

Winners and Losers from the Protestant Reformation: An Analysis of the Network of European Universities

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Motivation

- Medieval universities: central to the development of Europe (Greif 2006)
- Surprisingly, after having played an important role in the beginning of the Scientific Revolution, many of them seem to have declined.
- Particularly true for southern European universities, mostly Catholic
 - ▷ Italy: *“Yet in the 17th century, Italy lost its earlier pre-eminence in literary and scientific culture, falling behind by at least 20-30 years compared to other European countries.”* (Pepe 2006)
 - ▷ Spain: *“It could be said that throughout this long period, Spanish universities, which had been so prestigious until then, disconnected from the European cultural rhythm.”* (Esteve i Perendreu 2007)
 - ▷ France: *“The Age of Enlightenment is precisely for the University of Cahors as for most of her sisters the dark time of mediocrity.”* (Ferté 1975)

Motivation (cont'd)

- One possible explanation: the loss of mobility of persons and ideas following the Reformation and Counter-Reformation
 - ▷ Mobility of students has already been studied (Ridder-Symoens 1996)...
 - ▷ ...but little is known about the mobility pattern of scholars.
- When a given professor had appointments in two (or more) places over his life, it established a relationship enhancing the flow of ideas, manuscripts, students between the two places.
 - ▷ Knowledge was embodied in people
 - ▷ Knowledge diffusion through physical moves: e.g. rediscovery of Roman law in France (Arabeyre et al 2007)
 - ▷ Books travel physically with scholars: e.g. forgotten books by Greek philosophers in Italy (Harris 1995)

Underlying theory

Following the Reformation, **Confessionalization** of society

Process of “confession-building” (Lotz-Heumann 2016)

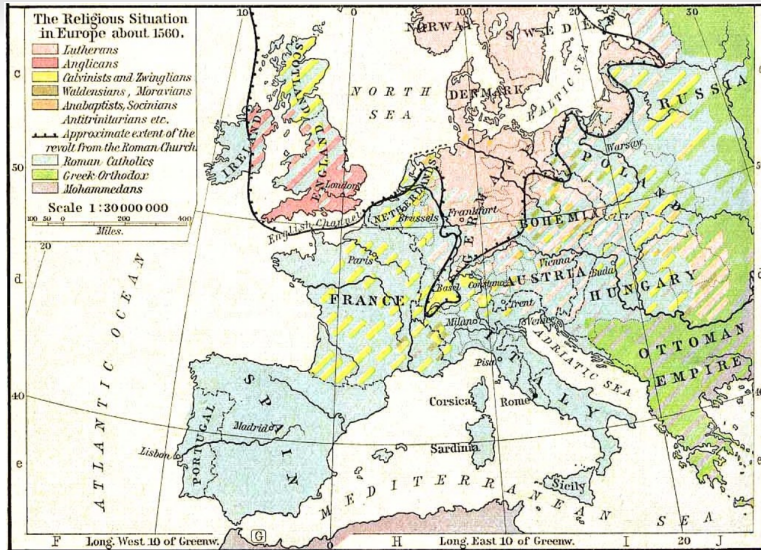
Occurred through “social-disciplining”, strict enforcement by the churches of their particular rules for all aspects of life in both Protestant and Catholic areas.

→ creating distinctive confessional identities (“Marburg is Calvinist, Wittenberg is “Lutheran”, Edinburgh is “Presbyterian”, Douai is “Catholic (Jesuit)” etc.

Confessionalization paved the way to early modern state formation

Reformation Timeline and Universities

Date	Event
1517	Luther circulates 95 Theses from University of Wittenberg (Lutheranism)
1521	Edict of Worms condemns Luther as a heretic
1523	Creation of new Protestant higher education institutions (Strasbourg, 1523, Zurich, 1525, Marburg 1527)
1529-1536	English Reformation, the Church of England. Canon law not taught any longer (Anglicanism)
1534	Formation of the Society of Jesus (Jesuits) by Saint Ignatius of Loyola
1559	University of Geneva created by Calvin (Calvinism)
1560	Scottish Reformation Parliament establishes the Kirk (Presbyterianism)
1562-1598	French Wars of Religion
1598	Edict of Nantes grants Calvinists substantial rights in France (until 1685) including the right to manage their own universities



Source: *The Historical Atlas* by William R. Shepherd, 1923

Objective

Can the decline of Catholic universities be explained by changes in the mobility network induced by the Reformation?

Methodology

1. New database on European academics to define seven networks of universities from 1000 to 1793.
2. Definition of a network. We assess the role of religion in shaping the network structure. Separate the effect of religion from the effect of geography with dyadic regressions and a counterfactual analysis.
3. We study the individual position of universities within the network (centrality) and explore how it relates to their publications.
4. measure the extent and strength of Confessionalization at the European level.

Literature

- **Effect of Protestantism on the development of Europe:** recent survey of Becker, Pfaff and Rubin (2016); special focus on human capital (Becker and Woessmann 2009), on study choices (Cantoni et al. 2018).
- **Economic history and networks:** Padget and Ansell (1993), Puga and Trefler (2014); on Reformation (Kim and Pfaff 2012, Becker et al. 2020)
- **Mobility of researchers and scientific production:** Ejermo et al. (2020), Moser et al. (2014), Ductor et al. (2014).
- **Empirical network analysis:** broad characteristics of evolutionary social networks (Goyal et al. 2006, Ductor et al. 2018); determinants of network formation (De Weerd 2004, Fafchamps and Gubert 2007); economic and social consequences of network structure (Jackson et al. 2017)

Data

On scholars and universities

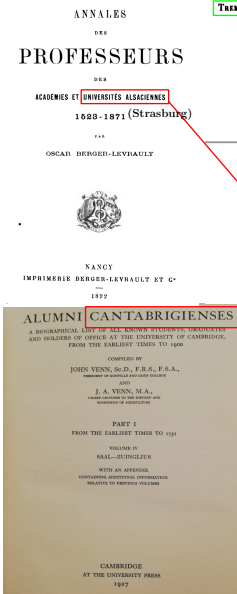
- Database of university scholars from de la Croix (2021).
- built from secondary sources (example next slide)
- 42,093 scholars and 168 universities from 1000 to 1793.

Religious affiliation

- We classify universities according to their religious affiliation as reported in Frijhoff (1996).
- Catholic (Secular, Jesuit), Protestant (Calvinist, Lutheran, Anglican, Presbyterian), “Mixed”

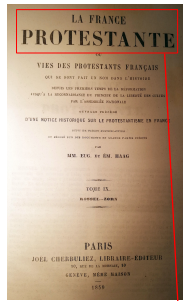
On academic production

- Summing all the publications recorded in Worldcat by members of universities



TREMELIUS, Emmanuel, Ferrariensis.
Natus 1510
Denatus (Sedan.) 9 Octobr. 1580.

Dagmar Drüll
HEIDELBERGER
GELEHRTENLEXIKON
1386-1651



18 — TRÉ
de Jean Tremblay et d'Anne Seyvon.
TREMELIUS (EMMANUEL), né à
Ferrare, vers 1510, et mort à Sedan,
le 9 oct. 1580.
Tremellius quitta la religion juive
dans laquelle il était né, pour embras-
ser la religion catholique, et celle-ci
pour se faire protestant. Après sa con-
version, il se retira à Lucques, où il
enseigna quelque temps la langue hé-
braïque, mais la crainte de l'inquisition
fini par le chasser d'Italie, ainsi que
Pierre Martyr et d'autres italiens, par-
tisans secrets de la Réforme. Il s'éta-
blit d'abord à Strasbourg, où il donna
des leçons d'hébreu. Plus tard, il pas-
sa en Angleterre et y resta jusqu'à la
mort d'Edouard. Chassé de nouveau
par Marie la sanguinaire, il retourna
en Allemagne en 1553, et fut placé
comme professeur d'hébreu dans l'école
de Hornbach. Quelque temps après, l'é-
lecteur palatin Frédéric III l'appela à
Heidelberg. En 1560, nous le trouvons
à Metz, où il s'était marié pendant un
premier séjour qu'il avait fait dans cette
ville avant de se rendre à Strasbourg.
S'il est vrai qu'il y fut arrêté par ordre
du maréchal de Vieilleville sous le rè-
gne de François II, sa détention fut de
courte durée, puisqu'il fut un des dé-
putés (1) que les Protestants de Metz
envoyèrent en Cour aussitôt après la
mort de ce prince, pour demander à la
reine régente la liberté du culte, le
rappel des bannis et la délivrance de
Guillaume Palisieux, prisonnier à An-
xerre. Les deux dernières demandes
furent accordées; quant à la première,
il fut répondu que les prétendus réfor-
més n'auraient ni temple ni lieu d'exer-
cice quelconque à Metz, qu'ils n'y tien-
draient aucune assemblée sous peine
de mort, mais que Senneterre leur as-
signerait un lieu hors de la ville pour
y faire leurs prêches. Il est probable
que Tremellius ne tarda pas à retour-
ner à Heidelberg, d'où, quelques an-
nées plus tard, il fut appelé à Sedan
par le duc de Bouillon pour y remplir
une chaire d'hébreu qu'il occupa jus-
qu'à sa mort.
L'auteur se nomme Didier Bédarride.

Tremellius (Tremmel), Immanuel

- 1561 – 1577 Theol. Fak.
- 1561 – 1577 Altes Testament; 1561 – 1575 He-
bräische Sprache
- * 1510 Ferrara (im Ghetto)
- † 9. Okt. 1580 Sedan
mosaisch, seit 1540 kath., seit 1541 ref.
- ⊙ Okt. 1544 Elisabeth N.N., Witwe
- K 1 T. 1 Stief-T. 1 S: Immanuel T., s. Toepke
2 (1886) S.26, Hundsnerscher (1996)
S.45

TREMILL or TREMYLL, — (senior). Pens. at PETERHOUSE,
in 1581. Probably Richard, s. and h. of Richard, of Bedford-
shire. Of Wrawby, Lincs. Married Helen, dau. of William
Thorley, of Northamptonshire. Probably brother of Henry
(1580) and of James (above). (Essex Pedigree, 608.)

TREMELIUS, JOHN EMMANUEL. Hebrew lecturer, 1550-3.
A Jew. B. at Ferrara, 1510. Studied at Padua between
1530 and 1540. Converted to Christianity by Cardinal Pole,
his godfather, 1540. Teacher of Hebrew at Lucca, where he
imbibed the opinions of the reformers chiefly through the
influence of Peter Martyr. Came to England; resided with
Archbishop Cramer at Lambeth Palace, 1547. Preb. of
Carlisle, 1552. Left England on the accession of Queen Mary,
1553. Head of the gymnasium at Hornbach, 1559. Imprisoned
for his Calvinistic views; released, 1560. Professor of Old
Testament studies at Heidelberg, 1561. D.D. (Heidelberg),
1561. Sent to England as Envoy of the Elector; resided with
Archbishop Parker, c. 1565. Expelled from Heidelberg, 1576.
Appointed teacher of Hebrew at Sedan. Translated the
Bible from Hebrew and Syriac into Latin. Author, mis-
cellaneous. Died at Sedan, Oct. 9, 1580. (Cooper, i. 425;
D.N.B.)

TREMELT, GEORGE. Adm. sizar (age 17) at SIDNEY, Dec. 21,

Measuring Publications from Worldcat

Tremellius, Immanuel 1510-1580

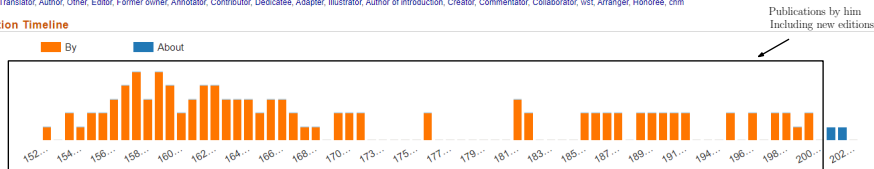
Overview

Works: 604 works in 1,721 publications in 7 languages and 8,995 library holdings

Genres: Commentaries Sacred works Paraphrases Sources History

Roles: Translator, Author, Other, Editor, Former owner, Annotator, Contributor, Dedicatee, Adapter, Illustrator, Author of introduction, Creator, Commentator, Collaborator, wst, Arranger, Honoree, cnm

Publication Timeline



Most widely held works about Immanuel Tremellius

- From Judaism to Calvinism : the life and writings of Immanuel Tremellius (c. 1510-1580) by Kenneth Austin (Book)
- Immanuel Tremellius : ein Proselytenleben im Zeitalter der Reformation by Wilhelm Becker (Book)
- When brethren walk together : Immanuel Tremellius (c. 1510-1580), Jewish-Christian conversion, Christian Hebraism, and Reformed Christianity by Joshua Andrew Johnson ()
- Immanuelis Tremellii specularius, dialogus pernecessarius, quo se Immanuel Tremellius purgat ab illis criminationibus, quas Gilbertus Genebrardus theologus Parisiensis diuinarum & Hebraicarum literarum professor regius, ipsi in chronographia, seu vniuersae historiae speculo intulerat by Immanuel Tremellius (Book)
- Testamenti veteris biblia sacra, sive, Libri canonici priscæ Judaeorum ecclesiae a Deo traditi by Théodore de Bèze (Book)

Seven Periods

1. First associations of professors or students dedicated to education - Univ of Paris (1000-1199)
2. Univ of Paris - Black Death (1200-1347)
3. Black Death - Printing Press (1348-1449)
4. Printing Press - First Protestant univ (1450-1522)
5. First Protestant univ - Edict of Nantes (1523-1597)
6. Edict of Nantes - Revocation of the Edict of Nantes (1598-1684)
7. Revocation of the Edict of Nantes - French Revolution (1685-1793)

Total number of scholars per Period

	1000	1200	1348	1450	1523	1598	1685
	-1199	-1347	-1449	-1522	-1597	-1684	-1793
<i>Old universities (founded bef. 1523)</i>							
C	230	2012	3987	5133	5023	4739	6154
P	12	78	270	909	1061	1083	1461
<i>New universities (founded aft. 1523)</i>							
C					768	2452	3511
P					551	1566	3024
<i>Ratios C/P</i>							
old	19.2	25.8	14.8	5.6	4.7	4.4	4.2
new					1.4	1.6	1.2

P bef. 1500 covers universities which converted later to Protestantism.

Total number of Publications per Period ($\div 1000$)

	1000	1200	1348	1450	1523	1598	1685
	-1199	-1347	-1449	-1522	-1597	-1684	-1793
<i>Old universities (founded bef. 1523)</i>							
C	23.0	132.5	81.7	204.8	331.1	178.4	200.9
P	0.9	8.8	3.1	73.2	326.3	339.0	427.2
<i>New universities (founded aft. 1523)</i>							
C					80.0	88.5	149.3
P					178.4	390.6	738.6
<i>Ratios C/P</i>							
old	24.31	15.13	26.24	2.80	1.01	0.53	0.47
new					0.45	0.23	0.20

P bef. 1500 covers universities which converted later to Protestantism.

Publications per Publishing Scholar per Period ($\div 1000$)

	1000	1200	1348	1450	1523	1598	1685
	-1199	-1347	-1449	-1522	-1597	-1684	-1793
<i>Old universities (founded bef. 1523)</i>							
C	0.24	0.32	0.17	0.25	0.23	0.14	0.10
P	0.16	0.17	0.11	0.48	0.56	0.44	0.37
<i>New universities (founded aft. 1523)</i>							
C					0.29	0.14	0.15
P					0.49	0.34	0.29
<i>Ratios C/P</i>							
old	1.52	1.90	1.55	0.52	0.41	0.31	0.28
new					0.59	0.41	0.51

P bef. 1500 covers universities which converted later to Protestantism.

Measuring Publications of a University

Issue: coverage of universities varies, mostly because the harvesting rate of obscure scholars varies

but the top scholars of each university are known.

in each period, we measure the publications p of a given university i by the sum of the publications of its top 5 members (S)

$$p_{it} = \ln \left(1 + \sum_{j \in S} p_{ijt} \right)$$

ps: for multiple affiliations, publications are divided equally between universities

Publications of top 5 Scholar per Period $\sum_{j \in S} p_{ijt}$

	1000	1200	1348	1450	1523	1598	1685
	-1199	-1347	-1449	-1522	-1597	-1684	-1793
<i>Old universities (founded bef. 1523)</i>							
C	18.7	88.5	57.8	139.8	184.4	113.0	113.1
P	0.9	6.4	3.0	66.5	234.6	146.8	166.9
<i>New universities (founded aft. 1523)</i>							
C					54.2	60.5	105.0
P					126.4	183.5	289.0
<i>Ratios C/P</i>							
old	19.91	13.82	19.50	2.10	0.79	0.77	0.68
new					0.43	0.33	0.36

P bef. 1500 covers universities which converted later to Protestantism.

Network of universities

Look at the data through the lens of graph theory

Let $N = \{1, 2, \dots, n\}$ be the set of universities in the network g (nodes, exogenous).

For two universities $(i, j) \in N$, we define $g_{ij} \in \{0, 1\}$ as the *link* (edge) between them:

- ▷ $g_{ij} = 1$ if at least one same scholar has taught in both universities, $g_{ij} = 0$ otherwise.
- ▷ links are *undirected*: $g_{ij} = g_{ji}$, for all i and j .
- ▷ the *strength* of the link s_{ij} is given by the number of scholars who have taught in both universities i and j .

Network: connecting scholars at the time of Immanuel Tremellius

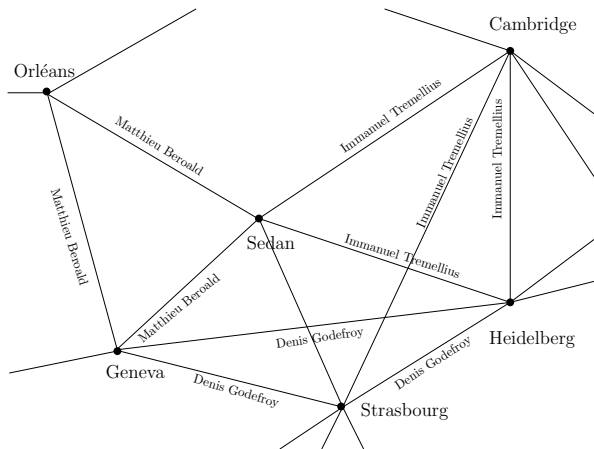


Figure: Network 1000-1199

Positioning of universities determined by the Fruchterman-Reingold force-directed algorithm.

Groups universities more closely together when they are linked to each other.

Only show big component.

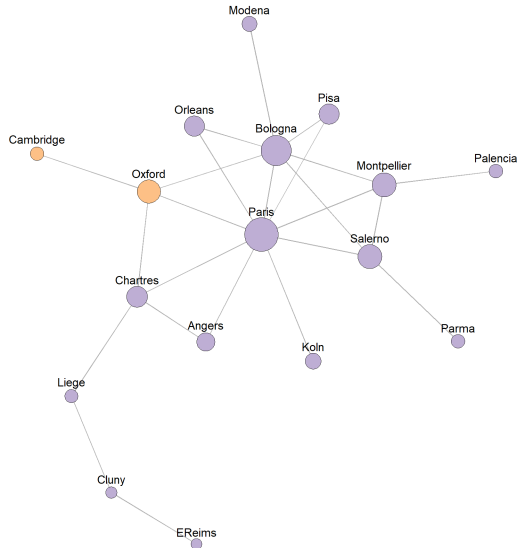


Figure: Network 1200-1347

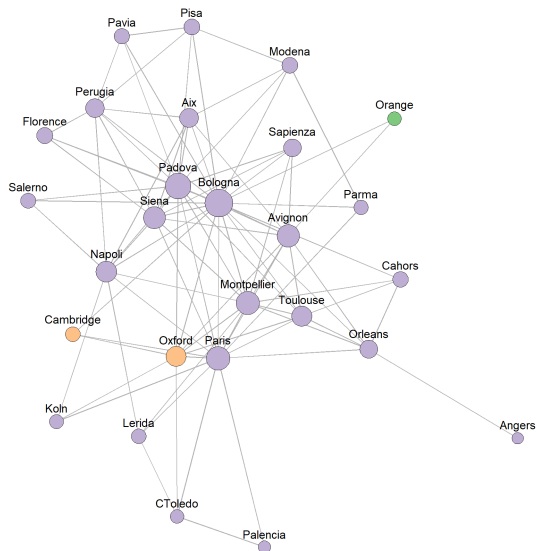


Figure: Network 1348-1449

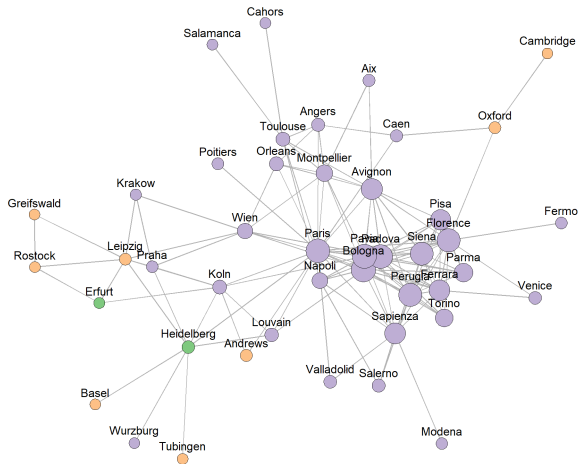


Figure: Network 1450-1522

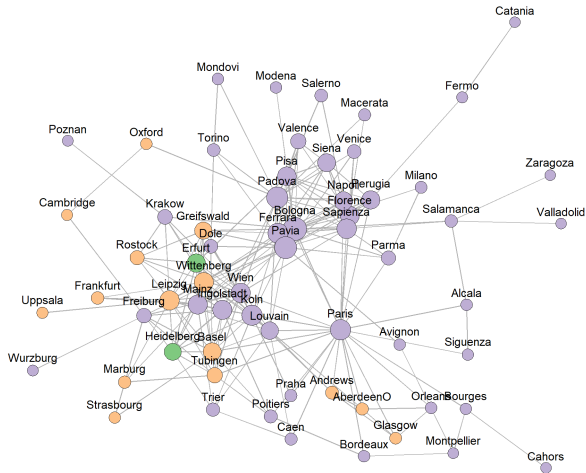


Figure: Network 1598-1684

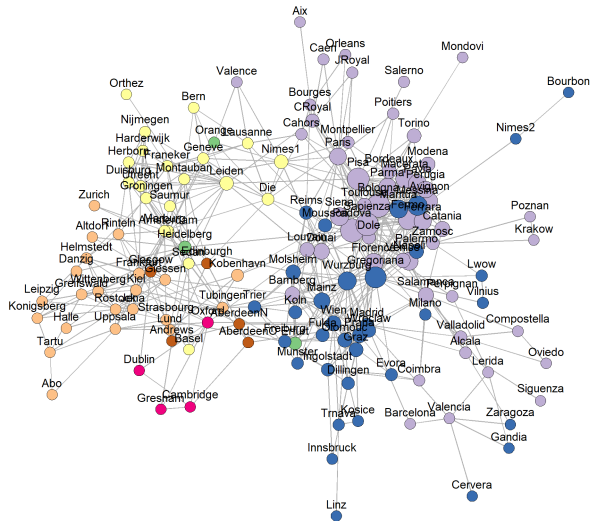
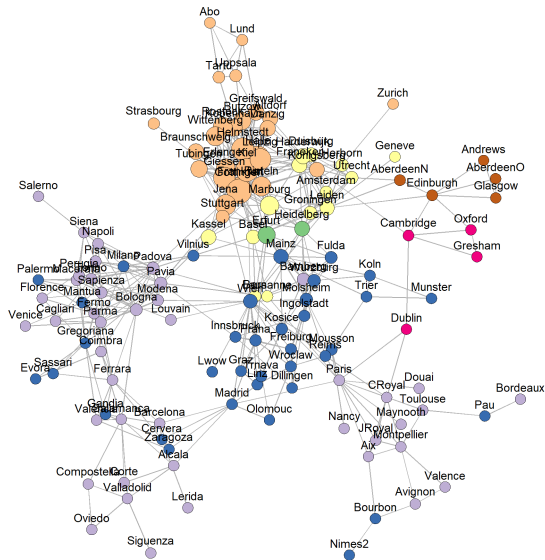


Figure: Network 1685-1793



Descriptive Statistics

	1000	1200	1348	1450	1523	1598	1685
	-1199	-1347	-1449	-1522	-1597	-1684	-1793
Universities	18	31	50	73	120	146	151
Connected universities	17	27	44	66	115	140	144
Connected pairs	24	93	136	231	692	535	473
Scholars in connected pairs	42	367	679	745	1555	1457	2146
Density	0.18	0.26	0.14	0.11	0.11	0.05	0.05
Diameter	6	3	6	5	5	7	8
Average distance	2.62	1.88	2.54	2.54	2.46	3.1	3.47

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Density: the ratio of observed links to the maximum number of possible links

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Average distance	2.62	1.88	2.54	2.54	2.46	3.1	3.47

Diameter: largest distance between any two universities in the network.

Position in the network

Five classic measures of centrality

- **degree**: number of univ i 's neighbors
- **strength**: average intensity of existing links with neighbors
- **closeness**: how quickly univ i is reachable from all other universities
- **betweenness**: the importance of univ i in connecting other universities in the network
- **eigenvector**: measures how “well-connected” univ i 's neighbors are

They all correlates with publications

Position in the network and Scientific Production: Panel of universities

<i>Dependent variable: publis of top 5 scholars</i>					
degree	0.087*** (0.016)				
strength		0.029** (0.013)			
closeness			10.241*** (1.510)		
betweenness				6.947*** (2.724)	
eigenvector					1.647*** (0.374)
Observations	589	589	538	589	589
Adjusted R ²	0.639	0.618	0.629	0.619	0.630

* p<0.1; ** p<0.05; *** p<0.01

Includes university and period fixed effects, controls for varying coverage & activity periods.

Connections between **C** and **P** universities

	1450	1523	1598	1685
	-1522	-1597	-1684	-1793
Proportion of C-P edges	20.78	21.1	5.05	3.59
IH index for C univ	0.57	0.54	0.87	0.92
IH index for P univ	0.33	0.29	0.64	0.69
Modularity religion	0.10	0.18	0.37	0.43

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Inbreeding homophily (IH) index: measures the amount of bias in favor of its own community
(0: random graph, 1: no connection with outsiders)

Connections between **C** and **P** universities

	1450 -1522	1523 -1597	1598 -1684	1685 -1793
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Modularity religion	0.10	0.18	0.37	0.43

Modularity: difference between observed number of links within religious groups and expected number of links in a random graph
 (= how much does religion “explain” the actual structure of the network)

To separate effect of religion from geography: dyadic regressions

- We consider all the possible pairs of universities i and j - *dyad* - for each period.
- Dependent variable: the presence (0/1) of a link, g_{ij}
(in appendix, the strength (or *intensity*) of the link, s_{ij} and the inverse of the length of the shortest path, $1/l(i, j)$)
- Control for geography: d_{ij} is the minimum cost it takes to travel from i to j computed using Özak's (2010, 2018) human mobility index.
- We control for coverage and activity overlap
- We use sub-religions $\mathbf{P}^L$, $\mathbf{P}^C$, $\mathbf{P}^P$, $\mathbf{P}^A$, $\mathbf{C}^S$, $\mathbf{C}^S$ to maximize predictive power.
- All possible interactions are included: belonging to same group, $\mathbf{I}(i, j \in \mathbf{P}^L)$, or not. e.g: $\mathbf{I}(i \in \mathbf{P}^L, j \in \mathbf{P}^C)$

Dyadic Regression: methodological discussion

Dyadic regression is a linear probability model applied to diads

Widely used in trade

Alternative: Exponential Random Graph models (ERGM)

non-linear model aimed at explaining the network structure as a whole
maximize the likelihood of a graph

ERGM better at predicting networks? but impose more structure on the data than
dyadic regressions

Dyadic Regression: results

	1000	1200	1348	1450	1523	1598	1685
	-1199	-1347	-1449	-1522	-1597	-1684	-1793
d_{ij}	-0.144*** (0.040)	-0.214*** (0.024)	-0.209*** (0.013)	-0.173*** (0.008)	-0.161*** (0.006)	-0.116*** (0.004)	-0.109*** (0.003)
$\mathbf{I}(i, j \in \mathbf{P}^L)$					-0.042 (0.048)	0.008 (0.027)	0.102*** (0.023)
$\mathbf{I}(i, j \in \mathbf{P}^C)$					0.205*** (0.063)	0.233*** (0.055)	0.304*** (0.039)
$\mathbf{I}(i, j \in \mathbf{P}^P)$					-0.018 (0.101)	0.445*** (0.072)	0.367*** (0.065)
$\mathbf{I}(i, j \in \mathbf{P}^A)$					0.442*** (0.119)	0.672*** (0.088)	0.537*** (0.078)
$\mathbf{I}(i, j \in \mathbf{C}^S)$					0.278*** (0.041)	0.163*** (0.024)	0.148*** (0.021)
$\mathbf{I}(i, j \in \mathbf{C}^J)$					0.135** (0.064)	0.081** (0.040)	0.162*** (0.036)
Observations	153	437	1,225	2,623	7,091	10,565	11,238
Adjusted R ²	0.313	0.447	0.363	0.297	0.270	0.217	0.247

Notes: *p<0.1; **p<0.05; ***p<0.01

Includes university fixed effects, controls for varying coverage & activity periods,
interaction terms between all subreligion

Dyadic Regression: results

	1000	1200	1348	1450	1523	1598	1685
	-1199	-1347	-1449	-1522	-1597	-1684	-1793
d_{ij}	-0.144*** (0.040)	-0.214*** (0.024)	-0.209*** (0.013)	-0.173*** (0.008)	-0.161*** (0.006)	-0.116*** (0.004)	-0.109*** (0.003)
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Simulated networks

We use the dyadic regression to predict links between any two universities → simulated networks

- a **predicted network**: using the benchmark regression.
- an **atheist (counterfactual) network**: cancelling the effect of religion – universities loose their religious identity

Both simulations keep the number of connected universities constant and equal to the observed one

(to be able to measure their centrality across simulations)

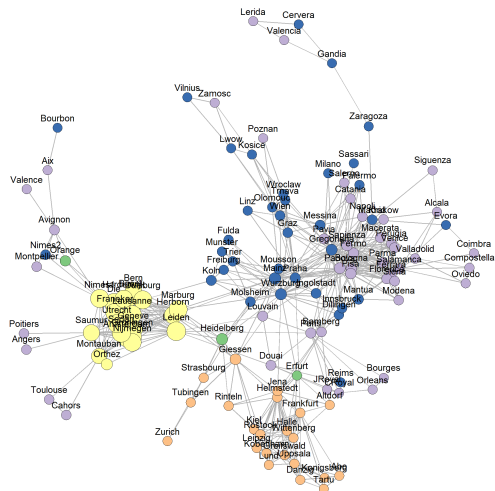
Simulated networks

		Observed	Predicted	Atheist
1598-1684	Connected U.	140	140	140
	Connected pairs	535	622	1259
	Density	0.05	0.06	0.12
	Average distance	3.10	3.36	2.48
	Modularity ($\mathbf{P} - \mathbf{C}$)	0.37	0.44	0.09
	Interfaith Edges (%)	5.05	3.70	38.13
1685-1793	Connected U.	144	144	144
	Connected pairs	473	789	1440
	Density	0.05	0.07	0.13
	Average Distance	3.47	3.61	2.18
	Modularity ($\mathbf{P} - \mathbf{C}$)	0.43	0.38	0.02
	Interfaith edges (%)	3.59	4.82	38.19

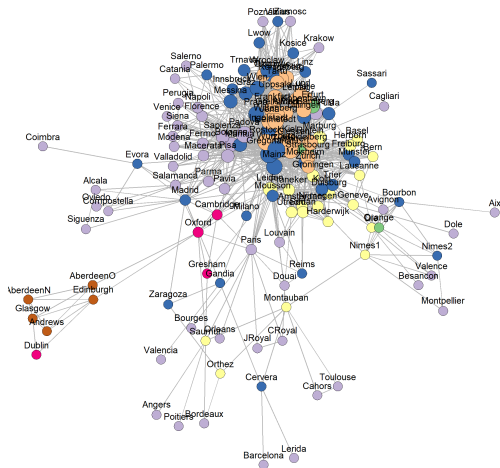
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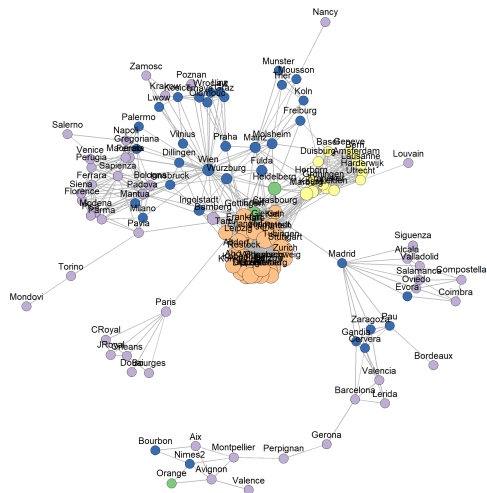
1598-1684: Predicted network



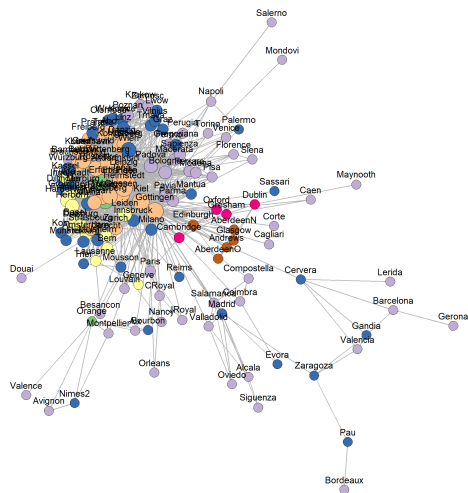
Atheist network



1685-1793: Predicted network



Atheist network



Winners and Losers from the Reformation

$\tilde{\lambda}_{it}$: eigenvector centrality of university i in Atheist network $\sim$ “natural” centrality

$\hat{\lambda}_{it}$: eigenvector centrality of university i in Predicted network

	1523-1597	1598-1684	1685-1793
$L^C = E_{i \in \mathbf{C}}[\hat{\lambda}_{it} - \tilde{\lambda}_{it}]$	+0.033	−0.118	−0.073
$L^P = E_{i \in \mathbf{P}}[\hat{\lambda}_{it} - \tilde{\lambda}_{it}]$	−0.133	+0.021	−0.066
$H_0 : L^C = L^P$, P-value	[0.000]	[0.038]	[0.784]

→ Initially, the network reorganization harms Protestants more

→ For the last two periods, it harms Protestants less

Religion & production: strategy

What we know so far

- Catholic universities have declined in terms of publications after the Reformation
- network structure is correlated with publications
- the Reformation has segmented the network of European universities
- It harmed Catholics more during the last two periods

How to measure the impact of the Reformation on publications through the network structure?

Religion & production: strategy

We explain the publications of institutions in a panel of universities with the following variables:

- university and period fixed effects
- religious dummy ($\mathbf{P} = \emptyset$ before 1523)
- eigenvector centrality in the Atheist network $\tilde{\lambda}_i$ to capture changes in the non-religious features of the network affecting publications
- difference in centrality between Predicted and Atheist networks $\hat{\lambda}_i - \tilde{\lambda}_i$ as a measure of the effect of religion through the network

Religions and Publications

<i>Dependent variable: p_{it}</i>				
$i \in \mathbf{P}$	2.893*** (0.466)		1.604*** (0.459)	1.636*** (0.457)
$\tilde{\lambda}_{it}$		4.448*** (0.446)	3.899*** (0.469)	4.033*** (0.471)
$\hat{\lambda}_{it} - \tilde{\lambda}_{it}$				0.818** (0.368)
Univ FE	YES	YES	YES	YES
Period FE	YES	YES	YES	YES
Observations	589	589	589	589
Adjusted R ²	0.487	0.548	0.559	0.564

Becoming Protestant
increases publications

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

$i \in \mathbf{M}$ included in controls. Reference: $i \in \mathbf{C}$

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Becoming more
central through
Reformation increases
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Main Results

The Protestant Reformation deeply affected the shape of the network of universities.

- ▷ Religion became a strong determinant of network structure, even when controlling for geography
- ▷ Sharp clear-cut divide between Protestant and Catholic univ
- ▷ Predicting network structure from a dyadic regression with and without religions, we isolate the effect of religion on each university centrality
- ▷ The Reformation impacted positively the publications in Protestant Universities, partly by improving their relative position in the network