The Impact of the Black Death on the Adoption of the Printing Press

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Comments Welcome
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A Tale of Two Cities

Liège, Belgium

Bristol, England

- 1300 Population = 11,000
- Black Death Mortality = 5%
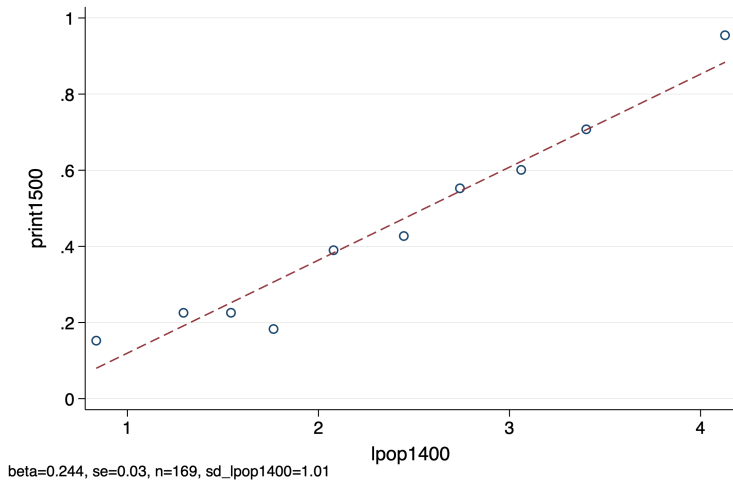- 1400 Population = 30,000
- Printing Press by 1500?
- → Yes

- 1300 Population = 11,000
- Black Death Mortality = 37%
- 1400 Population = 10,000
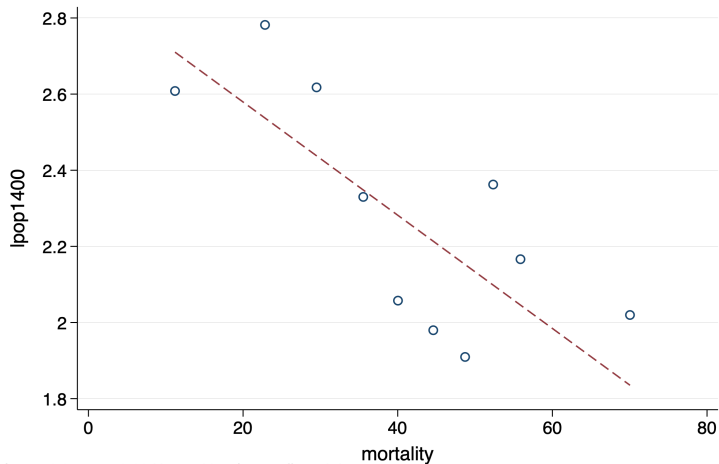- Printing Press by 1500?
- → No

What we do in this paper. . .

- ▶ We provide causal evidence that the Black Death destroyed market potential and retarded adoption of the printing press across cities during its first fifty years of diffusion (up to 1500)

- ▶ We provide causal evidence that this impact persisted at least up to 1600

- ▶ We investigate the negative impact of the Black Death on the extended market potential of a city and show that there were spatial spillovers

City population in 1400 vs. adoption of press before 1500
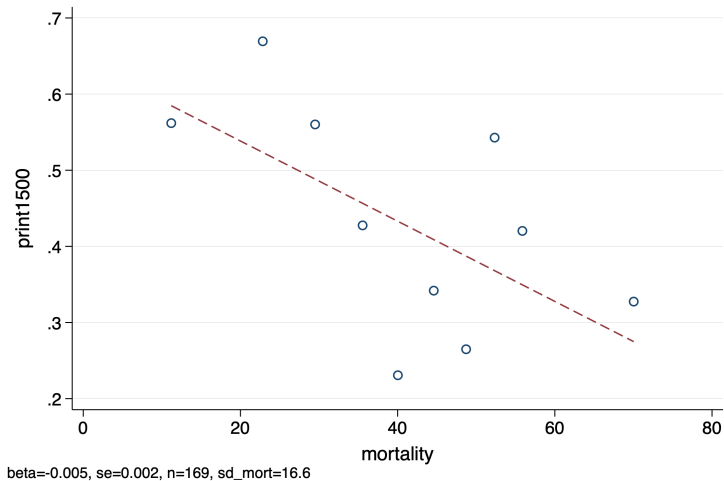

beta=0.244, se=0.03, n=169, sd_lpop1400=1.01

City BD mortality vs. city population in 1400

beta=-0.015, se=0.0046, n=169, sd_mortality=16.6

BD mortality vs. press adoption before 1500

beta=-0.005, se=0.002, n=169, sd_mort=16.6

Why do we care?

1. Literature on diffusion of technology and market size

   ▶ Acemoglu, 2001, Acemoglu & Linn, 2004

   ▶ Historical literature sometimes suggests Black Death encouraged press adoption because of it's impact on **factor prices**... `more`

   ▶ Other times the historical literature suggests that the impact of the Black Death on **market size** mattered for the diffusion of the press... `more`

   → Our study suggests that the impact of the Black Death on market size dominated

2. Who got the press early is of massive historical importance

   ▶ City Growth `more`

   ▶ The Reformation `more`

The Printing Press Revolution

- ▶ Movable type printing press invented by Johannes Gutenberg around 1440 in Mainz, Germany

- ▶ Printing press: one of the most important technologies of the last millennium (labor saving)

- ▶ Diffuses gradually across cities

- ▶ By 1475, about 50 cities have a press. By 1500 about 200. By 1600 about 475.

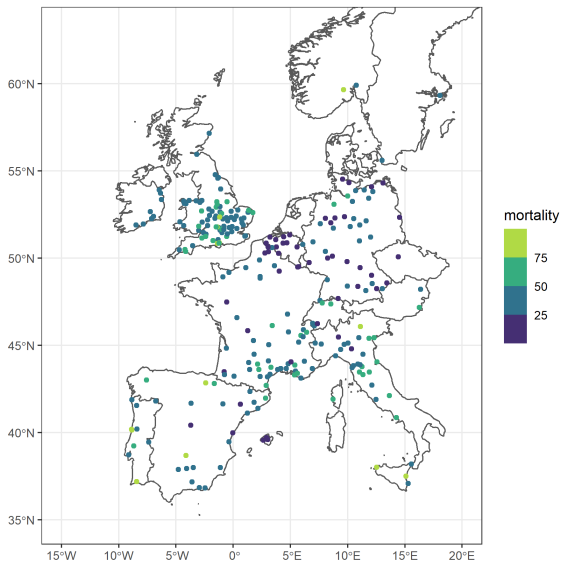- ▶ 8 million books printed by 1500

1. Provide evidence that Black Death mortality was random across cities

2. Show that the size of cities in 1400, predicted by random growth generated by the Black Death, also predicts early adoption of the press between 1450 and 1500 (as well as the amount of editions printed).

3. Investigate spatial spillovers from the Black Death on press adoption

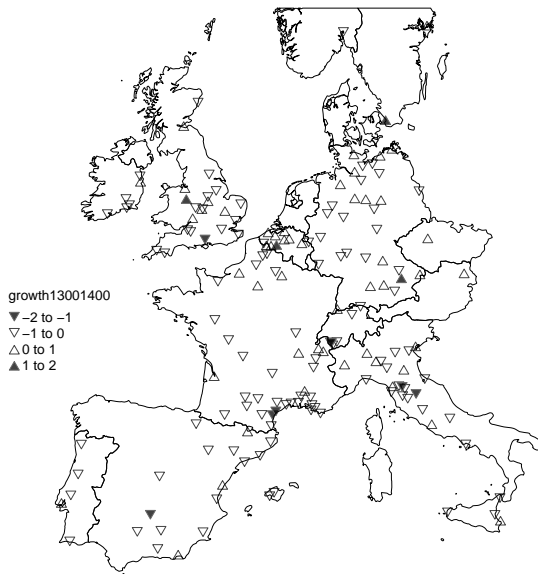The Black Death as a Persistent and Random Population
Shock

Black Death Data

- **Black Death cumulative mortality rates** in 1347-1352. Data for 274 localities (Source: Christakos et al 2005).

- **Populations** of 1,801 towns & cities in 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1750, 1800 and 1850 (Sources: Bairoch 1988, Chandler 1987). 457 cities ($>$ 1,000 inh.) in 1300.

- **Main sample:** <u>169 cities</u> existing in 1300 for which we know mortality ($\approx$ 60% of Western Europe's urban pop then).

- Data on various **controls** proxying for *locational fundamentals*, *increasing returns*, *institutions* and *contemporaneous shocks*:
    - Coast, rivers, soils, temperature, elevation, latitude, longitude;
    - Roman roads, land routes, trade networks, universities;
    - Political institutions, battles and other contemporaneous shocks.

274 Cities with Mortality Data

Base Sample: 169 Cities with Mortality and Population Data

growth13001400
▼ −2 to −1
▽ −1 to 0
△ 0 to 1
▲ 1 to 2

The Persistence of the Black Death Shock and Spillovers

▶ Begin by estimating for city i...

$$\%\Delta\text{Pop}_{i,t} = \alpha + \beta BD_i + \varepsilon_{i,t}$$

$\%\Delta\text{Pop}_{i,t}$: population growth (%) from 1300-1400.

BD_i: Black Death mortality rate (%) in 1347-1352.

By construction, $\beta = $ -0.01 in very short-run (mortality measured as 0-100).
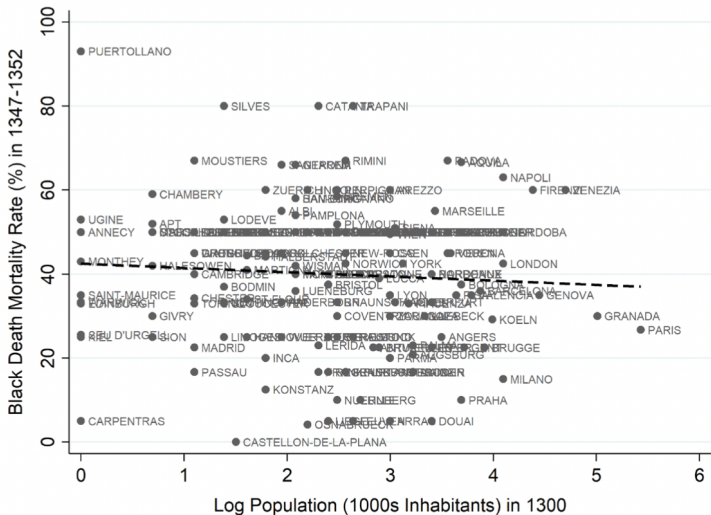
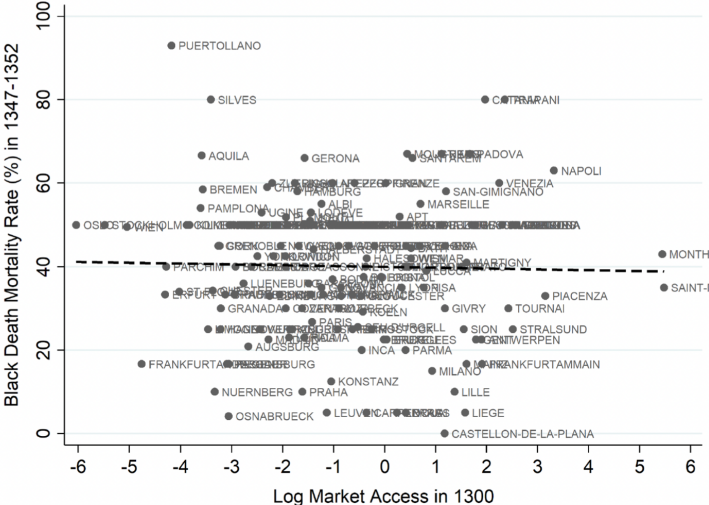|	(1) growth13001400	(2) growth13001400
mortality	−0.00846*** (0.00266)	
mean_mortality		−0.0145*** (0.00406)
N	169	169

A Comparatively "Pure" Population Shock.

- ▶ Huge Shock

- ▶ Acute—plague recurrences tended to be much less deadly (not always!) and spread over following centuries. Also, we can control for these on the extensive margin.

- ▶ Only killed people—infrastructure left intact.

- ▶ Did not explicitly target a sub-group of the population (e.g. intellectuals or a particular ethnic group).

- ▶ No government or international organization sponsored aid in the aftermath.

No correlation with city size...

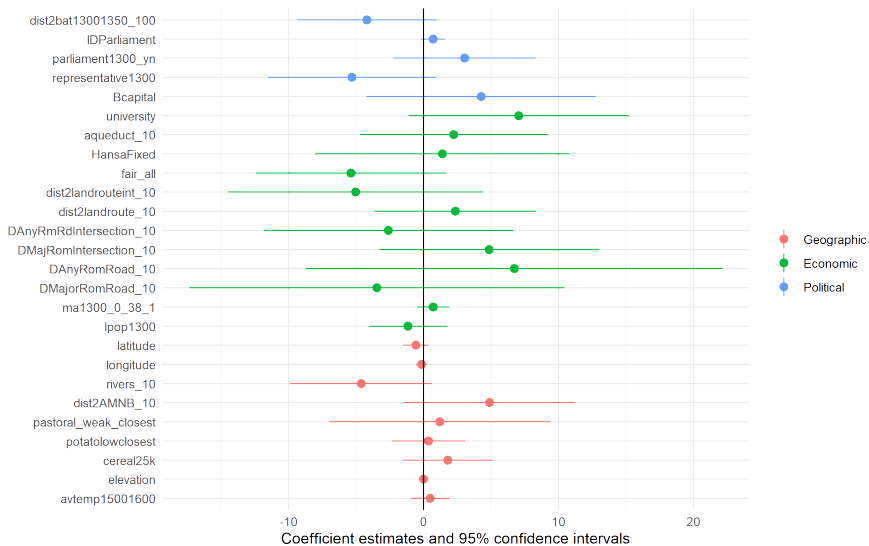No correlation between mortality (1347-52) and initial city size.

No correlation with market access...

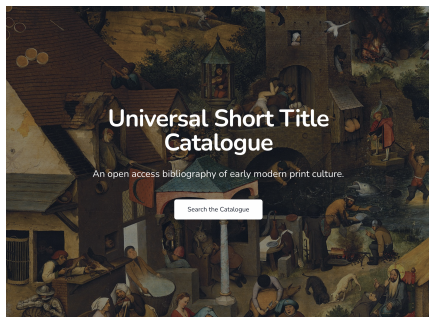No correlation between mortality (1347-52) and market access (1300).

No correlation with observables...

Coefficient estimates and 95% confidence intervals

Legend: Geographic, Economic, Political

y-axis labels (top to bottom):
dist2bat13001350_100, IDParliament, parliament1300_yn, representative1300, Bcapital, university, aqueduct_10, HansaFixed, fair_all, dist2landrouteint_10, dist2landroute_10, DAnyRmRdIntersection_10, DMajRomIntersection_10, DAnyRomRoad_10, DMajorRomRoad_10, ma1300_0_38_1, lpop1300, latitude, longitude, rivers_10, dist2AMNB_10, pastoral_weak_closest, potatolowclosest, cereal25k, elevation, avtemp15001600

x-axis: -10, 0, 10, 20

more

Using the USTC to Measure Early Print Adoption

The Universal Short Title Catalogue

Universal Short Title Catalogue

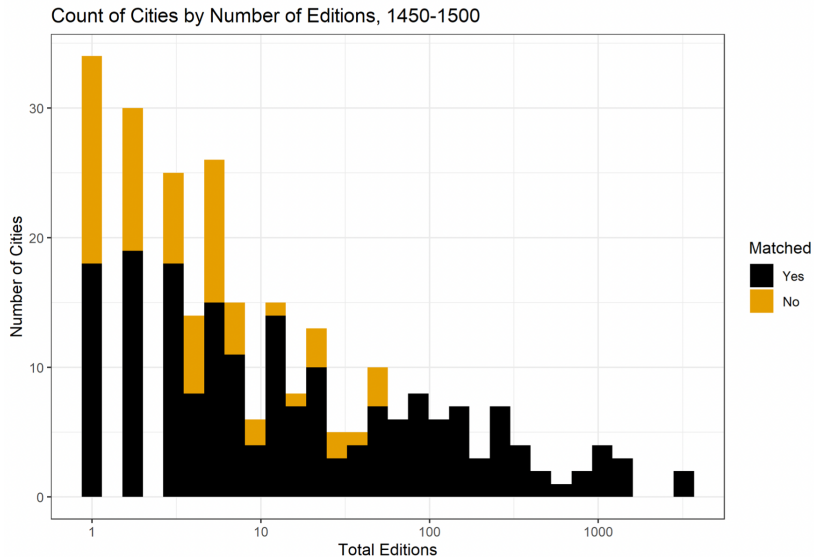An open access bibliography of early modern print culture.

Search the Catalogue

- Meta-data on all books published in Europe between the invention of printing and the end of the sixteenth century.

- E.g. Title, date of publication, edition, author, location of publication, publisher (in some cases), subject (coded by researchers.

- Based out of University of St Andrews with partners in University College, Dublin.

- Based on editions located in over 5,000 libraries worldwide.

Acquiring the USTC Data

▶ The USTC webpage allows you to search within given parameters. But we wanted the whole thing, so we scraped it.

▶ "Edition" is the basic unit of analysis, so. . .

1. Saved the HTML code.

2. Extract information from the HTML code using R and regex.

→ Results in 826,084 observations.

3. Remove any observations lacking info on location or year of publication.

→ 712,982 observations.

4. Restrict sample to editions published before 1600 (USTC is ongoing project moving forward in time). And eliminate editions with discrepancies (small number).

→ 343,660 observations.

City Matches between USTC and Mortality Sample, 1450-1500

Count of Cities by Number of Editions, 1450-1500

Empirical Results

- OLS up to 1500 `more`

- 2SLS up to 1500

- 2SLS up to 1600 `more`

- Spatial Spillovers

- Specialization `more`

2SLS up to 1500

▶ Specification...

$$\text{print}_i = \alpha + \beta \text{lpop1400} + \lambda X_i + \varepsilon_i \tag{1}$$

▶ Where *print$_i$* is either a dummy for city i adopting press by 1500 or the cumulative number of editions printed by city i. X is a vector of controls. We always control for university or bishopric presence in a town.

▶ Instrument *lpop1400* using city-level black death mortality

▶ We will also control for:

  ▶ Market Access in 1300 `more`

  ▶ Cereal Suitability `more`
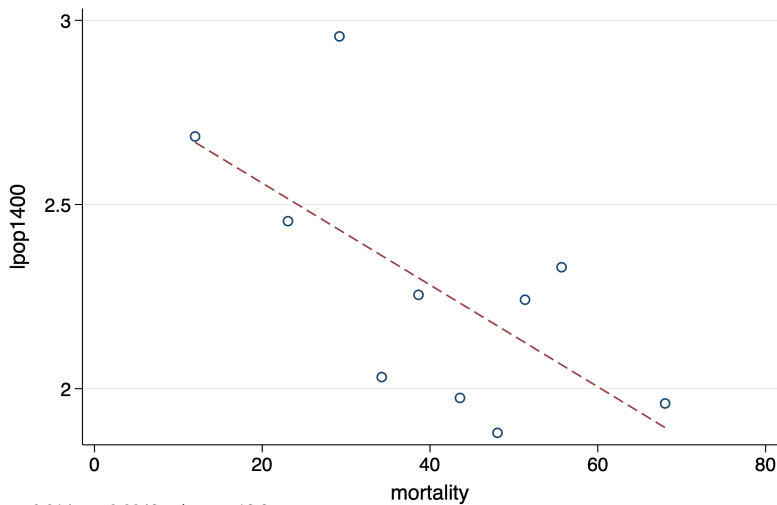
▶ We report Conley Standard Errors for all regressions

2SLS up to 1500, First Stage

Dependent Variables:		lpop1400	
Model:	(1)	(2)	(3)
Variables			
mortality	-0.0149***	-0.0151***	-0.0138***
	(0.0053)	(0.0052)	(0.0042)
Bishopric or University	Yes	Yes	Yes
Market Access in 1300	No	Yes	Yes
Cereal 25k	No	No	Yes
Fit statistics			
R²	0.16206	0.16347	0.18016
F-test	10.637	8.0121	7.1640
Observations	169	169	169

Conley (260km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Column 3 suggests 1sd increase in mortality associated with 0.22sd decrease in population in log pop. in 1400.

First Stage Bin Scatter

beta=0.014, se=0.0046, sd_mort=16.6
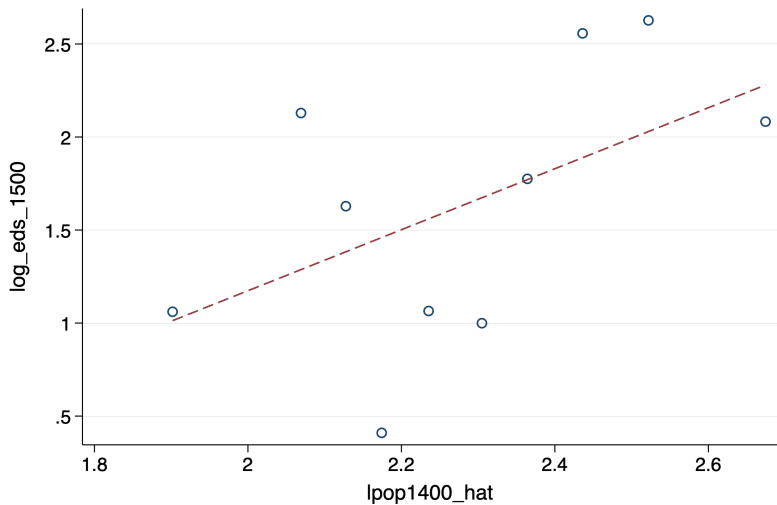
Second Stage Regs: 1500

Dependent Variables:		print1500			log_eds_1500	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
lpop1400	0.3542**	0.3071**	0.3306**	1.706*	1.546**	1.639**
	(0.1739)	(0.1326)	(0.1356)	(0.8644)	(0.6849)	(0.6640)
Bishopric or University	Yes	Yes	Yes	Yes	Yes	Yes
Market Access in 1300	No	Yes	Yes	No	Yes	Yes
Cereal 25k	No	No	Yes	No	No	Yes
Fit statistics						
Observations	169	169	169	169	169	169

Conley (260km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Column 3 suggests 1sd decrease in population (about 1.00) in 1400 associated with 37% lower probability of having a press by 1500. Column 6 suggests a 1sd decrease in population in 1400 associated with 0.73sd fewer editions published by 1500.

Second Stage Bin Scatter: Cumulative Editions: 1500

beta=1.64, se=0.72

Were there spatial spillovers from the Black Death?

▶ Create the shock to market access for a town by calculating market access in 1300 and 1400, excluding own town, and then taking the log difference. (more)

▶ This is potentially endogenous to a lot of things (war, transport network, weather shocks, etc...)

▶ Exploit Tobler's First Law of Economic Geography:

Everything is related to everything else, but near things are more related than distant things

▶ We create measures of our MA shock variable systematically excluding cities within a certain radius of the own city.

▶ We do this for radii of 0, 50, 100, 150, 200, and 250 kilometers.

→ Expect that as the radius goes up, the shock measure will be less biased, but more noisy.
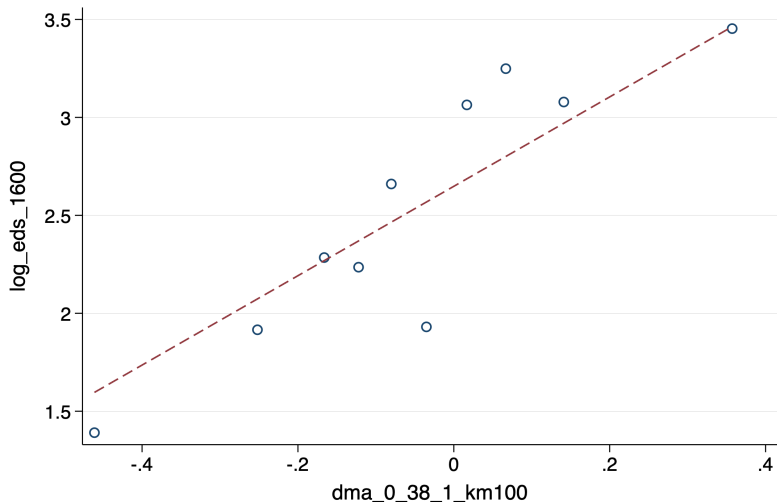
Regs: 1600 No. Editions

Dependent Variable:			log_eds_1600			
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
dma_0_38_1	0.5384***					
	(0.1921)					
dma_0_38_1_km50		1.323***				
		(0.4891)				
dma_0_38_1_km100			2.282***			
			(0.8074)			
dma_0_38_1_km150				1.512**		
				(0.6813)		
dma_0_38_1_km200					1.197	
					(1.112)	
dma_0_38_1_km250						1.650
						(1.417)
Bishopric or University	Yes	Yes	Yes	Yes	Yes	Yes
Market Access in 1300	Yes	Yes	Yes	Yes	Yes	Yes
Cereal 25k	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
R^2	0.19730	0.19914	0.21283	0.19083	0.18563	0.18693
F-test	22.810	23.076	25.091	21.885	21.153	21.336
Observations	470	470	470	470	470	470

Conley (240km) standard-errors in parentheses
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Bin Scatter: 100km: 1600 No. Editions

beta=2.28, se=0.53, sd_eds_1600=2.9

1sd in change in MA (0.23) leads to 0.18sd decrease in editions published.

Summary

1. Black Death Caused Lower Press Adoption Before 1500
   - ▶ 1 sd change in lpop1400 → 33% lower adoption
   - ▶ 1 sd change in lpop1400 → 75% of sd fewer editions

2. Black Death Caused Lower Press Adoption Before 1600
   - ▶ 1 sd change in lpop1400 → 28% lower adoption
   - ▶ 1 sd change in lpop1400 → 90% of sd fewer editions

3. Before 1500 Black Death Generated Spatial Spillovers that Impeded Press Adoption (relatively small)
   - ▶ 1 sd change in market access between 1300 and 1400 → 5% lower adoption
   - ▶ 1 sd change in market access between 1300 and 1400 → 13% of sd fewer editions

4. After 1500 Black Death's Impact on Extended Trade Network Mattered (a little) More
   - ▶ 1 sd change in market access between 1300 and 1400 → 8% lower adoption
   - ▶ 1 sd change in market access between 1300 and 1400 → 18% of sd fewer editions

Conclusions

- Printing press was really important.

- Black Death was really important.

- The two seem to be related.

- This has implications for how we think about the relationship between disease environment and economic development.

- The direct demographic impact of Black Death was devastating to technological diffusion.

- Also speaks to the lit on technical innovation—market size matters.

Levenshtein Distance

For example, the Levenshtein distance between "kitten" and "sitting" is 3, since the following 3 edits change one into the other, and there is no way to do it with fewer than 3 edits:

1. **k**itten → **s**itten (substitution of "s" for "k"),
2. sitt**e**n → sitt**i**n (substitution of "i" for "e"),
3. sittin → sittin**g** (insertion of "g" at the end).

- Also know as "edit distance".

- Counts as equal two strings that can be transformed into each other by a given number of edits (e.g. insertions, deletions, or substitutions).

- return

Matches between USTC and Mortality Sample

Period	1450-1500	1450-1600
Matched USTC Cities	193	475
Missing USTC Cities	68	340
% Cities Matched	0.74	0.58
Matched USTC Editions	25,494	329,658
Missing USTC Editions	518	14,002
% Editions Matched	0.98	0.96

Black Death Mortality and Market Access
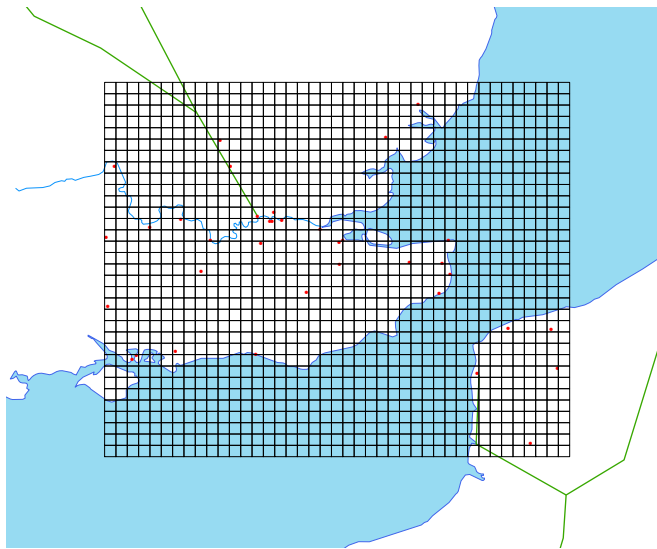
- Market Access for city j is defined as:

$$MA_j = \sum_{i=j} N_i \tau_{ji}^{-\sigma} \qquad (2)$$

- where N_i is the population of city i, τ_{ji} is the cost of travel between cities j and i, and σ is a trade elasticity (from Donaldson & Hornbeck (2015) = 3.8).
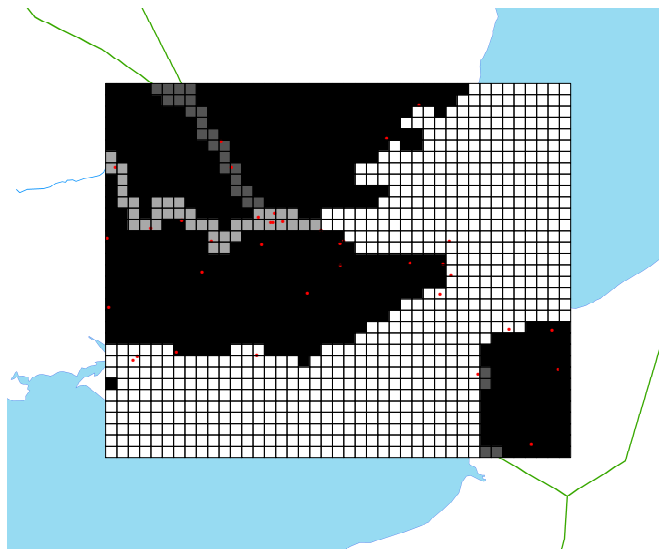
- Where does τ_{ji}, or, 'travel cost' come from?

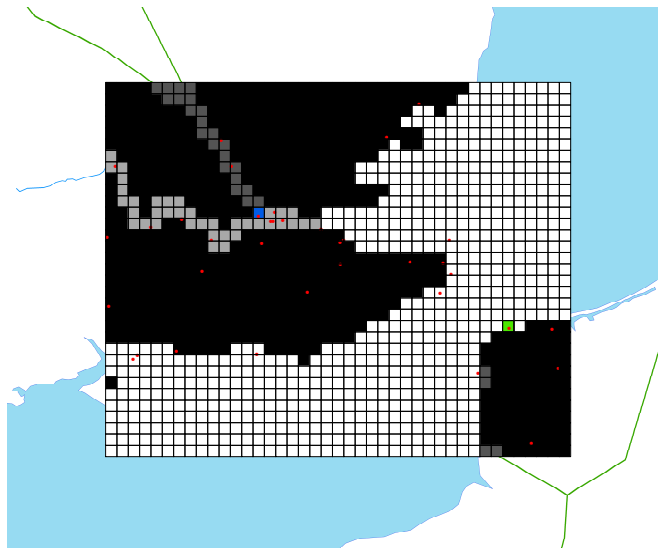Start with vector data containing cities, rivers, seas, and trade routes...
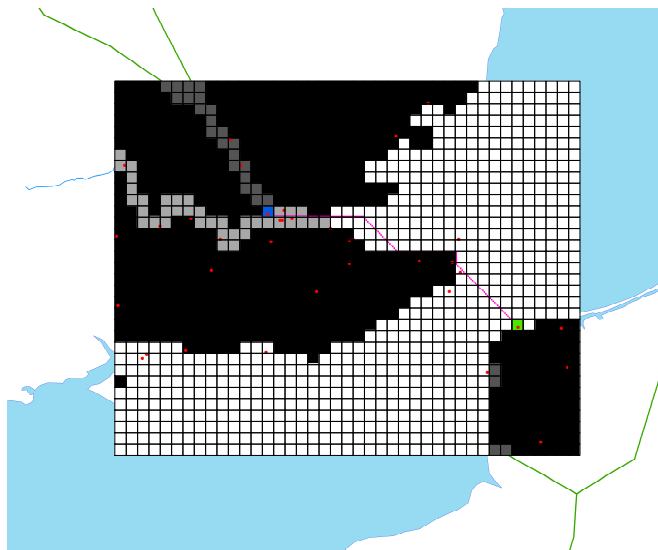
Superimpose a 5km x 5km grid...

Transform into a raster taking value of least cost transport for each grid...

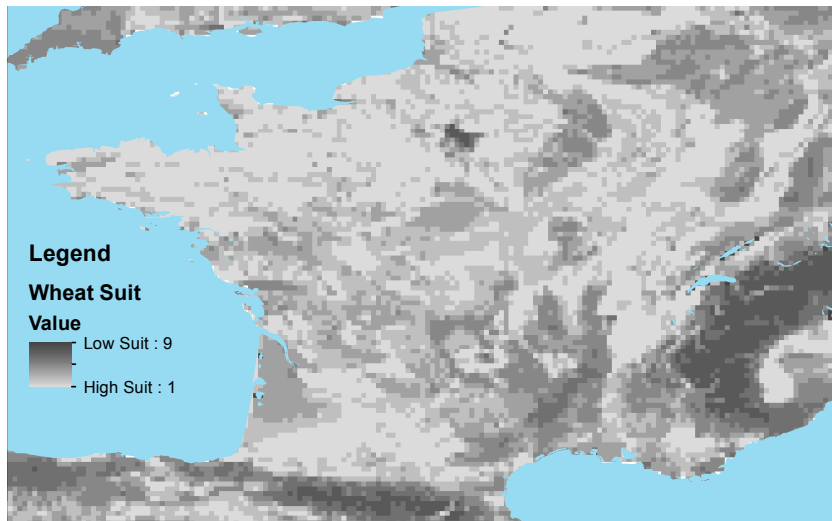Choose two cities: London and Calais. . .

Apply Dijkstra's Algorithm to identify least cost path and cost of taking least cost path (τ)...

Rinse and repeat 1,603,840 times. . .

GAEZ Soil Suitability

- At resolution of 0.5 by 0.5 degrees, combines data on:

  - Climate characteristics (e.g. precipitation, frequency of wet days, mean temperature, daily temperature range, vapor pressure, cloud cover, sunshine, ground-frost frequency, and wind speed)

  - Land characteristics (soil type and slope)

  - Crop constraints

- Index from 0 to 9 for *potential* of region to grow crop.

- Assume low inputs and no irrigation.

GAEZ Soil Suitability

Legend

Wheat Suit
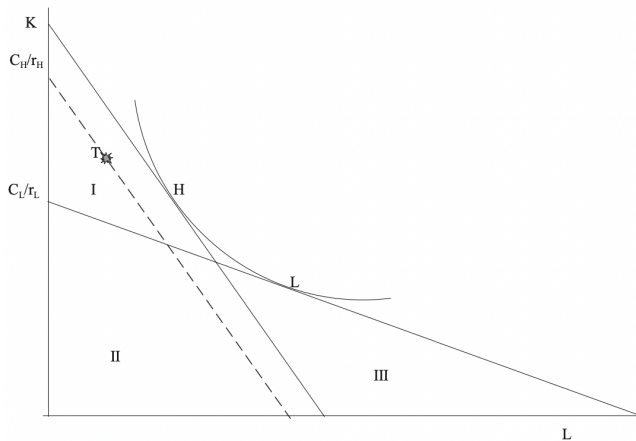
Value

Low Suit : 9

High Suit : 1

Return

Theory I: Labor Saving Innovation

One labour-saving innovation that also addressed the changes in patterns of demand in the aftermath of the plague was the printing press...Scribes had been employed to copy manuscripts. With the sharp rise in wages, this labour-intensive method ran into difficulties.

– Şevket Pamuk, European Review of Economic History, 2007

Theory I: Labor Saving Innovation (Allen, 2011)

Potential Points of Entry for the Black Death

return

Balance Table

	(1) mortality	(2) mortality	(3) mortality	(4) mortality
avtemp15001600	0.205 (0.656)			0.851 (0.881)
elevation	0.00465 (0.00712)			0.00893 (0.00801)
cerealclosest	0.926 (1.559)			2.384 (1.801)
potatolowclosest	0.232 (1.893)			−1.430 (2.110)
pastoral_weak_closest	1.089 (4.235)			0.683 (4.528)
dist2AMNB_10	5.362* (3.169)			3.068 (4.171)
rivers_10	−4.677* (2.650)			−6.037* (3.247)
longitude	−0.122 (0.210)			−0.0554 (0.304)
latitude	−0.785* (0.422)			−0.377 (0.516)
lpop1300		−0.894 (1.377)		−2.133 (1.938)
lma1300_cost1_38		0.570 (0.631)		0.480 (0.729)
DMajorRomRoad_10		−5.001 (7.797)		−2.715 (6.167)
DAnyRomRoad_10		8.059 (8.401)		4.832 (6.720)
DMajRomIntersection_10		4.034 (4.124)		6.048 (4.021)
DAnyRmRdIntersection_10		−1.403 (4.524)		−0.968 (4.427)
dist2landroute_10		2.208 (3.035)		3.434 (3.010)
dist2landrouteint_10		−5.047 (4.811)		−6.670 (4.904)
fair_all		−5.657 (3.593)		−3.213 (4.066)
HanseaFixed		1.183 (4.806)		5.262 (6.073)
aqueduct_10		1.864 (3.643)		−0.622 (3.777)
university		6.722 (4.186)		5.742 (4.345)
Bcapital			4.276 (4.300)	2.122 (4.643)
representative1300			−5.292* (3.155)	−0.376 (3.832)
parliament1300_yn			3.040 (2.673)	0.916 (3.452)
lDParliament			0.707 (0.450)	0.0676 (0.449)
dist2bat13001350_100			−4.191 (2.614)	−2.848 (2.762)
N	169	165	169	165
adj. R^2	0.099	0.009	0.036	0.086

No Correlation with Local Physical Geography

- Average temperature between 1500 and 1600
- Elevation
- Cereal suitability more
- Potato suitability
- Pastoral suitability
- Within 10km of sea
- Within 10km of river
- Longitude
- Latitude

No Correlation with Local Economic Geography

- City population in 1300
- Market access in 1300
- Within 10km of major Roman road
- Within 10km of any Roman road
- Within 10km of major Roman road intersection
- Within 10km of any Roman road intersection
- Within 10km of medieval road (from Shepherd Atlas)
- Within 10km of medieval intersection (from Shepherd Atlas)
- Medieval fair location
- Member of Hanseatic League
- Roman aqueduct
- University

No Correlation with Local Institutions

- Capital city
- Representative institution in 1300
- Years parliament met in 14th century
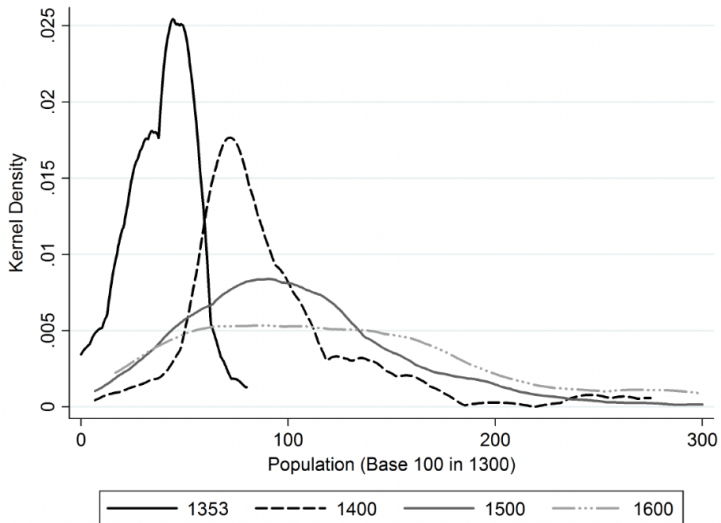- Distance to parliament
- Distance to battles between 1300 and 1350

Theory II: Market Size

> . . . the invention of the printing press can in some ways be attributed to the decimation of the European population by the Black Death. The survivors of the Plague had inherited the property of the deceased. Thus the average wealth of European society increased, along with the demand for goods and services. Copies of both books and business documents were in high demand. In particular, the founding and growth of the European universities in the twelfth and thirteenth centuries increased the demand for books.
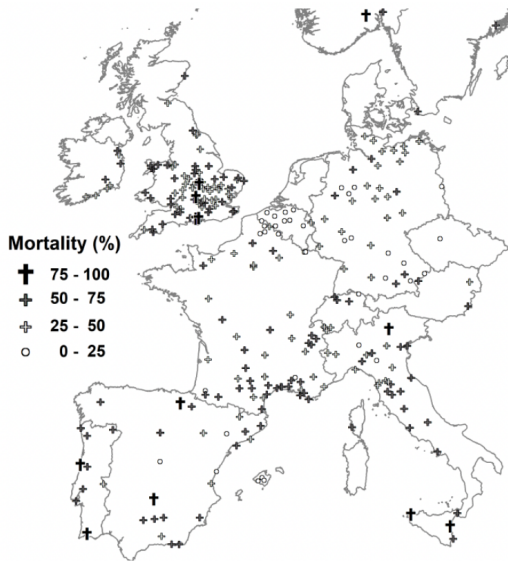>
> –David Deming, Science and Technology in World History, Vol 3, 2010.

A very long time. . .

return

Distribution of Black Death Mortality

Mortality (%)

✝ 75 - 100
✝ 50 - 75
✢ 25 - 50
○ 0 - 25

Impact of Printing Press I: City Growth

- ▶ Dittmar (2011) argues that cities that received a press in first 50 years received a significant growth advantage.

- ▶ Suggests that this was due to localized impact of press (books were expensive to trade).

- ▶ Limited evidence that, e.g. merchant manuals, gave these cities a human capital advantage.

- ▶ Identification from 2SLS using distance to Mainz as IV.

Impact of Printing Press II: The Reformation

prophetic dream of Friedrich III of Saxony on Luther's posting of
the 95 Theses in Wittenberg—Martin Luther writing with a large
pen knocking off the tiara of Pope Leo X

return

- Rubin (2014) finds that cities with a press by 1500 were about 30% more likely to be reformed.

- Johnson and Koyama (2019) argue that the reformation was crucial for the development of religious liberty and, through it's interaction with state capacity, present-day liberal institutions.
book

Matching the USTC Data to City Mortality Data

▶ The city names in the Bairoch data don't always match those in the USTC data (and in some cases the same city is spelled differently in the USTC).

▶ Start by doing a naive left join on city name. Checked by hand (e.g. there is a Brest in France and in Belarus).

▶ Then use a fuzzy matching technique—Levenshtein Distance—to do another round of matching.

▶ Experiment with various values of edit distance and check results by hand.

▶ Attempt to match remaining mortality cities by hand (e.g. Prague, rendered as Praha in Bairoch and Aix-en-Provence as Aix).

▶ Of 1,312 unique place names present in the USTC data, we find matches to 631 cities in our Bairoch data. We find 193 cities from 1450-1500, and 475 cities from 1450-1600 (though not all these intersect with our mortality cities).
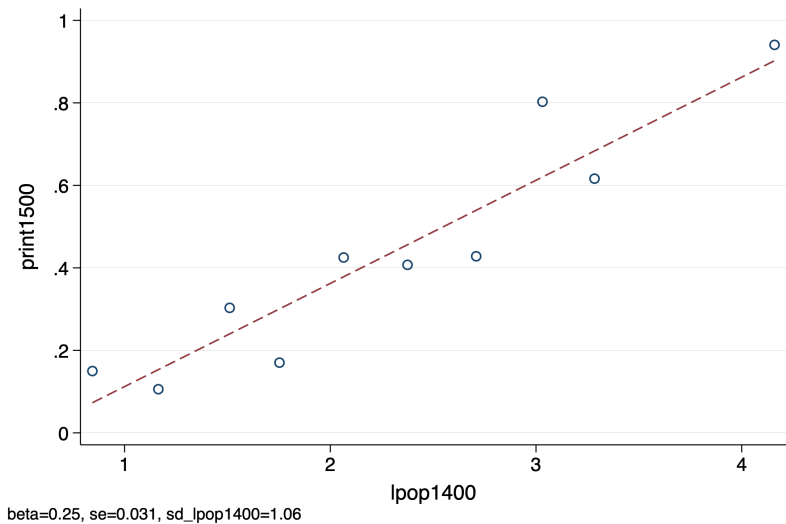
OLS Table: 1500

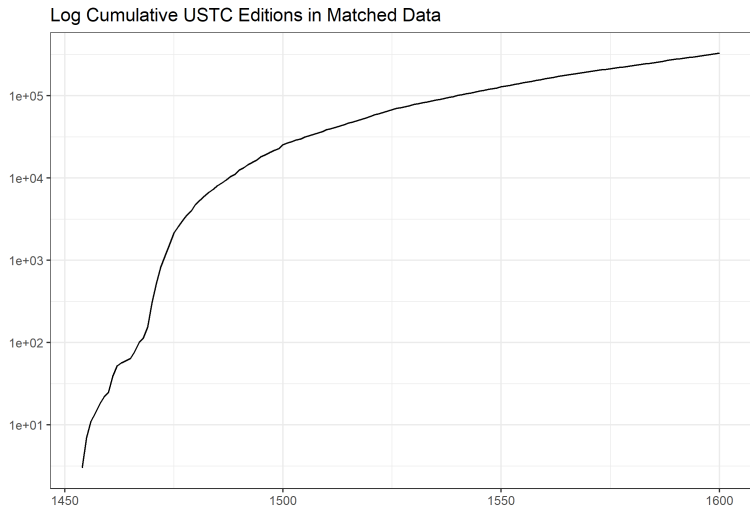| Dependent Variables:		print1500			log_eds_1500	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
lpop1400	0.2443***	0.2459***	0.2501***	1.216***	1.222***	1.236***
	(0.0350)	(0.0392)	(0.0394)	(0.1728)	(0.1898)	(0.1955)
Bishopric or University	Yes	Yes	Yes	Yes	Yes	Yes
Market Access in 1300	No	Yes	Yes	No	Yes	Yes
Cereal 25k	No	No	Yes	No	No	Yes
Fit statistics						
R^2	0.30850	0.35863	0.36091	0.38645	0.41429	0.41556
F-test	24.537	22.925	18.410	34.642	29.001	23.180
Observations	169	169	169	169	169	169

Conley (260km) standard-errors in parentheses
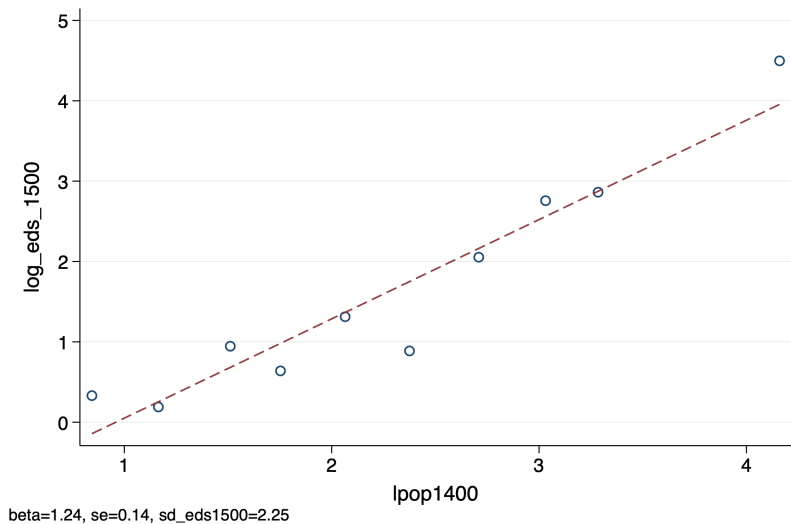*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

OLS Bin Scatter: Dummy: 1500

beta=0.25, se=0.031, sd_lpop1400=1.06

We can also look at the intensive margin. . .

Log Cumulative USTC Editions in Matched Data

OLS Bin Scatter: Cumulative Editions: 1500

beta=1.24, se=0.14, sd_eds1500=2.25

return

Second Stage Regs: 1600

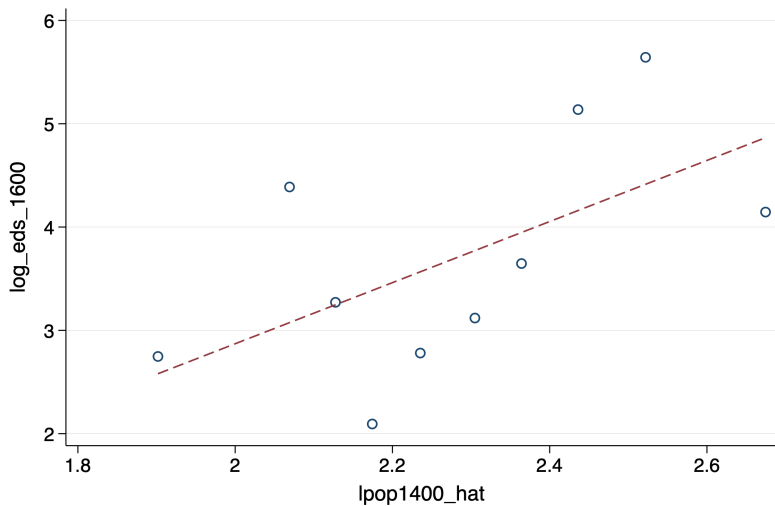| Dependent Variables:		print1600			log_eds_1600	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
lpop1400	0.3629***	0.3196***	0.2739**	3.418***	3.074***	2.957***
	(0.1014)	(0.0999)	(0.1176)	(0.9458)	(0.6201)	(0.5924)
Bishopric or University	Yes	Yes	Yes	Yes	Yes	Yes
Market Access in 1300	No	Yes	Yes	No	Yes	Yes
Cereal 25k	No	No	Yes	No	No	Yes
Fit statistics						
Observations	169	169	169	169	169	169

Conley (260km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Second Stage Bin Scatter: Dummy: 1600

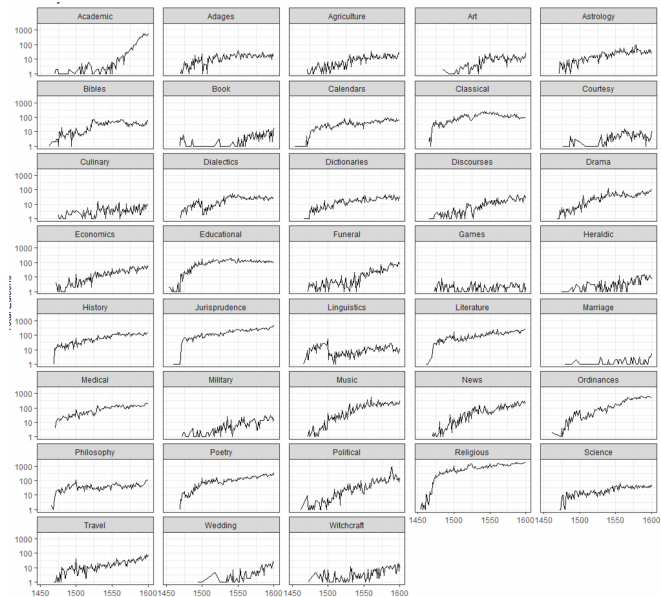beta=0.28, se=0.14, sd_print1600=0.50

Second Stage Bin Scatter: Cumulative Editions: 1600
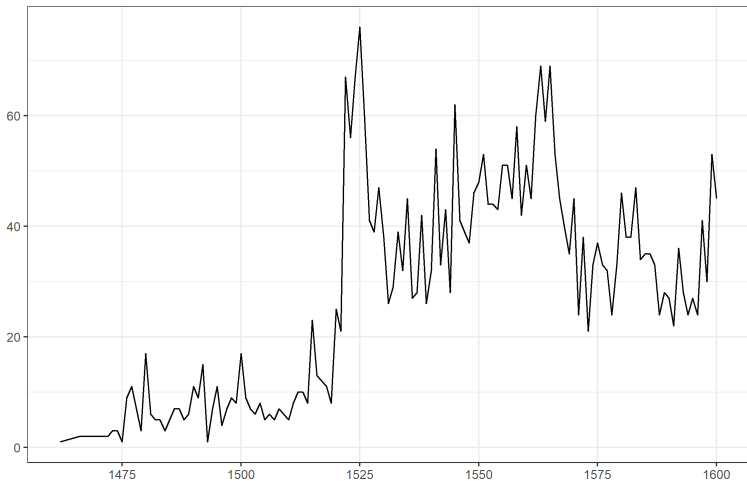

beta=2.96, se=0.96, sd_eds1600=2.9

return

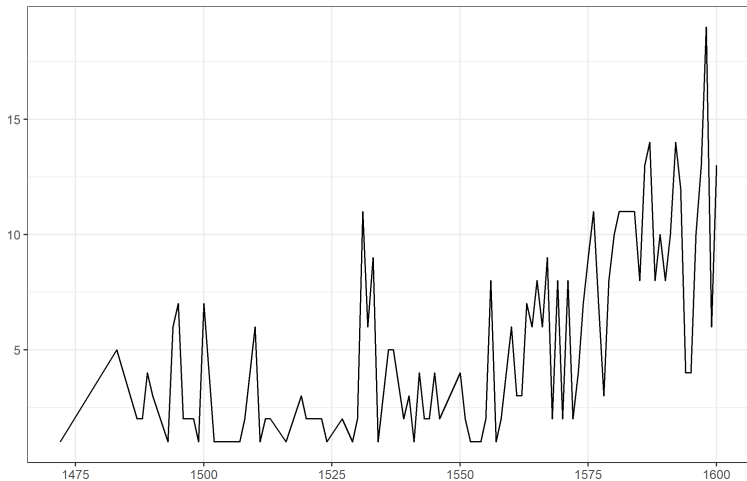We can also investigate how much specialization by subject there was in printing by city...

These catagories kind of make sense. . .
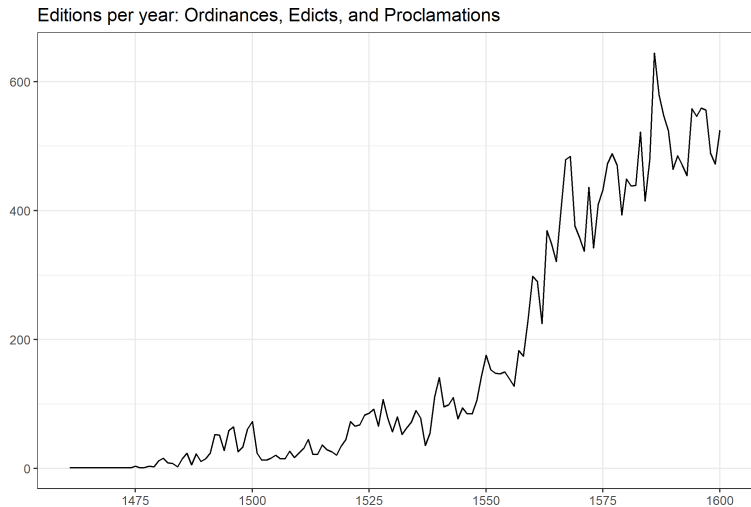

Editions per year: Bibles

These catagories kind of make sense...

Editions per year: Witchcraft, Demonology, Occult writings

These catagories kind of make sense. . .

Editions per year: Ordinances, Edicts, and Proclamations

We calculate a Herfindahl-Hirschman Index by city x subject

$$HHI_j = \sum_{i=1}^{n} s_{ji}^2$$
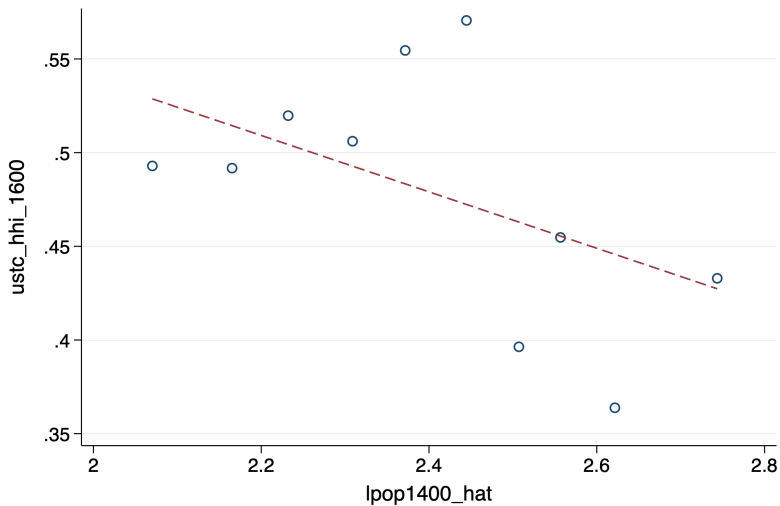
▶ Where s_{ji} is the share of each subject $i \in n$ published in city j

▶ A higher value means less specialization.

Dependent Variables:		ustc_hhi_1600	
Model:	(1)	(2)	(3)
Variables			
lpop1400	-0.1642	-0.1447*	-0.1243**
	(0.0996)	(0.0777)	(0.0570)
Bishopric or University	Yes	Yes	Yes
Market Access in 1300	No	Yes	Yes
Cereal 25k	No	No	Yes
Fit statistics			
R^2	0.27435	0.30733	0.31325
F-test	1.6355	1.2704	1.0170
Observations	117	117	117

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

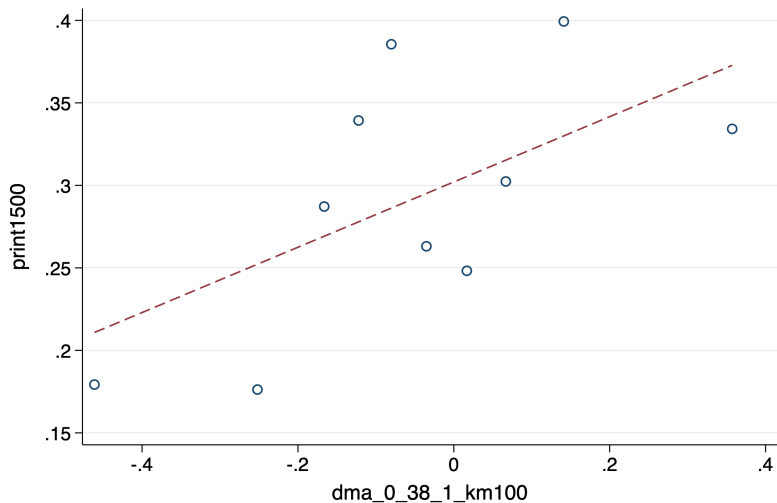# Second Stage of 2SLS HHI vs. lpop1400

beta=-0.15, se=0.1, sd_hhi=0.24

return

Dependent Variable:	print1500					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
dma_0_38_1	0.0586**					
	(0.0230)					
dma_0_38_1_km50		0.2359***				
		(0.0819)				
dma_0_38_1_km100			0.1979*			
			(0.1088)			
dma_0_38_1_km150				0.1171		
				(0.1048)		
dma_0_38_1_km200					0.0263	
					(0.1633)	
dma_0_38_1_km250						-0.0470
						(0.1916)
Bishopric or University	Yes	Yes	Yes	Yes	Yes	Yes
Market Access in 1300	Yes	Yes	Yes	Yes	Yes	Yes
Cereal 25k	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
R^2	0.12841	0.14364	0.13029	0.12309	0.12085	0.12095
F-test	13.672	15.566	13.902	13.026	12.757	12.769
Observations	470	470	470	470	470	470

Conley (240km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Bin Scatter: 100km: 1500 Dummy

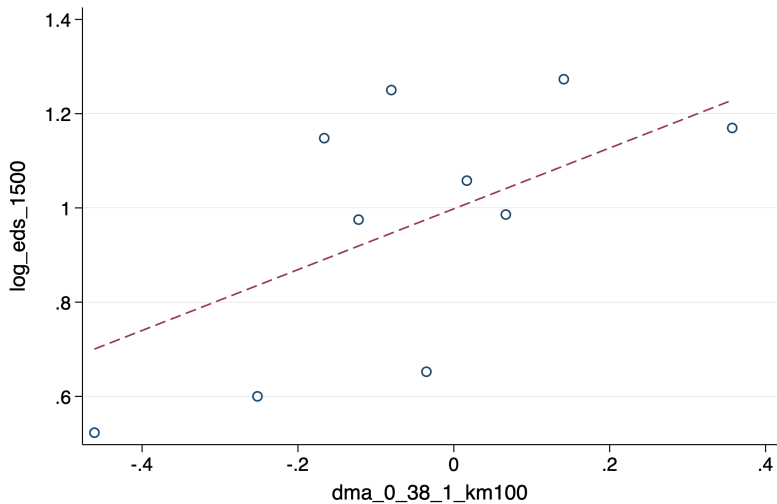
beta=0.2, se=0.09, sd_dm_ma_100=0.23

Regs: 1500 No. Editions

Dependent Variable:			log_eds_1500			
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
dma_0_38_1	0.2842*					
	(0.1691)					
dma_0_38_1_km50		0.8197***				
		(0.3112)				
dma_0_38_1_km100			0.6455			
			(0.5120)			
dma_0_38_1_km150				0.4453		
				(0.5022)		
dma_0_38_1_km200					0.1982	
					(0.6440)	
dma_0_38_1_km250						0.0384
						(0.7566)
Bishopric or University	Yes	Yes	Yes	Yes	Yes	Yes
Market Access in 1300	Yes	Yes	Yes	Yes	Yes	Yes
Cereal 25k	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
R^2	0.14766	0.15367	0.14274	0.13850	0.13671	0.13641
F-test	16.077	16.850	15.451	14.919	14.695	14.658
Observations	470	470	470	470	470	470

Conley (240km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Bin Scatter: 1500 No. Editions
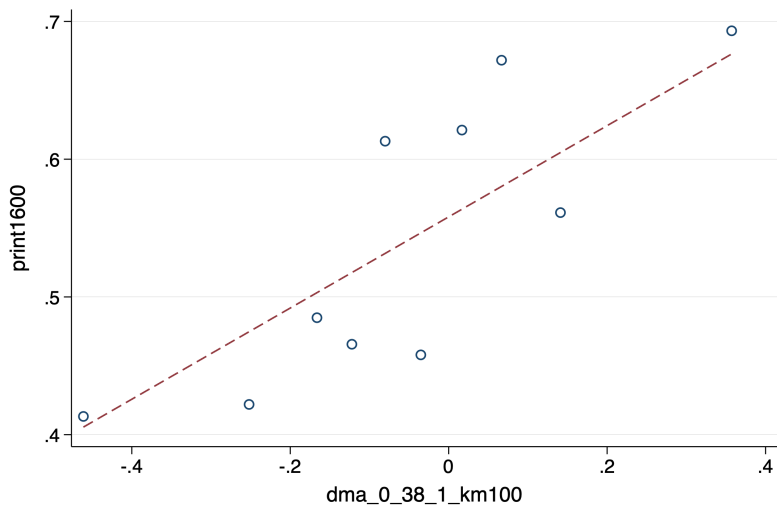

beta=0.65, se=0.35, sd_eds_1500=1.18

return

Regs: 1600 Dummy

Dependent Variable:			print1600			
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
dma_0_38_1	0.0624**					
	(0.0300)					
dma_0_38_1_km50		0.2039*				
		(0.1113)				
dma_0_38_1_km100			0.3310**			
			(0.1394)			
dma_0_38_1_km150				0.1932**		
				(0.0970)		
dma_0_38_1_km200					0.0880	
					(0.1736)	
dma_0_38_1_km250						0.1686
						(0.2426)
Bishopric or University	Yes	Yes	Yes	Yes	Yes	Yes
Market Access in 1300	Yes	Yes	Yes	Yes	Yes	Yes
Cereal 25k	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
R^2	0.19795	0.20493	0.21289	0.19598	0.19153	0.19274
F-test	22.903	23.920	25.099	22.621	21.984	22.156
Observations	470	470	470	470	470	470

Conley (240km) standard-errors in parentheses
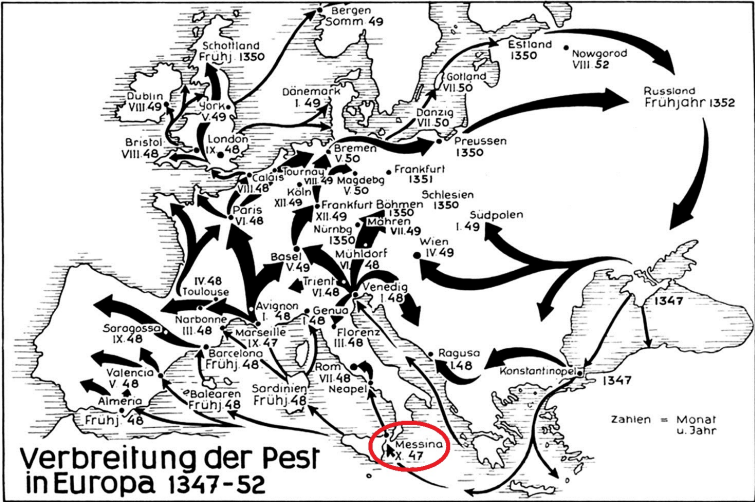*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Bin Scatter: 100km: 1600 Dummy

beta=0.33, se=0.09, sd_dma_100km=0.23

return

European outbreak in 1347-52. Port of entry: Messina (Oct 1347)
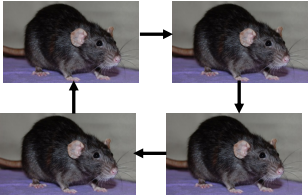

Verbreitung der Pest in Europa 1347-52

more

Disease contagion process of the Black Death.

Black rats infected with *Yersinia Pestis* traveling on boats and carts from Asia

They infect European rats that in turn infect other European rats.

Humans infect other humans (**pneumonic plague**) and rats.

Fleas drink rat's blood. Bite humans once rats die (**bubonic plague**).

Symptoms (you die one to seven days after initial infection).
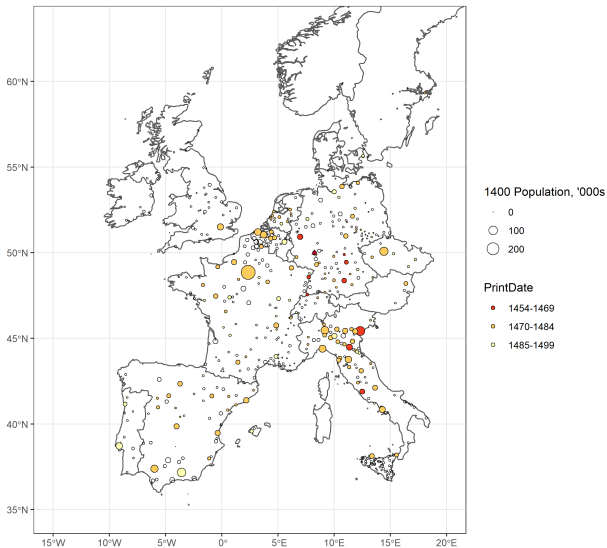

Buboes

Black warts

Coughing of blood

Seizures

The 193 cities matched from USTC to Bairoch

Spread of the Printing Press up to 1500
Matched Bairoch-USTC Cities

1400 Population, '000s
· 0
○ 100
○ 200

PrintDate
● 1454-1469
● 1470-1484
○ 1485-1499

more