Creativity over Time and Space

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Motivation

- Creativity is often concentrated in time and space, across different domains
- Vienna around the turn of the XIXth century, with figures like Freud, Klimt and many others
- Baghdad in the IXth century
- Florence in the XVth century
- London in the late XVIth century
- Paris in the early XIXth century
- New York/San Francisco in the past few decades

Questions

1. How does the spatial distribution of creativity look like?
2. Is there spatial movement of clusters over time?
3. Is there "co-agglomeration" of key creative people in different fields?
4. How did these patterns evolve over time?
5. Is upper-tail human capital in creative occupations correlated with measures of innovation?
6. What predicts the formation of creative clusters?

- Knowing answers is important, given central role of creativity in human progress and economic development

What we do

- Focus on creative elites and key individuals in Europe over long time span
- City-level *production* and attraction of *upper-tail human capital in creative occupations*
- Info on date and place of birth (PoB) / death (PoD) of thousands of notable individuals in arts, business, science and humanities between 11th and 19th century
- Births: "innovation exposure effects" during childhood (Bell et al. 2016)
- Match with historical data on European cities
- Famous creatives (FC) born /immigrants in city, per 1000 inhabitants
- Study patterns (ups and downs) and determinants of clusters of creative elites

Related Work

- Upper tail human capital and the industrial revolution (Mokyr 2009, Meisenzahl & Mokyr 2011, Squicciarini & Voigtländer 2014)
- Microdata on upper tail human capital: Schich et al. 2014, De la Croix & Licandro 2015, Gergaud et al. 2016, Dittmar & Meisenzahl 2016
- We focus more specifically on creative individuals, on spatial patterns over time (using the city as the unit of analysis) and on the effects of the local environment (f.i. institutions) on the formation of creative clusters

Related Work (con't)

- Spatial movements of clusters over time: Duranton 2007's model, Kerr 2010
- Localized Knowledge Spillovers: Duranton & Puga 2004, Combes & Gobillon 2015; Jaffe et al. 1993, Glaeser 1999, Rosenthal & Strange 2003, Moretti 2004, Arzaghi & Henderson 2008, Serafinelli 2015
- Local Environment/Institutions/Culture of tolerance and innovation: Donges et al. 2016, Falck et al. 2011, Florida 2005; Saxenian 1994, Bénabou et al. 2015, McCloskey 2016, Tabellini 2016
- Most of these studies generally focus on recent periods, and often exploit patent data; in contrast, we study a very long historical period with data on creative elites.

*Outline

- Data definition and sources
- Conceptual Framework
- Description of main patterns in the data
- Local institutions and births
- Concluding remarks

Data

- FC: Freebase.com as coded by Schich. et al. 2014
- Large Google-owned knowledge base that is publicly editable and available under a license which allows for sharing and remixing
- It stores info from variety of sources, most notably Wikipedia
- Notability of people is defined as the curatorial decision of inclusion in the (partly crowd-sourced) Freebase
- Dataset #2: Meisenzahl and Mokyr 2011's data on UK engineers (born 1660 - 1830)
- Dataset #3: Yu at el 2015's Historical Popularity Index, which correlates highly with individual accomplishment
- Sensitivity: Delacroix and Licandro 2015's data from old dictionaries and encyclopedias

Data

Freebase.com

- Arts (Performing): Actor, Singer, Musician, Playwright etc
- Arts (Non-Performing): Writer, Novelist, Journalist, Composer, Author, Architect, etc
- Humanities and Sciences: Mathematician, Physician, Philosopher, Scientist, Physicist, Chemist, Historian, etc
- Business: Entrepreneur, Engineer, Businessperson, Sailor, Manager, etc

Data (con't)

- The source entails measurement error, and possibly some reporting bias
- We don't have information on location at different stages of the career (this complicates in part. the study of attraction)
- But the data arguably compensate this inaccuracy with their breadth in terms of time, geography and disciplines
- In part. FC more likely to capture radical creativity, compared to general indicators of human capital. And they allow us to study activities in periods and domains where patents data are not available (very long run horizon needed to document ups and downs of clusters)

*Categories (con't)

Table: Freebase Professional Categories

	Number of people
Performing arts	3947
Non performing arts	5007
Humanities and Sciences	4516
Business	1263
Governance	2950
Sports	340
Unclassified	25580
Total Unique IDs	40980

Table: Count of Famous Creatives and Population

Century	Unscaled Births	Unscaled Immigrants	Population (1000's)
1000	10	9	2004
1100	17	8	2089
1200	39	32	2993
1300	40	29	6092
1400	167	115	4867
1500	476	342	6785
1600	698	488	10478
1700	1790	1424	12595
1800	9051	6488	25444

Table: Summary Statistics

Variable	Mean	(Std. Dev.)	Min.	Max.	N
Births	0.183	(0.534)	0	9.75	6226
Immigrants	0.111	(0.655)	0	21.5	6226
Commune	0.504	(0.5)	0	1	3091
University	0.118	(0.323)	0	1	3091
Non-Absolutist State	0.352	(0.478)	0	1	3091
Population	11780.794	(25219.232)	316.228	948000	6226
Large state	0.627	(0.484)	0	1	3091
Bishop	0.382	(0.486)	0	1	3091
Archbishop	0.118	(0.323)	0	1	3091
Capital	0.07	(0.255)	0	1	3091
Plundered	0.022	(0.146)	0	1	3091

Notes: Population is interpolated for year 1100

Conceptual Framework

- Formation or decay of creative clusters affected by local shocks on either demand or supply (eg., local culture or local institutions can stimulate the supply, enlightened lord or rich bourgeoisie can enhance demand)
- Production: $b_{ct} = a_c + \gamma_t + \beta x_{ct} + \varepsilon^b_{ct}$
- b_{ct}: famous creatives born in city c during century t per 1,000 inhabitants
- x_{ct} : observable demand and supply shifters
- local institutions (open exchange of ideas + democracies better able to benefit from new technologies, by letting individuals with comparative advantage enter entrepreneurship - Acemoglu 2008)
- population and other
- ε^b_{ct}: unobservable demand and supply shocks

Conceptual Framework

- Attraction: $i_{ct} = a_c + \gamma_t + \beta x_{ct} + \varepsilon^i_{ct}$
- i_{ct}: number of immigrants, i.e. number of deaths in city c of FC born elsewhere per 1,000 inhabitants
- local demand shocks likely to be more important for i
- agglomeration effects vs pecuniary externalities

Road Map

1. **How does the spatial distribution of creativity look like?**
2. Is there spatial movement of clusters over time?
3. Is there "co-agglomeration" of key creative people in different fields?
4. How did these patterns evolve over time?
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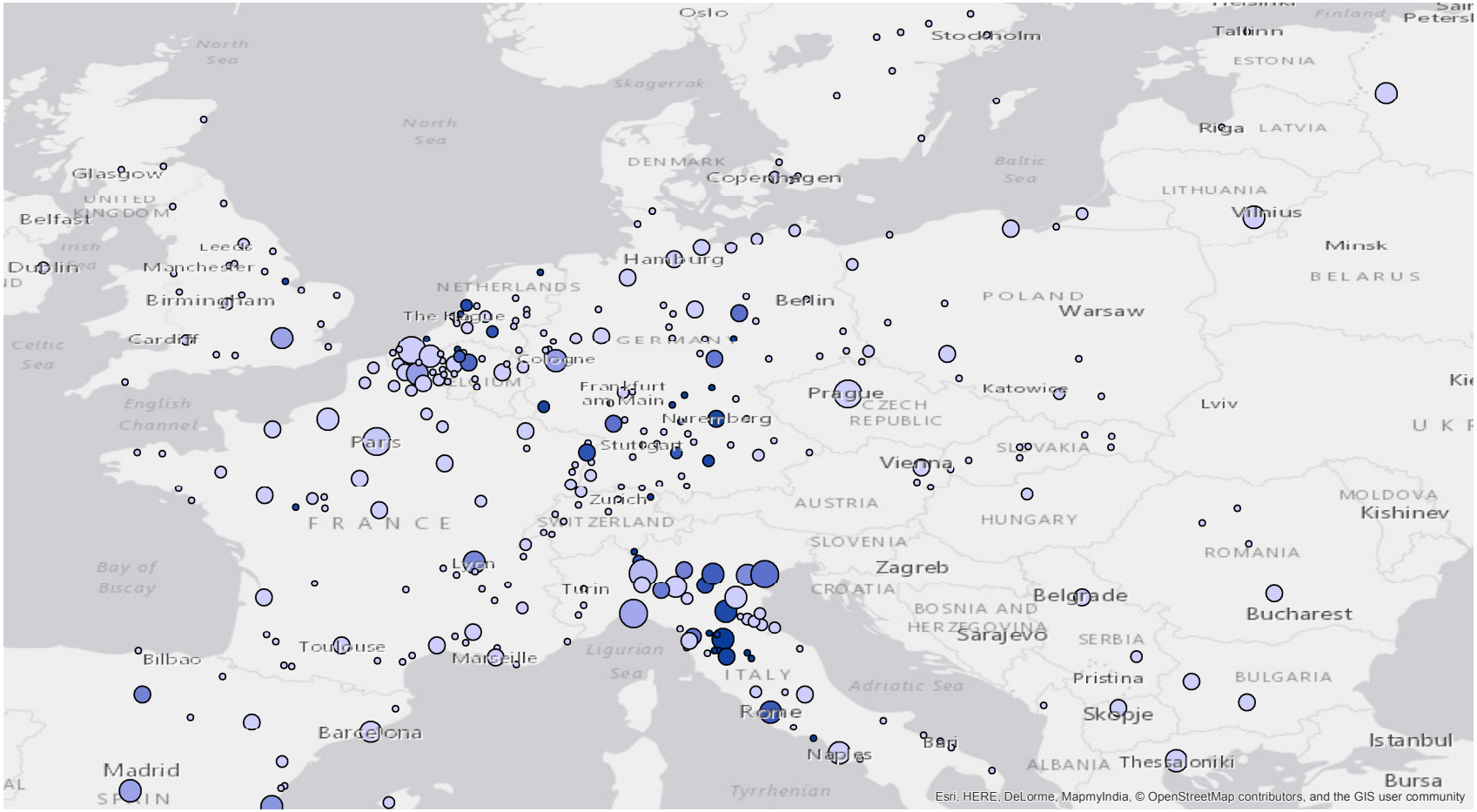
1400-1499

Darker tone: higher Births, larger circle: larger pop.



1800-1899

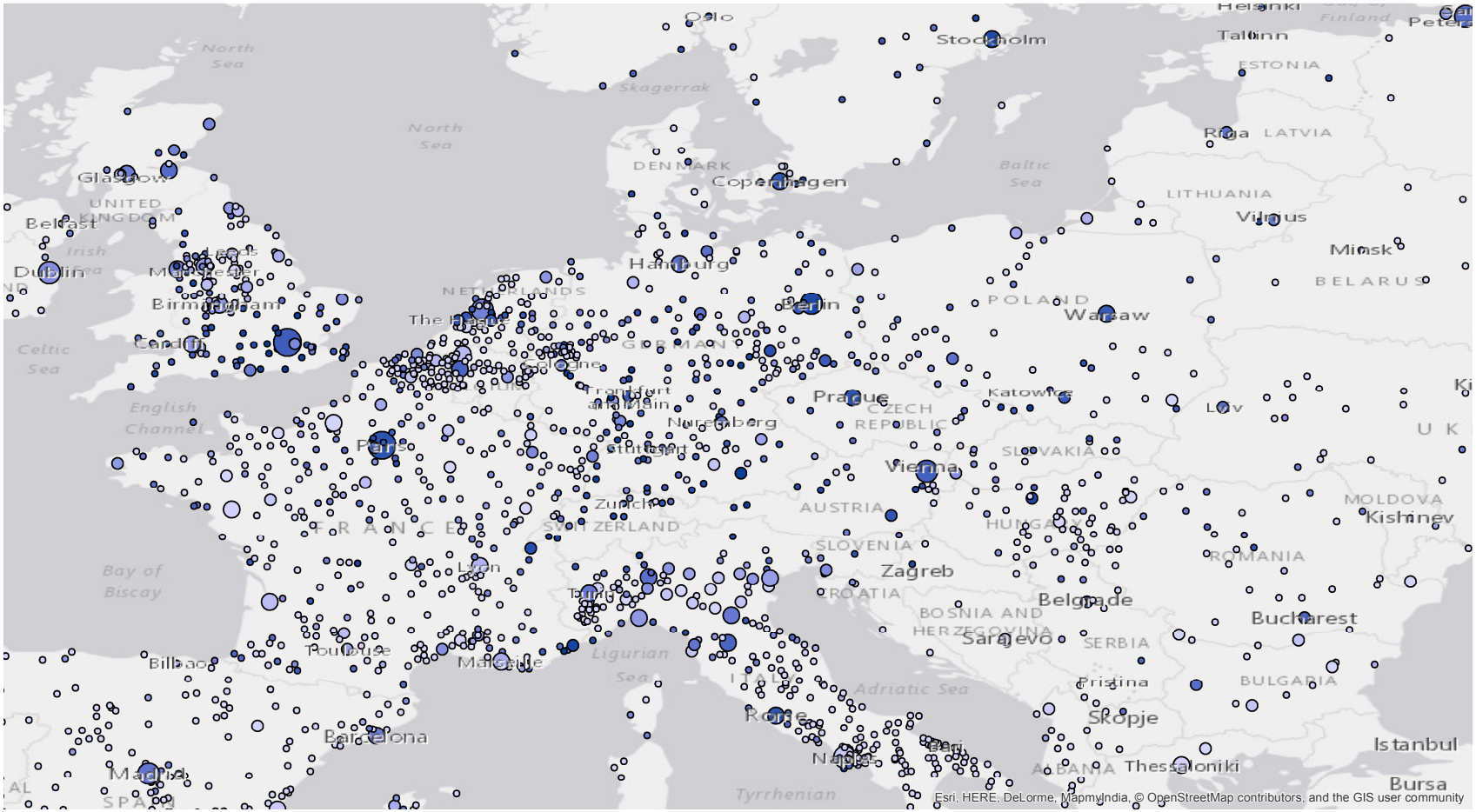

Oslo
Stockholm
Helsinki
Tallinn
ESTONIA
LATVIA
LITHUANIA
Vilnius
Minsk
BELARUS
Copenhagen
DENMARK
North Sea
Skagerrak
Baltic Sea
Glasgow
UNITED KINGDOM
Belfast
Dublin
Irish Sea
Celtic Sea
English Channel
Bay of Biscay
Hamburg
Berlin
POLAND
Warsaw
NETHERLANDS
GERMAN
Cologne
Frankfurt am Main
Nuremberg
Stuttgart
Prague
CZECH REPUBLIC
Katowice
Lviv
Paris
Vienna
SLOVAKIA
AUSTRIA
Zurich
SWITZERLAND
HUNGARY
MOLDOVA
Kishinev
ROMANIA
SLOVENIA
Zagreb
CROATIA
Belgrade
BOSNIA AND HERZEGOVINA
Sarajevo
SERBIA
Bucharest
BULGARIA
Pristina
Skopje
Lyon
Toulouse
Marseille
Ligurian Sea
Adriatic Sea
Rome
Naples
Bari
Bilbao
Barcelona
Madrid
SPAIN
Tyrrhenian
ALBANIA
Thessaloniki
Istanbul
Bursa
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Table: Summary Statistics, XIXth century

Variable	**Mean**	**(Std. Dev.)**	**Min.**	**Max.**	**N**
Population	12039.735	(31101.354)	1000	948000	2114
Births	0.382	(0.778)	0	9.75	2114
Immigrants	0.225	(0.968)	0	21.5	2114

1800-1899

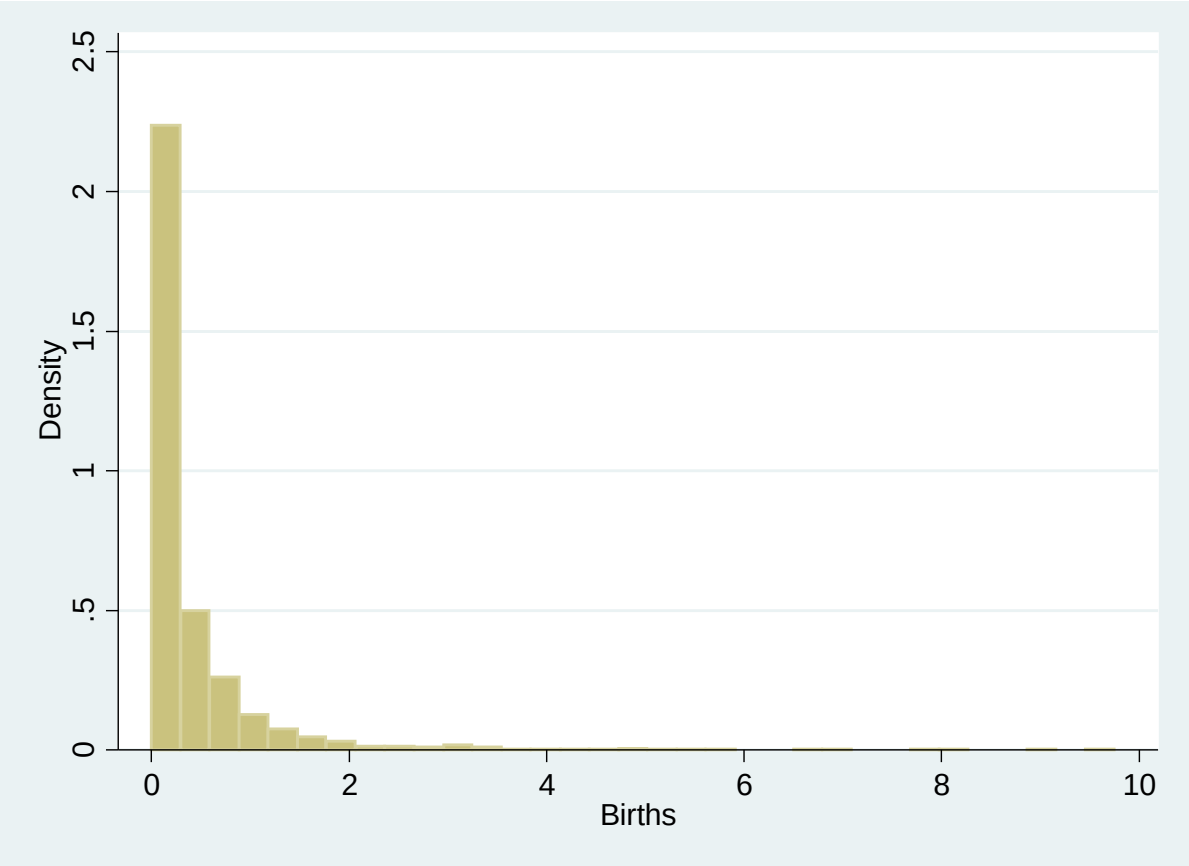
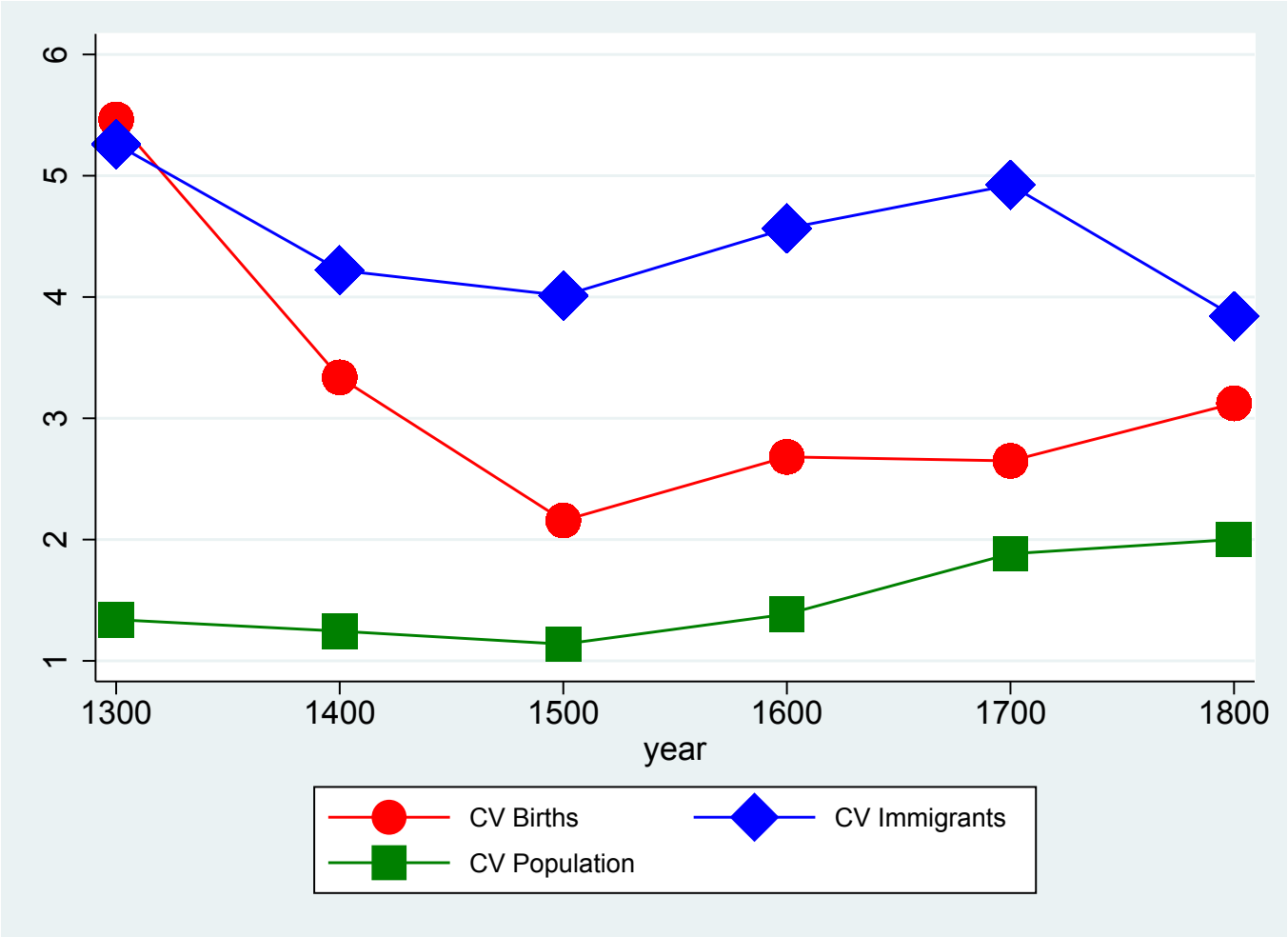


Figure: Coefficient of Variation of Births, Immigrants, Population, XIVth to XIXth century



Road Map

1. **How does the spatial distribution of creativity look like? - FC appear to be more concentrated than population**
2. Is there spatial movement of clusters over time?
3. Is there "co-agglomeration" of key creative people in different fields?
4. How did these patterns evolve over time?
5. Is upper-tail human capital in creative occupations correlated with measures of innovation?
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- A comparison of XVth and XIXth century maps suggests some spatial movement of clusters over time
- XVth century: Florence, Nuremberg, Siena
- XIXth century: darker tones Northern Europe + UK
- Look at Spearman's rank correlation coefficients, i.e. Spearman's ρ between variable measured in t, and same variable measured in $t+1$

Table: Spearman's rank correlation coefficient for key variables over time

Century	(1) Births	(2) Immigrants	(3) Population
XIVth-XVth	0.172^{**}	0.313^{***}	0.838^{***}
XVth-XVIth	0.319^{***}	0.273^{***}	0.870^{***}
XVIth-XVIIth	0.318^{***}	0.422^{***}	0.839^{***}
XVIIth-XVIIIth	0.336^{***}	0.413^{***}	0.791^{***}
XVIIIth-XIXth	0.461^{***}	0.512^{***}	0.700^{***}

Notes: Each row reports Spearman's rho for a given variable measured at t and t+1. For instance, the row "XVIth-XVIIth" reports the measure of statistical dependence between the variable in the column measured in XVIth century and the same variable measured in the XVIIth century.

*Transitions

- Use transition matrices for our key variables across cities
- For centuries after 1300, we divide the distribution into five segments and compute the probability of moving between them

Table: Transitions: Births

	t+1: **0**	t+1: **1**	t+1: **2**	t+1: **3**	t+1: **4**
t: **0**	.67	.1	.09	.08	.06
t: **1**	.2	.46	.18	.11	.05
t: **2**	.29	.21	.22	.14	.13
t: **3**	.26	.11	.14	.3	.19
t: **4**	.14	.04	.15	.23	.43

Road Map

1. How does the spatial distribution of creativity look like?
2. **Is there spatial movement of clusters over time?**
   - There appears to be less persistence in Births and Immigrants than population. Evidence of spatial movements of clusters over time (downward mobility appears to be faster than upward)
3. Is there "co-agglomeration" of key creative people in different fields?
4. How did these patterns evolve over time?
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- Unconditional correlations of FC in different disciplines

- Conditional correlations, to remove observable common shocks
- Condition on commune, large state, bishop, archbishop, spatial lag of FC, capital, plundered, population (in logs), university

Table: Coagglomeration

	Arts Non-Performing	Arts Performing	Humanities and Sciences
	Panel A: Births		
Arts, Performing	0.5401 ***		
	0.3159 ***		
Humanities and Sciences	0.4748 ***	0.3601 ***	
	0.4666***	0.2636***	
Business	0.3806***	0.3398 ***	0.3933 ***
	0.2964***	0.1506***	0.3216***

Each entry represents a pairwise correlation of residuals from regressions of famous people per 1000 inhabitants in each discipline on period dummies (upper row) and period dummies plus controls (lower rows). The dependent variable is *Births in discipline i* in Panel A and *Immigrants in discipline i* in Panel B. * p<0.1, . * p<0.1, ** p<0.05, *** p<0.01.

Table: Coagglomeration

	Arts Non-Performing	Arts Performing	Humanities and Sciences
	Panel B: Immigrants		
Arts, Performing	0.7653 ***		
	0.7030***		
Humanities and Sciences	0.5943 ***	0.4863***	
	0.5576***	0.3851***	
Business	0.5691 ***	0.5533 ***	0.3819 ***
	0.5051***	0.5222***	0.3619***

Each entry represents a pairwise correlation of residuals from regressions of famous people per 1000 inhabitants in each discipline on period dummies (upper row) and period dummies plus controls (lower rows). The dependent variable is *Births in discipline i* in Panel A and *Immigrants in discipline i* in Panel B. * p<0.1, . * p<0.1, ** p<0.05, *** p<0.01.

Road Map

1. How does the spatial distribution of creativity look like?
2. Is there spatial movement of clusters over time?
3. **Is there "co-agglomeration" of key creative people in different fields?**
   - Yes. Clusters are diverse
4. How did these patterns evolve over time?
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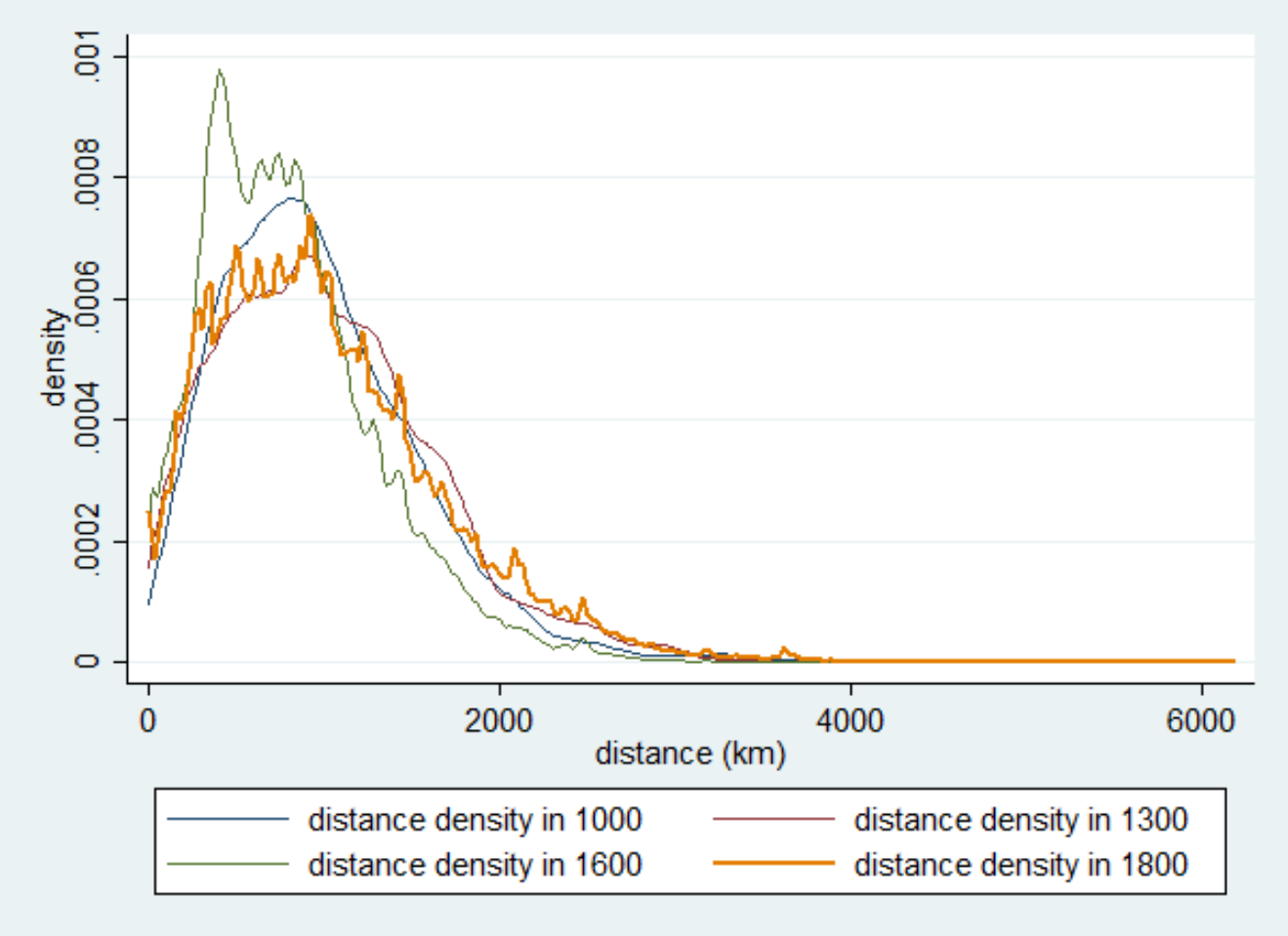
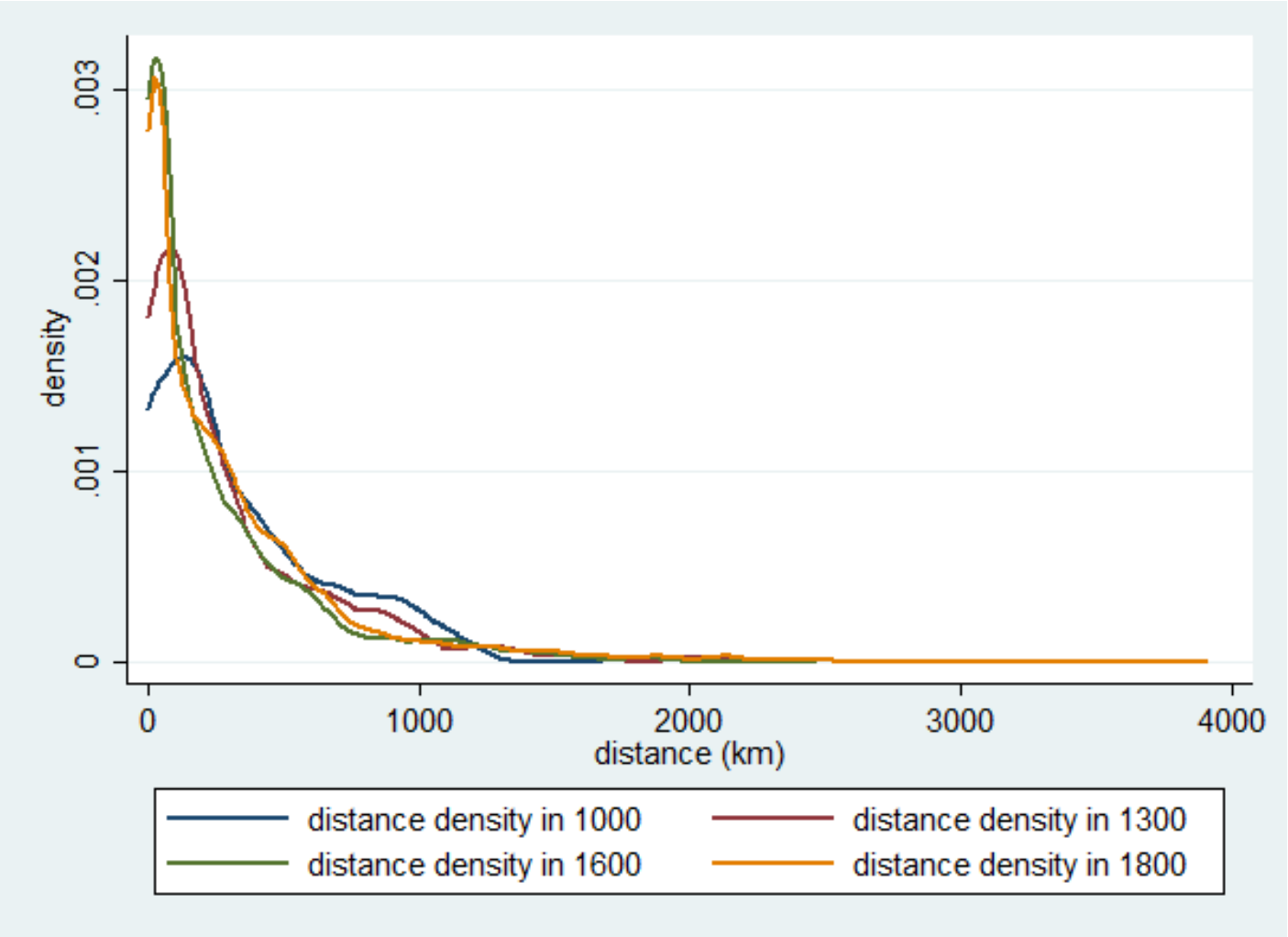
Distance between PoB of any two FC by century



Distribution of PoB-PoD distances by century



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1. How does the spatial distribution of creativity look like?
2. Is there spatial movement of clusters over time?
3. Is there "co-agglomeration" of key creative people in different fields?
4. **How did these patterns evolve over time?**
   -Stable patterns in the data, despite large changes in transportation, communications etc

5. Is upper-tail human capital in creative occupations correlated with measures of innovation?
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5. **Is upper-tail human capital in creative occupations correlated with measures of innovation?**
6. What predicts the formation of creative clusters?

- Meisenzahl and Mokyr (2011)'s data on UK engineers (born 1660 - 1830)

Table: Births and Measures of Innovation

	$Patents_b$	$Rewards_b$
	(1)	(2)
Births	0.566*	0.140**
	(0.320)	(0.058)
Observations	168	168
Adjusted R-squared	0.161	0.283
Period Dummies	YES	YES
City FE	YES	YES
Controls	YES	YES
Mean y	0.352	0.0564
SD y	1.257	0.194
Mean Births	0.460	0.460
SD Births	0.509	0.509

Standard errors (clustered at the NUTS 2 region level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Road Map

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4. How did these patterns evolve over time?
5. **Is upper-tail human capital in creative occupations correlated with measures of innovation?**
   - Yes it correlates well; f.i. 1SD change in Births associated with change of 0.29 patents per 1000 inhabitants. This compares to a mean of 0.35
6. What predicts the formation of creative clusters?

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6. **What predicts the formation of creative clusters?**

City population (economic performance), status and FC

$$Y_{ct} = \alpha_c + \delta_t + \pi_1 \log(Population)_{ct} + \pi_2 \log(Population)_{ct-1} + u_{ct}. \quad (1)$$

- where Y_{ct} is either Births or Immigrants
- using city population as index of performance in line with recent empirical studies on long-term economic growth (DeLong & Shleifer 1993, Acemoglu et al. 2005; Dittmar 2011, Nunn & Qian 2011, Cantoni & Yuchtman 2010). In the premodern era, size of the urban population reflects ability of economies to produce agricultural surplus, attract resources, and provide infrastructure needed to feed, house, and employ those living in cities (de Vries 1984).
- alternative measures of status on the city on RHS (Bishop, Archbishop, Capital)

Table: Economic Success and Creativity, Births

	(1)	(2)	(3)	(4)	(5)
Log (Population)	-0.020				
	(0.019)				
L1.Log (Population)	0.021				
	(0.017)				
Bishop		-0.000			
		(0.027)			
L1.Bishop		-0.027			
		(0.028)			
Archbishop			0.027		
			(0.036)		
L1.Archbishop			-0.064**		
			(0.031)		
Capital				0.016	
				(0.021)	
L1.Capital				0.047	
				(0.030)	
Commune					0.048***
					(0.016)
L1.Commune					0.028*
					(0.016)
Observations	3,260	2,963	2,963	2,963	2,963
Adjusted R-squared	0.128	0.205	0.205	0.206	0.210
Period Dummies	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Mean y	0.193	0.107	0.107	0.107	0.107

- "Elizabethan London suffered “dearness without scarcity” (inflation); this fell most heavily on the aristocracy and the very poor. Then the wool trade collapsed, England entered “the worst economic depression in history” (Wilson, 1965), and Parliament anxiously debated means of averting a Bellum Rusticum" (Banks, 1997)

Table: Economic Success and Creativity, Immigrants

	(1)	(2)	(3)	(4)	(5)
Log (Population)	0.008				
	(0.016)				
L1.Log (Population)	0.009				
	(0.012)				
Bishop		-0.011			
		(0.020)			
L1.Bishop		-0.019			
		(0.022)			
Archbishop			0.034		
			(0.028)		
L1.Archbishop			-0.046**		
			(0.023)		
Capital				0.046*	
				(0.027)	
L1.Capital				0.088*	
				(0.050)	
Commune					0.035**
					(0.015)
L1.Commune					0.036**
					(0.017)
Observations	3,260	2,963	2,963	2,963	2,963
Adjusted R-squared	0.128	0.205	0.205	0.206	0.210
Period Dummies	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Mean y	0.193	0.107	0.107	0.107	0.107

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6. **What predicts the formation of creative clusters?**
   a. **FC not preceded by population**

Question

- Local democratic institutions $=>$ Births?
- Sample: restricted to cities $>$ 3000 inhabitants

Commune

Degree of local participative government from Bosker et al.

- Forms of local participative government start to evolve during the period following the collapse of the Carolingian Empire when Europe was politically fragmented. In the power vacuum that resulted, cities could organize themselves and claim a kind of self-rule that was often acknowledged by the sovereign in return for taxes or loyalty (Jones, 2003).

Commune

Degree of local participative government from Bosker et al.

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- The first occurrences of communal self-government showed up in the eleventh and twelfth centuries in Spain and Italy, spreading over the rest of Europe in the following centuries.

Commune

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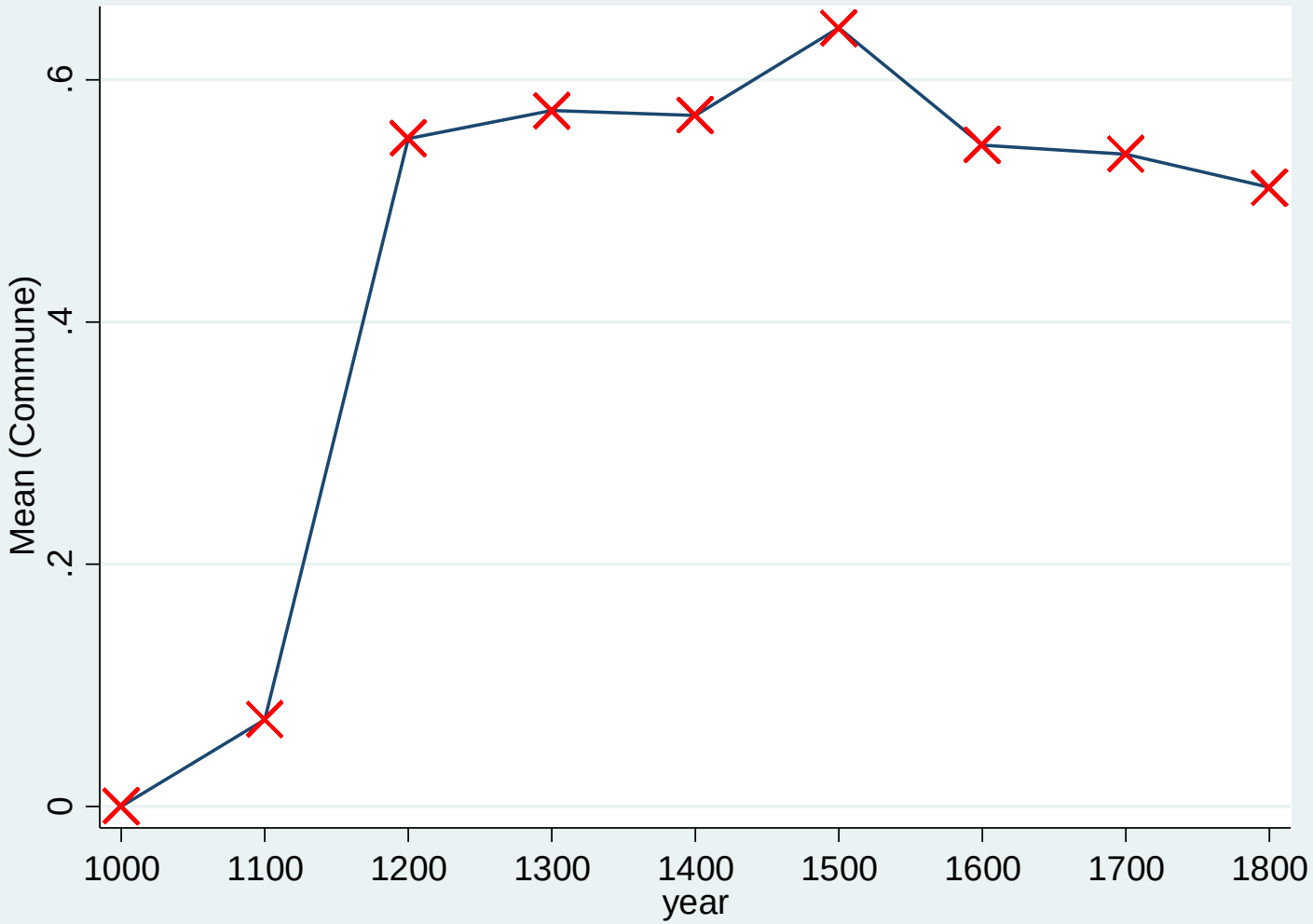
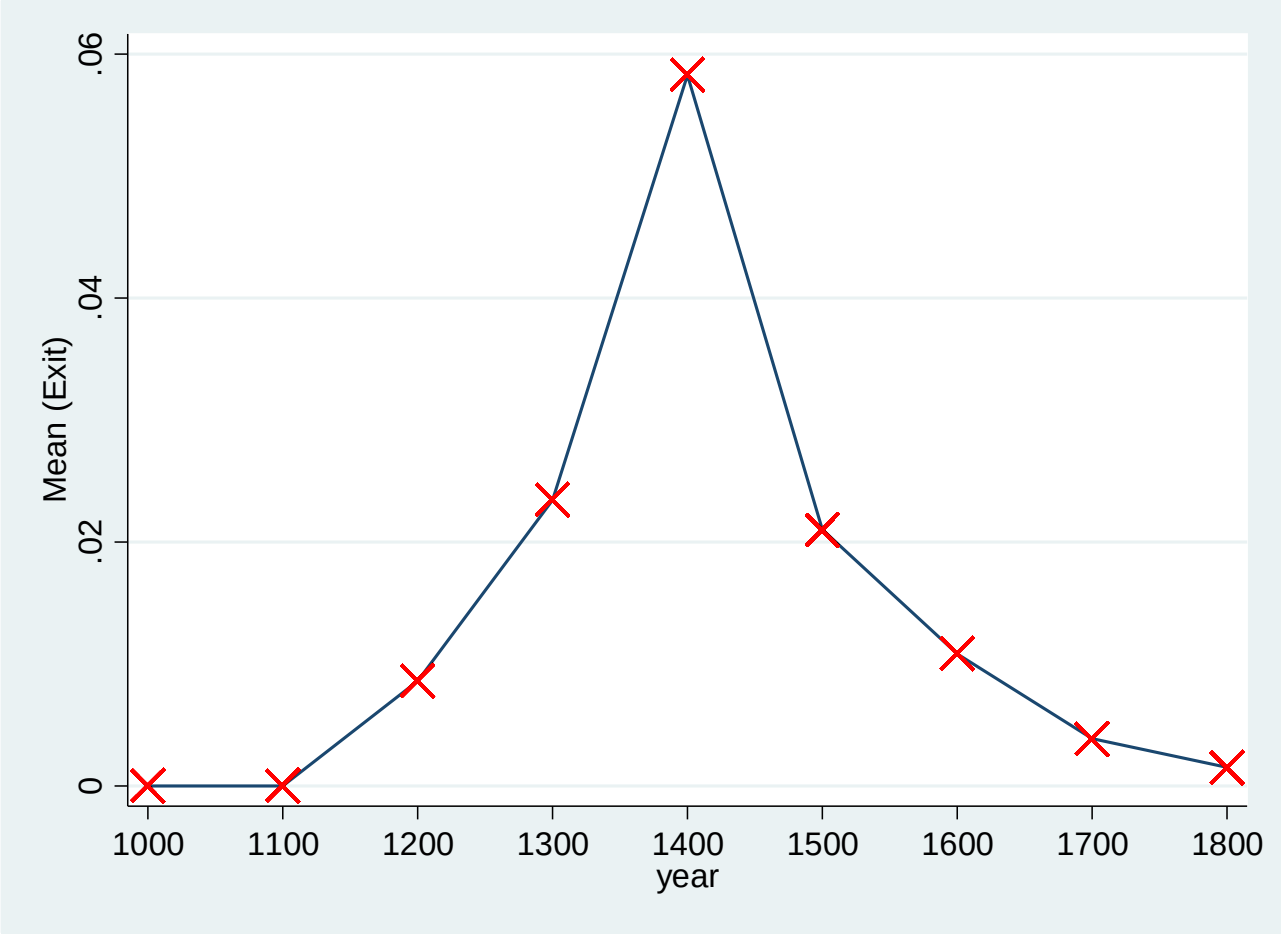
- The first occurrences of communal self-government showed up in the eleventh and twelfth centuries in Spain and Italy, spreading over the rest of Europe in the following centuries.
- measured at the turn of the century

Commune Status over Time



*Entry into Commune Status

*Exit from Commune Status



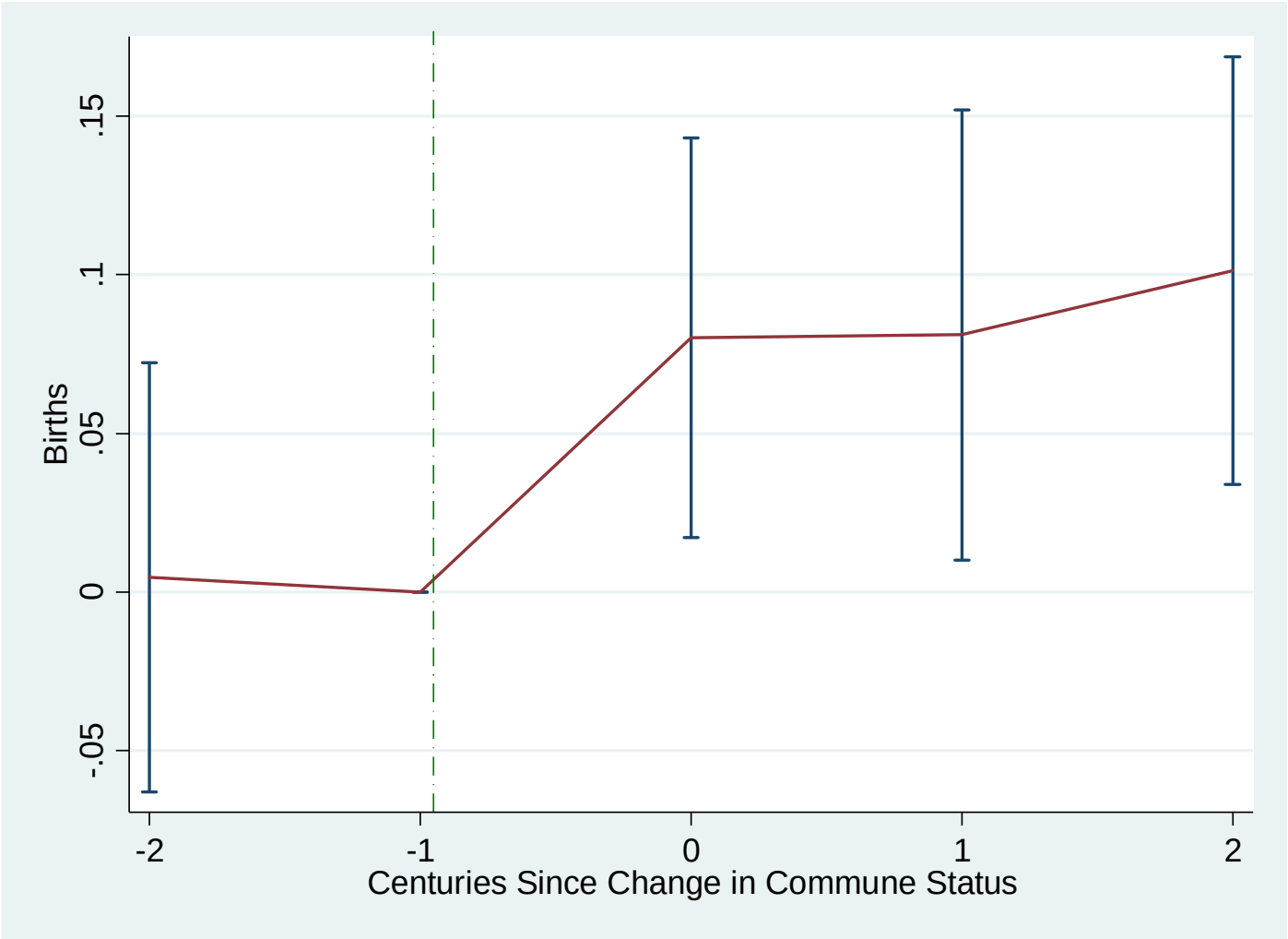
Commune and Creativity

- Dependent variable: $Y_{ct} = Births_{ct}$ = Births per 1000 inhabitants

$$Y_{ct} = \beta_1 Commune_{ct} + \beta_2 X_{ct} + \beta_3 \tilde{Y}_{ct} + \alpha_c + \delta_t + u_{ct}$$

- $\tilde{Y}_{ct}$ = spatial lag of Y_{ct} within current NUTS 1 region
- i.e. weighted average of Y_{dt}, for $d \neq c$ within same region, weighted by inverse distance
- X_{ct} = Large state, Bishop, Archbishop, Capital, Plundered
- Then add potentially "bad" controls - University, Population

NUTS 1 regions


Births
-.05
0
.05
.1
.15
-2
-1
0
1
2
Centuries Since Change in Commune Status

Instrumental variables estimates

- Instrument Commune with regional waves in institutional change:
  - "*Regional Commune*" (incidence of Commune in NUTS 1 region, leaving out own-city obs)
- Throughout control for regional waves in creativity (births of FC)
- Regional pattern reflects the regional determinants of city institutions, which tend to have similar histories, political cultures, practical problems, and close informational ties (Persson Tabellini 2009, Acemoglu et al. 2016)

*Instrumental variables estimates (con't)

- R_c : geographic region in which city lies
- We posit that commune status in city c is influenced by commune status in the set of cities $I_c = \{c' : c' \neq c, R_{c'} = R_c\}$
- Regional influence to become a commune that a city c faces: $Z_{ct} = \frac{1}{|I_c|} \sum_{c' \in I_c} Commune_{c't}$

*Instrumental variables estimates (con't)

- Exclusion Restriction: conditional on period and city FEs (and spatial lag of Y_{ct} within current NUTS 1 region), regional waves of institutional change captured by the variable Z_{ct} have no direct effect on FC per capita of city c at time t
- Spatial lag of Y_{ct} : address possibility that regional waves of institutional change capture effects of regional correlated shocks in FC

Table: IV Estimates, Dep. var. is *Births*

	(1)	(2)	(3)	(4)
			Panel A: 2SLS estimates	
Commune	0.184***	0.115**	0.105**	0.109**
	(0.058)	(0.050)	(0.053)	(0.056)
Spatial Lag Births		293.350***	293.939***	293.525***
		(66.049)	(66.126)	(66.180)
Observations	2,436	2,349	2,349	2,349
Adjusted R-squared	0.003	0.137	0.138	0.137
Period Dummies	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Baseline Controls	NO	NO	YES	YES
Additional Controls	NO	NO	NO	YES
Number of Clusters	201	196	196	196
Fstat, instrum., 1st stage	16.52	53.07	49.27	50.28
Mean y	0.108	0.111	0.111	0.111
SD y	0.247	0.250	0.250	0.250
			Panel B: First-stage estimates	
Regional Commune	1.390***	1.905***	1.897***	1.858 ***
	(0.342)	(0.262)	(0.267)	(0.262)

Standard errors (clustered at the region level) in parentheses.

Road Map

1. How does the spatial distribution of creativity look like?
2. Is there spatial movement of clusters over time?
3. Is there "co-agglomeration" of key creative people in different fields?
4. How did these patterns evolve over time?
5. Is upper-tail human capital in creative occupations correlated with measures of innovation?
6. **What predicts the formation of creative clusters?**

a. FC not preceded by population

b. Local democracy (Commune) => + 0.08-0.12 births of FC per 1000 inhabitants. This compares to a mean of 0.11

What have we learned

- FC appear to be more concentrated than population
- Spatial movements of clusters over time (downward mobility appears to be faster than upward)
- Clusters are diverse
- Stable patterns in the data, despite large changes in transportation, communications etc
- Upper-tail human capital in creative occupations correlates well with measures of innovation
- FC not preceded by population; Commune => births of FC

- **CAUTION: some of the results still preliminary; exploring robustness**
- Next: (a) flow of ideas. people migrate from a plundered city (true in the data) to "enclaves"; (b) superstar effects (using higher frequency/more recent data)

THANK YOU

Commune

Further Info

- "The result of these forms of local participative government was that citizens could better protect their property against predating local lords, regulate their own systems of justice, and introduce laws beneficial to industry and trade (Weber, 1922, 1958)"

*Yu at el 2015

- $>$ 25 languages in Wikipedia
- Historical Popularity Index (HPI) combines info on number of languages in which a biography is present in Wikipedia (L), time since birth, and page-views (2008–2013)
- HPI correlate highly with individual accomplishment (based on printed encyclopedias)
- Limitation in our setting: largest pool 11,341 biographies vs 150,000 in Schich et al 2015
- Correlation between our variable and Yu et al's: 0.5

Yu et al (2016)

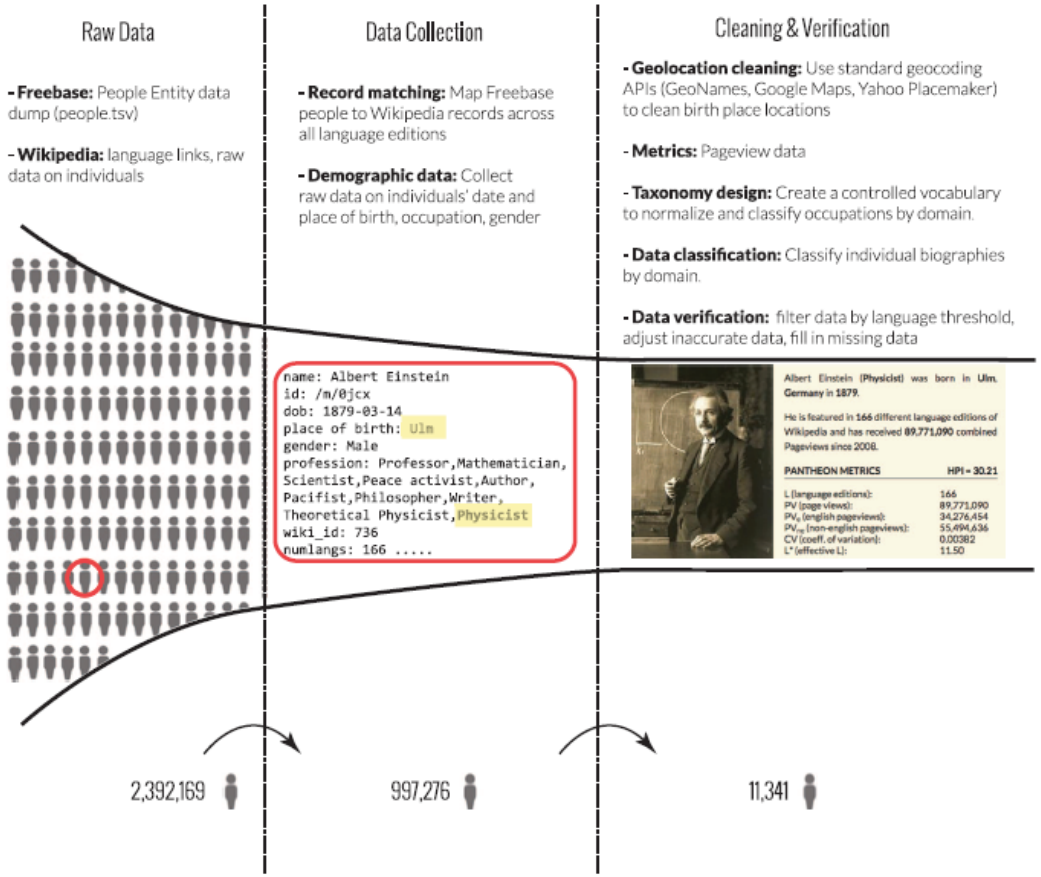


Figure 1. Pantheon Data Workflow. Flow diagram detailing the data collection process for the Pantheon 1.0 ($n = 11{,}341$). Inset image from pantheon.media.mit.edu.

Yu et al (2016)

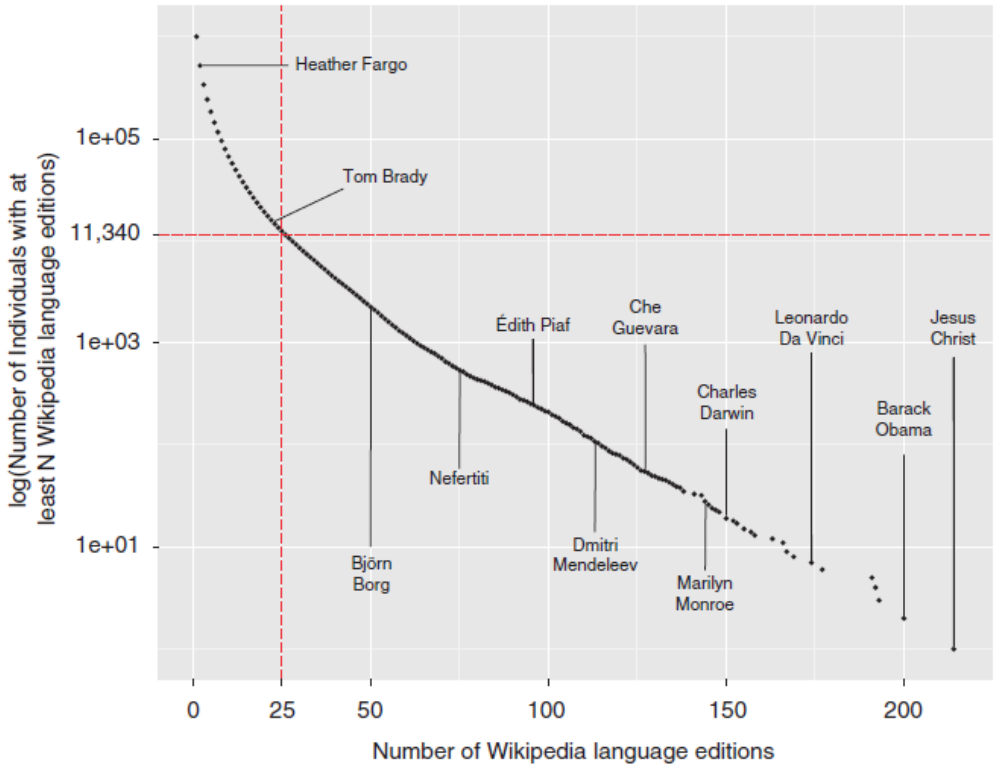


Figure 2. Cumulative Number of Individuals with at least N Wikipedia Language Editions. Cumulative distribution of biographies on a semi-log plot, as a function of the number of languages in which each of these biographies has a presence.

*Florence

Banks (1997)

- Golden Period: from about 1440 to 1490
- "early bump of productivity with Dante and Boccaccio and Giotto and Cimabue, but it faded out (perhaps as a subtle consequence of the Black Plague). Then came a new lot, with Michelangelo, Leonardo Da Vinci, Machiavelli, Botticelli, Donatello, Politian, Mirandola, Lorenzo the Magnificent, and so forth. But before the birth of Cimabue (1240) and after the death of Galileo (1642), not much happened in the city"

*London

Banks (1997)

- Golden Period: from about 1570 to 1640;
- "Marlowe and Shakespeare and Jonson and Raleigh and Bacon and Spenser laid the foundation for English writing, and there are a host of lesser luminaries whose hands helped. But their momentum ended with the coming of Cromwell (Milton stands alone). From the close perspective of college courses in the Restoration and Neoclassical periods, we can name many well regarded writers (Dryden, Pope, Wycherly) before the Romantic poets burst forth, but the central point is that English talent isn't evenly sprinkled like pepper on potatoes"

NUTS

The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU for the purpose of : The collection, development and harmonisation of European regional statistics.

NUTS 1

NUTS 2 - Clustering Level

Birth-to-death distances, 1800

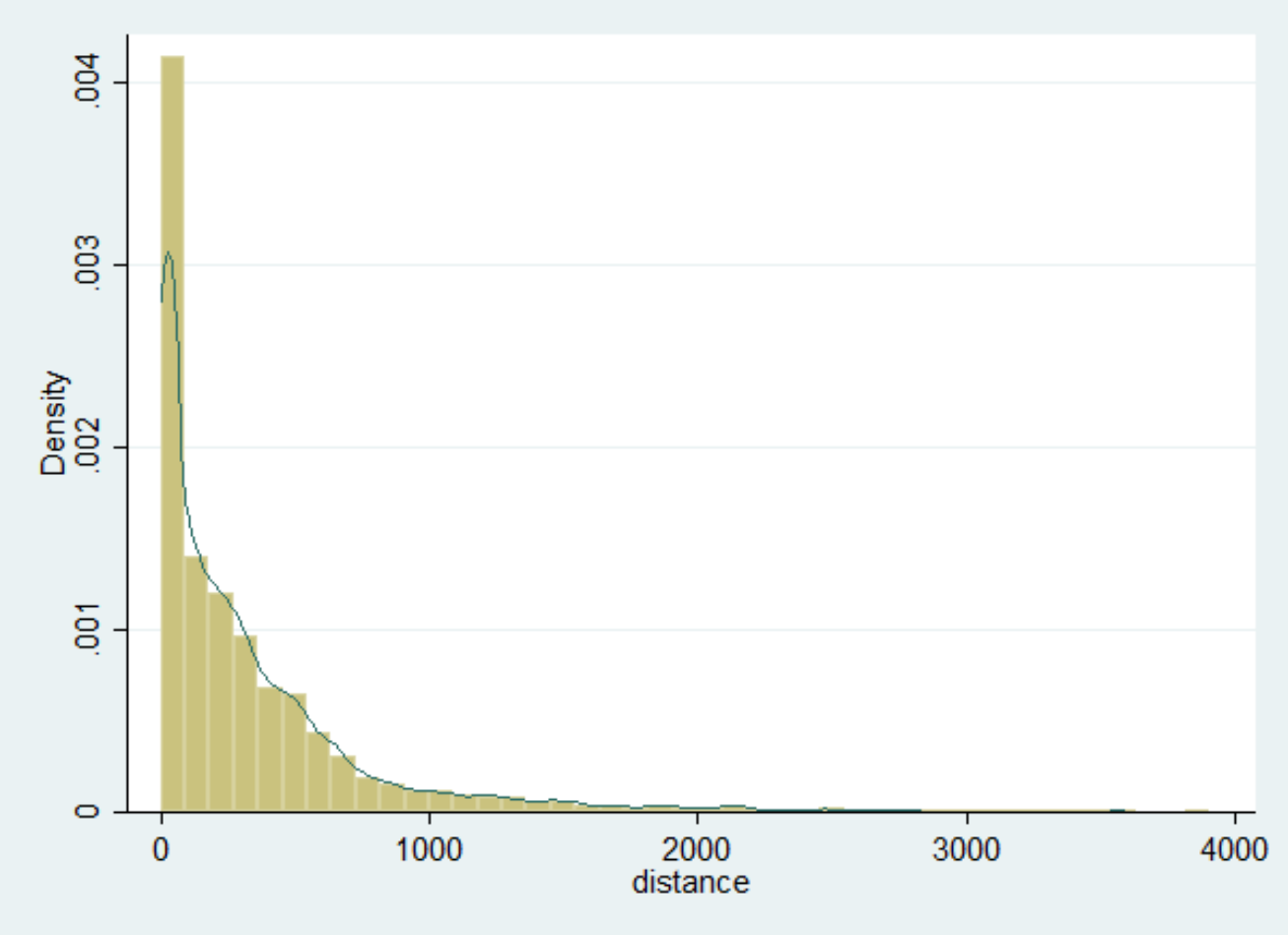
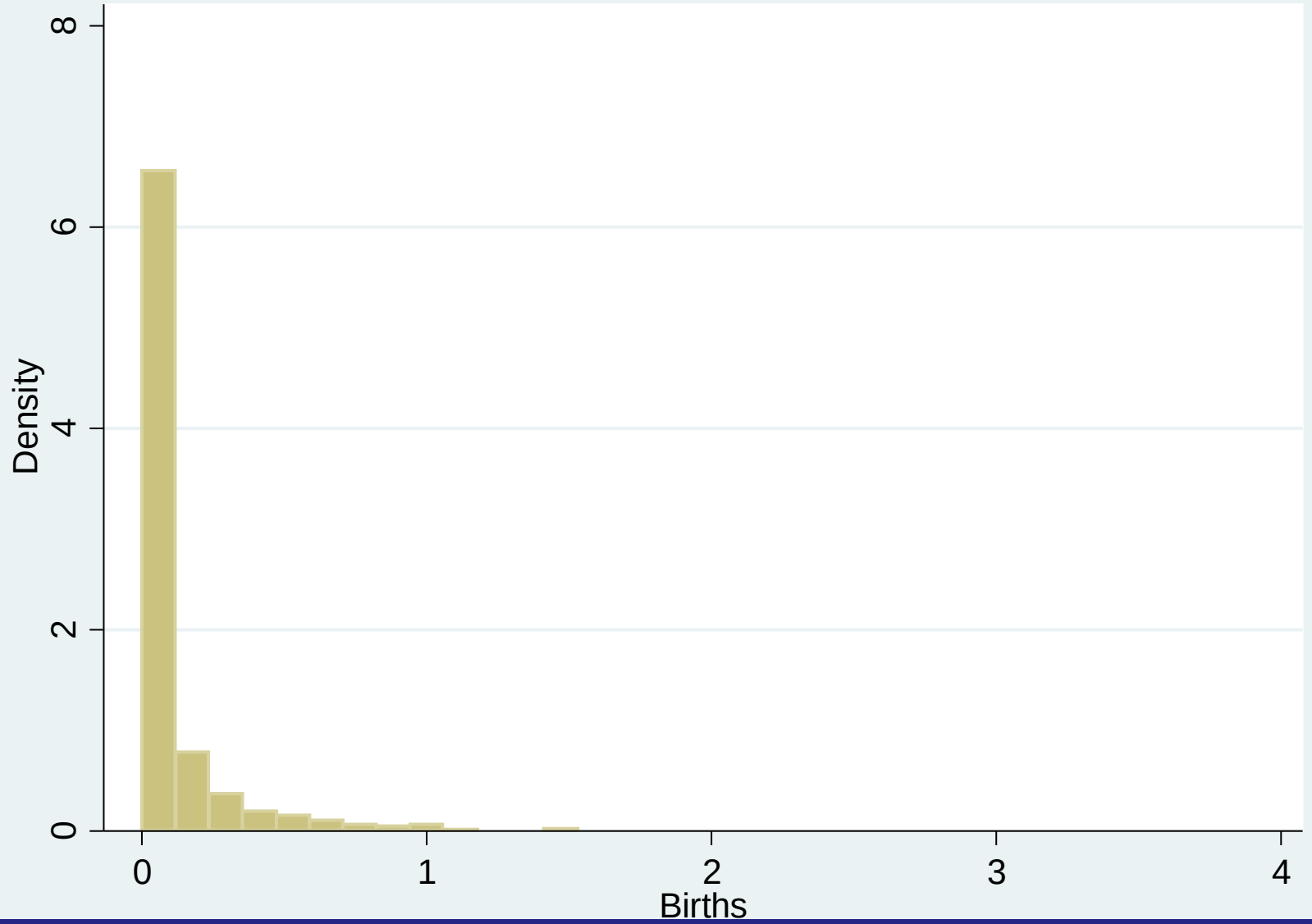


Table: Summary Statistics, XVth century

Variable	Mean	(Std. Dev.)	Min.	Max.	N
Population	11615.752	(17656.554)	1000	200000	419
Births	0.024	(0.081)	0	0.667	419
Immigrants	0.013	(0.06)	0	0.5	419

Banks 1997 "One can spend pleasant postprandial hours noting similar clusters in Japan (late Heian period), Persia (just before Genghis Khan), the T'ang dynasty".


Density
0
2
4
6
8
0
1
2
3
4
Births

Conceptual Framework

Production of talent

$$b_{ct} = a_c + \gamma_t + \beta x_{ct} + \delta s_{ct} + \varepsilon^b_{ct} \quad (2)$$

- b_{ct}: famous creatives born in city c during century t per 1,000 inhabitants
- x_{ct} : observable demand and supply shifters (local institutions, population and other)
- s_{ct} : is the stock of ideas
- ε^b_{ct}: unobservable demand and supply shocks
- compared to deaths, we expect supply shifters to dominate demand shifters
- we do not directly observe s_{ct} but we can proxy for s_{ct} using the centrality of city c (in the European network created by migrations of FC) measured in the second half of century $t-1$

*Specific Questions: Network analysis

- Does flow of ideas predict subsequent births of FC?
- Movement of FC as proxy for diffusion of knowledge (ideas move with people; meetings enable more debate on the merits of each new idea)
- Migration (PoB => PoD) as link in a directed network
- Network centrality => subsequent births of FC?
  - Across / within disciplines
  - Exploit lag structure for identification

Network Centrality and Births

- Ideas flow with people
- Meetings enable more debate on the merits of each new idea
- Are more "central" cities (in terms of death attractions) also more productive of creative people ?

- Can think of movements of famous creatives (FC) as creating a *directed network*

  - Cities as nodes in network

  - Movements of FC as directed links between nodes, carrying ideas

Network and Centrality (con't)

How to measure *centrality* of cities in the network?

- centrality as closeness, defined as random-walk closeness centrality (RWCC):
  - Step = transition from i (birth) to j (death)
  - Prob(transition) = fraction of FC who move from i to j in the period
  - Centrality = expected N of steps to reach city i from any other city in network; i.e cities with direct links to other highly linked cities are more central - more likely to receive flow of ideas

Centrality and Births

- Add network centrality as additional regressor
- Contemporaneous, or measured in previous 50 years

Table: Network Centrality and Births

	(1)	(2)	(3)	(4)
Centrality	0.032***			
	(0.010)			
Centrality (2nd half t-1)		0.085***		
		(0.020)		
Centrality Arts			-0.003	
			(0.009)	
Centrality Hum. and Sc. + Bus			0.079***	
			(0.017)	
Centrality Arts (2nd half t-1),				0.018
				(0.021)
Centrality Hum. and Sc. + Bus. (2nd half t-1) ,				0.043***
				(0.010)
Commune	0.069**	0.080*	0.070**	0.083*
	(0.035)	(0.043)	(0.034)	(0.044)
Log (1 + Spatial Lag Births)	183.987***	128.624***	184.592***	130.971***
	(40.249)	(36.200)	(38.529)	(36.908)
Observations	2,349	1,518	2,349	1,518
Period Dummies	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Baseline Controls	YES	YES	YES	YES
Additional Controls	YES	YES	YES	YES
Mean y	0.0880	0.0975	0.0880	0.0975
SD y	0.168	0.176	0.168	0.176

The dependent variable is defined as Log (1+*Births*). Standard errors (clustered at the NUTS 1 region level) in parentheses. Commune is instrumented with Regional Commune.

Network and Centrality (con't)

- Centrality highly correlated across disciplines (0.67)
- Correlation of births stronger with (lagged) centrality in humanities, science and business, while art centrality not correlated with subsequent births (in any discipline)
- A one SD change in RWCC is associated with a 6 p. p. increase in Births.

Table: OLS Regressions, Births

	(1)	(2)	(3)	(4)	(5)
Commune	0.041***	0.035***	0.038***	0.033***	0.034***
	(0.010)	(0.011)	(0.011)	(0.010)	(0.011)
Log (1 + Spatial Lag Births)		194.936***	194.966***	194.875***	194.121***
		(40.834)	(40.895)	(40.911)	(40.933)
Spatial Lag Commune			-0.071		
			(0.090)		
Observations	2,452	2,349	2,349	2,349	2,349
Adjusted R-squared	0.306	0.397	0.396	0.397	0.397
Period Dummies	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Baseline Controls	NO	NO	NO	YES	YES
Additional Controls	NO	NO	NO	NO	YES
Number of Clusters	201	196	196	196	196
Mean y	0.0860	0.0880	0.0880	0.0880	0.0880
SD y	0.167	0.168	0.168	0.168	0.168

The dependent variable is defined as ln(1+*Births p.c.*). Standard errors (clustered at the region level) in parentheses.

Table: IV Estimates, Dep. var. is ln(1+*Births p.c.*)

	(1)	(2)	(3)	(4)	(5)
			Panel A: 2SLS estimates with fixed effects		
Commune	0.122***	0.069**	0.216**	0.064*	0.066*
	(0.039)	(0.032)	(0.085)	(0.033)	(0.034)
Log (1 + Spatial Lag Births p.c.)		193.540***	188.532***	193.611***	192.849***
		(40.721)	(40.539)	(40.753)	(40.701)
Spatial Lag Commune			-0.653**		
			(0.304)		
Observations	2,436	2,349	2,349	2,349	2,349
Adjusted R-squared	0.080	0.214	0.108	0.215	0.214
Period Dummies	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Baseline Controls	NO	NO	NO	YES	YES
Additional Controls	NO	NO	NO	NO	YES
Number of Clusters	201	196	196	196	196
Fstat, instrum., 1st stage	16.52	53.07	15.59	49.27	50.28
Mean y	0.0859	0.0880	0.0880	0.0880	0.0880
SD y	0.167	0.168	0.168	0.168	0.168
			Panel B: First-stage estimates		
Regional Commune	1.390***	1.905***	1.303***	1.897***	1.858 ***
	(0.342)	(0.262)	(0.330)	(0.267)	(0.262)

The dependent variable is defined as ln(1+*Births p.c.*). Standard errors (clustered at the region level) in parentheses.

*Remarks

- We fail to reject the null hypothesis of no effect on *Births* for:

- bishop, archbishop, capital
- population, university
- plundered

A few more examples

From Banks (1997)

"One can spend pleasant postprandial hours noting similar clusters in Weimar, Paris (twice), London (the Romantics), Vienna, Japan (late Heian period), Persia (just before Genghis Khan), the T'ang dynasty, and New York".

*Notes

The figure plots point estimates for leading and lagging indicators for the change in commune status. It plots the point estimates of the following specification: $Births_{ct} = \alpha + \beta_{-2} Commune_{ct-2} + \beta_0 Commune_{ct} + \beta_1 Commune_{ct+1} + \beta_2 Commune_{ct+2} + \delta_t + \mu_c)$. $Commune_{ct-2}$ is set to 1 for periods up to and including 2 periods prior to the change in commune status and 0 otherwise. $Commune_{ct+2}$ is set to 1 for all periods 2 periods after the change in commune status and 0 otherwise. The omitted category is one period prior to the change in commune status. We control for *Spatial Lag Births*

*Specific Questions

- What patterns in the data? How did they evolve over time ?
  - Concentration of FC in time/space/across disciplines
  - Persistence of clusters of FC
  - city population (economic success) and FC
- Effect of local democracy (Commune) on births of FC/incomers
  - Event-study framework; instrument Commune with incidence of Commune in the region