *** **	**0.051(0.049) *** **	**0.086 (0.056) *** **	**0.043 (0.050) *** **	**0.076 (0.055) *** **
1	**0.285 (0.135) ** **	**0.290 (0.124) ** **	**0.141 (0.082) ** *	0.132 (0.088)	0.124 (0.082)	0.114 (0.087)
2	0.196 (0.207)	0.198 (0.190)	0.030 (0.123)	-0.003 (0.127)	-0.027 (0.122)	-0.052 (0.126)
3	0.147 (0.218)	0.191 (0.237)	0.302 (0.223)	0.252 (0.221)	0.210 (0.222)	0.173 (0.216)
4	**0.640 (0.361) ** *	**0.652 (0.381) ** *	**0.912 (0.364) ** **	**0.817 (0.343) ** **	**0.843 (0.359) ** **	**0.752 (0.330) ** **
5	-0.074 (0.455)	0.088 (0.568)	0.235 (0.445)	0.230 (0.440)	0.205 (0.426)	0.144 (0.379)
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

Robustness checks

1. ATT by century – altering operation threshold to 30-years

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	**0.237 (0.143) ***	**0.294 (0.162) ***	0.194 (0.122)	0.194 (0.133)	0.156 (0.120)	0.149 (0.124)
By century						
1200-1299	**0.149 (0.080) ***	0.358 (0.220)	**0.167 (0.080) ****	**0.315 (0.179) ***	**0.172 (0.080) ****	**0.266 (0.146) ***
1300-1399	**0.344 (0.105) ****	**0.492 (0.169) ****	**0.382 (0.105) *****	**0.470 (0.139) ****	**0.372 (0.104) *****	**0.426 (0.124) ****
1400-1499	**0.250 (0.112) ****	**0.376 (0.150) ****	**0.289 (0.108) ****	**0.357 (0.128) ****	**0.260 (0.107) ****	**0.316 (0.121) ****
1500-1599	0.183 (0.150)	0.269 (0.175)	0.144 (0.134)	0.175 (0.148)	0.104 (0.133)	0.136 (0.141)
1600-1699	**0.316 (0.188) ***	**0.313 (0.183) ***	0.219 (0.151)	0.163 (0.146)	0.160 (0.149)	0.109 (0.141)
1700-1799	0.179 (0.198)	0.179 (0.184)	0.100 (0.155)	0.040 (0.145)	0.061 (0.152)	-0.002 (0.137)
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

2. ATT by century – excluding suspended universities

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	0.189 (0.149)	0.252 (0.173)	0.162 (0.138)	0.168 (0.150)	0.130 (0.140)	0.133 (0.146)
By century						
1200-1299	**0.129 (0.071) ***	0.311 (0.233)	**0.146 (0.072) ****	**0.268 (0.161) ***	**0.150 (0.071) ****	**0.233 (0.135) ***
1300-1399	**0.265 (0.102) ****	**0.418 (0.175) ****	**0.347 (0.092) *****	**0.465 (0.133) *****	**0.339 (0.092) *****	**0.420 (0.122) ****
1400-1499	**0.207 (0.094) ****	**0.322 (0.146) ****	**0.245 (0.098) ****	**0.313 (0.128) ****	**0.219 (0.100) ****	**0.279 (0.126) ****
1500-1599	0.120 (0.165)	0.187 (0.191)	0.093 (0.161)	0.110 (0.173)	0.060 (0.163)	0.087 (0.174)
1600-1699	0.261 (0.201)	0.278 (0.198)	0.172 (0.184)	0.123 (0.18)	0.125 (0.187)	0.085 (0.179)
1700-1799	0.149 (0.208)	0.173 (0.204)	0.100 (0.176)	0.057 (0.170)	0.062 (0.178)	0.016 (0.166)
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. trends	No	No	Yes	Yes	No	No
NUTS2 lin. trends	No	No	No	No	Yes	Yes
Het. lin. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

3. ATT by century – Spatial robust S.E. 100km

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	**0.212 (0.134)**	0.242 (0.148)	**0.195 (0.115) ***	0.180 (0.121)	0.157 (0.114)	0.142 (0.115)
By century						
1200-1299	**0.108 (0.061) ***	0.269 (0.210)	**0.125 (0.061) ****	**0.227 (0.140)**	**0.129 (0.061) ****	**0.195 (0.115) ***
1300-1399	**0.323 (0.105) ****	**0.438 (0.156) ****	**0.395 (0.100) *****	**0.471 (0.122) *****	**0.385 (0.100) *****	**0.432 (0.112) *****
1400-1499	**0.256 (0.096) ****	**0.344 (0.133) ****	**0.320 (0.103) ****	**0.364 (0.118) ****	**0.291 (0.103) ****	**0.329 (0.114) ****
1500-1599	0.154 (0.143)	0.202 (0.160)	0.135 (0.128)	0.146 (0.137)	0.095 (0.128)	0.113 (0.133)
1600-1699	0.286 (0.180)	0.266 (0.168)	0.212 (0.145)	0.147 (0.138)	0.157 (0.144)	0.103 (0.134)
1700-1799	0.149 (0.190)	0.129 (0.175)	0.104 (0.147)	0.034 (0.136)	0.060 (0.144)	-0.004 (0.131)
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. Trends	No	No	Yes	Yes	No	No
NUTS2 lin. Trends	No	No	No	No	Yes	Yes
Het. Lin. Trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

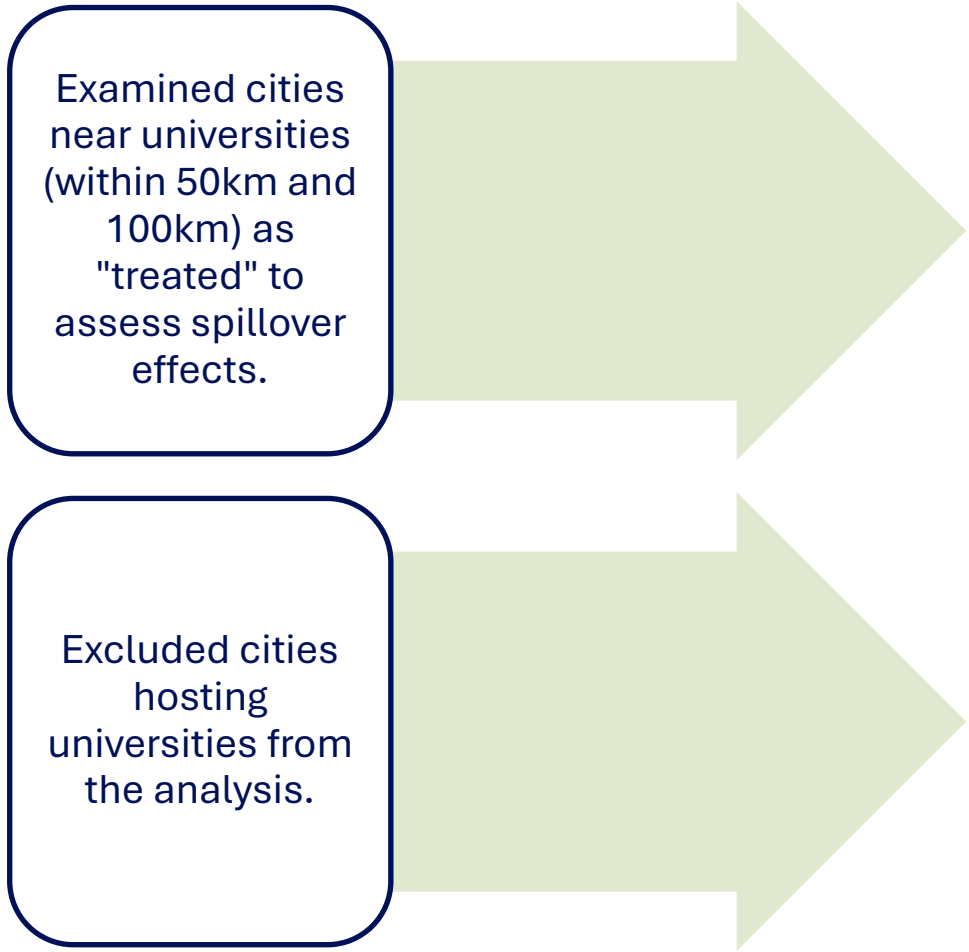
4. ATT by century – Include the first three universities

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	0.203 (0.130)	**0.232 (0.131) ***	0.161(0.114)	0.161 (0.116)	0.122 (0.113)	0.122 (0.113)
By century						
1200-1299	**0.087 (0.049) ***	0.173 (0.170)	**0.091 (0.055) ***	**0.222 (0.111) ****	**0.096 (0.054) ***	**0.178 (0.093) ***
1300-1399	**0.277 (0.104) ****	**0.351 (0.148) ****	**0.334 (0.103) ****	**0.435 (0.119) *****	**0.323 (0.102) ****	**0.386 (0.114) ****
1400-1499	**0.229 (0.095) ****	**0.300 (0.128) ****	**0.275 (0.106) ****	**0.340 (0.116) ****	**0.244 (0.105) ****	**0.299 (0.114) ****
1500-1599	0.112 (0.139)	0.164 (0.144)	0.071 (0.131)	0.101 (0.133)	0.028 (0.130)	0.068 (0.131)
1600-1699	0.281 (0.173)	**0.279 (0.154) ***	0.179 (0.142)	0.132 (0.133)	0.122 (0.141)	0.093 (0.131)
1700-1799	0.181 (0.184)	0.173 (0.165)	0.103 (0.141)	0.034 (0.131)	0.061 (0.138)	-0.002 (0.128)
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. Trends	No	No	Yes	Yes	No	No
NUTS2 lin. Trends	No	No	No	No	Yes	Yes
Het. Lin. Trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

Spillover effects

Spillover effects



- Very weak evidence of negative spillover effects on cities within 50km of universities but not statistically significant.

- Consistently, when we eliminate non-university cities from the sample close to university ones, results are very close to the baseline estimations.
- Overall, **no clear evidence** of spillover effects.

ATT by century – Spillover effects

	Baseline	Spillover effects at 50km	Drop cities below 50km
ATT	0.142 (0.116)	-0.044 (0.063)	0.118 (0.108)
By century			
1200-1299	**0.195 (0.112) ***	0.027 (0.075)	**0.171 (0.101) ***
1300-1399	**0.432 (0.113) *****	-0.041 (0.082)	**0.404 (0.108) *****
1400-1499	**0.329 (0.114) ****	-0.024 (0.075)	**0.309 (0.110) *****
1500-1599	0.113 (0.134)	0.032 (0.068)	0.112 (0.127)
1600-1699	0.103 (0.135)	-0.025 (0.071)	0.081 (0.128)
1700-1799	-0.004 (0.131)	**-0.132 (0.074) ***	-0.047 (0.124)
Time-invariant cov.	Yes	Yes	Yes
City FE	Yes	Yes	Yes
NUTS2 lin. Trends	Yes	Yes	Yes
Het. Lin. Trends	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

All estimations refer to the most comprehensive model 3b

Channels of university impact on urban growth

Potential channels/mechanisms

How?

Allow the cohort and century-specific effects to depend on certain predetermined characteristics (Wooldridge 2021;2023)

Capture effects of geographical and historical contexts

We tested as potential channels:

- Proximity to:
  - Atlantic Ocean
  - coast
  - rivers
  - Mainz
  - Wittenberg
  - Roman roads
  - thermal baths
  - bridges
  - castles

Potential channels/mechanisms

Potential Channels

- Proximity to the coast significantly **moderates** the effect **possibly due to** universities **role in maritime trade** through specialized training in navigation, trade law, and mercantile practices.

- Historical evidence: proximity of universities to the coast impacted their role in fostering population growth and urban expansion. **Coastal universities contributed to development of human capital tailored for maritime trade** (de Pleijt & van Zanden, 2016; Koyama et al., 2019).

To visualize the mechanism

We split the sample according to the city proximity to the coast:

→ **Cities close to the coast** (distance from the coast below the median)

→ **Cities away from the coast** (distance from the coast above the median)

→ University has a positive impact **only when** located close to the coast.

ATT by century – Channels of university impact

	Baseline	Close to the coast (below 50 perc.: 85.57 km)	Away from the coast (above 50 perc.: 85.57 km)
ATT	0.142 (0.116)	**0.277 (0.152) ***	-0.100 (0.081)
By century			
1200-1299	**0.195 (0.112) ***	**0.408 (0.190) ****	0.113 (0.075)
1300-1399	**0.432 (0.113) *****	**0.591 (0.153) *****	**0.313 (0.143) ****
1400-1499	**0.329 (0.114) ****	**0.551 (0.140) *****	-0.091 (0.085)
1500-1599	0.113 (0.134)	0.263 (0.183)	**-0.201 (0.091) ****
1600-1699	0.103 (0.135)	0.238 (0.174)	-0.149 (0.123)
1700-1799	-0.004 (0.131)	0.057 (0.161)	-0.172 (0.131)
Time-invariant cov.	Yes	Yes	Yes
City FE	Yes	Yes	Yes
NUTS2 lin. Trends	Yes	Yes	Yes
Het. Lin. Trends	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.

All estimations refer to the most comprehensive model 3b

Conclusions

Conclusions

- We investigate the establishment of Universities in Europe across centuries to identify their impact on economic development
- We extensively examine it for the first time relying on unified dataset
- We find significant positive effects for the early centuries and non-significant afterwards in accordance with historical narratives
- Potential channel the proximity to the coast possibly due to universities role in maritime trade

Thank you

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Additional robustness – time varying covariates

ATT - control for time varying covariates

To avoid potential bias from endogenous time-varying covariates, we excluded time varying covariates from our primary analysis.

Including such variables might introduce a "bad controls" problem, distorting the estimated treatment effect.

Nevertheless, additional robustness checks including these covariates confirm our baseline findings

We control for

Black Death mortality rate

Proximity to battles

Presence of archbishopric (dummy)

Presence of bishopric (dummy)

Proximity to archbishopric

Proximity to bishopric

Proximity to trade centre

Potato suitability (25K)

ATT by century - control for time varying covariates

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
ATT	0.203 (0.130)	**0.232 (0.131) ***	0.161 (0.114)	0.161 (0.116)	0.122 (0.113)	0.122 (0.113)
By century						
1200-1299	**0.087 (0.049) ***	0.173 (0.170)	**0.091 (0.055) ***	**0.222 (0.111) ****	**0.096 (0.054) ***	**0.178 (0.093) ***
1300-1399	**0.277 (0.104) ****	**0.351 (0.148) ****	**0.334 (0.103) ****	**0.435 (0.119) *****	**0.323 (0.102) ****	**0.386 (0.114) ****
1400-1499	**0.229 (0.095) ****	**0.300 (0.128) ****	**0.275 (0.106) ****	**0.340 (0.116) ****	**0.244 (0.105) ****	**0.299 (0.114) ****
1500-1599	0.112 (0.139)	0.164 (0.144)	0.071 (0.131)	0.101 (0.133)	0.028 (0.130)	0.068 (0.131)
1600-1699	0.281 (0.173)	**0.279 (0.154) ***	0.179 (0.142)	0.132 (0.133)	0.122 (0.141)	0.093 (0.131)
1700-1799	0.181 (0.184)	0.173 (0.165)	0.103 (0.141)	0.034 (0.131)	0.061 (0.138)	-0.002 (0.128)
Time-invariant cov.	No	Yes	No	Yes	No	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 lin. Trends	No	No	Yes	Yes	No	No
NUTS2 lin. Trends	No	No	No	No	Yes	Yes
Het. Lin. Trends	Yes	Yes	Yes	Yes	Yes	Yes

Note: Significance levels: ***1%, **5%, *10%, Spatial robust standard errors in parentheses.