Catholic Censorship and the Demise of Knowledge Production in Early Modern Italy

Fabio Blasutto* David de la Croix†

*Stockholm School of Economics †IRES/LIDAM, UCLouvain & CEPR

Toulouse, June 2022

The decline of Italy

15-16th centuries: undisputed Italy's primacy in knowledge creation (Galileo)

North and Western Europe overtook Italy in the following two centuries

Reasons for the relative decline of Italy ? Counter-Reformation (Landes 1999) or war & pandemics (Alfani)

The Church started to fight against the ideas which will produce the Scientific Revolution

Several tools used. Here focus on *Index Librorum Prohibitorum* - censorship

Could censorship be important for Italy's demise ?

Censorship

Key idea

- Censorship makes new ideas less available to others,
- distorts people choice to develop non-compliant ideas (occupational choice)

Structural approach to model occupational choice mechanism and assess its weight

- construct a large sample of academic scholars active in Italy from 1400 to 1750 and document the intensity of censorship,
- measure their quality (human capital) through publications
- identify the deep parameters of a novel model linking censorship to knowledge diffusion and occupational choice,
- counterfactual experiment to assess quantitatively the role of censorship in the decline in total publications per scholar in Italy.

Preview of the results (1)

New facts

- in the sixteenth century, censored authors were of much better quality than non-censored authors,
- less and less true as time passes,
- intensity of censorship decreased over time.

Model

- growth model with novel occupational choice made by printers between printing compliant/conformist books or revolutionary/non-conformist books

Preview of the results (2)

Quantitative (calibration - simulation)

- imposing a censorship rate of 19% on the non-conformist books was sufficient to decrease the share of non-conformist authors from 51% in 1470-1550 to 24% in 1680-1750,
- censorship reduced by 40% the average log publication per scholar in Italy,
- half of this drop stems from the induced reallocation of talents towards compliant activities,
- The effect of adverse macroeconomic conditions on knowledge production is one fourth of the effect of censorship.

Literature

Literature on the effects of censorship in other contexts. Our innovation: endogenous selection of agents into compliant vs. non-compliant knowledge

Literature on Catholic censorship, Becker, Pino, and Vidal-Robert (2021) and Comino, Galasso, and Graziano (2021). They focus on books. We focus on authors, their quality, and have structural growth model.

Interactions between church and society, Bénabou, Ticchi, and Vindigni (2021). We rationalize the Church's late reaction to the rise of Protestantism.

Literature on the decline of Italy.

Academies, Scholars, Publications, and Censorship

Our unit of observation is an academic scholar active in Italy over 1400-1750.

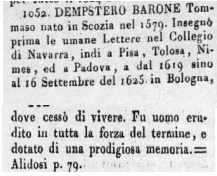
Start from list of universities (Frijhoff) and academies (McClelland, British Library)

Establish list of their members from secondary sources

Look for their publications in Worldcat

Look if they were censored in *Index Librorum Prohibitorum* (Bujanda 2002)

Example


1052. DEMPSTERO BARONE Tomaso nato in Scozia nel 1579. Insegnò prima le umane Lettere nel Collegio di Navarra, indi a Pisa, Tolosa, Nimes, ed a Padova, a dal 1619 sino al 16 Settembre del 1625. in Bologna, dove cessò di vivere. Fu uomo erudito in tutta la forza del termine, e dotato di una prodigiosa memoria. = Alidosi p. 79.

We also find him in Pisa, from Fabroni (1792)

Pandectis laudabiliter versari. Ea propter non diu fuit apud nos (fuit autem vix biennium) & ex eo tempore siluit Pandectarum cathedra ad annum usque 1616. quo illam occupavit Thomas Dempsterus. Hominis dignitas atque fama admonent nos, ut in illius vita explicanda paullulum immoremur.

We check bio details in Treccani (1931)

In Mazzetti (1847) we find that Tomaso Demstrero taught at the University of Bologna


TRECCANI ISTITUTO MAGAZINE CATALOGO SCUOLA LIBRI ARTE TRECCANI

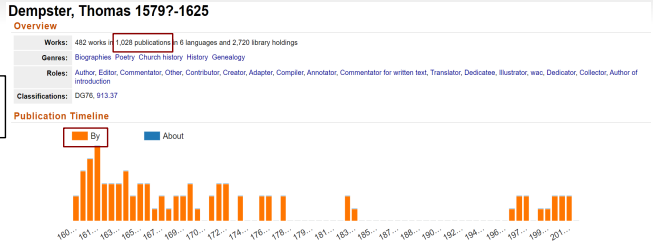
DEMPSTER, Thomas

Enciclopedia Italiana (1931)

Crea un ebook con questa voce | Scaricalo ora (0) Condividi

DEMPSTER, Thomas. - Storico e filologo, nato a Cliftbog (Aberdeenshire) nel 1579, morto, dopo una vita assai avventurosa, a Bologna, dove era stato nominato professore di umanità, il 6 settembre 1625. A Bologna appunto fu pubblicata postuma (1627) la più nota delle sue opere, *Historia Ecclesiastica gentis Scotorum*, dove spiegò, con la sua dottrina, il suo accentuato nazionalismo scozzese. Della sua produzione nel campo della storia e filologia classica, ricordiamo l'*Antiquitatum Romanorum corpus absolutissimum* (Parigi 1613, e in varie altre edizioni sino al 1743), e il *De Etruria regali* (scritto nel 1615-20; edito postumo a Firenze nel 1723-24), ampia raccolta di materiali antiquari, storici e archeologici sull'antica Etruria, per cui il D. si può considerare l'iniziatore degli studi d'etruscologia. Il D. fu anche poeta latino, ai suoi tempi di grande fama.

We look for publications in Worldcat



We find in Bujanda (2002) his censored books and the date of censorship

DEMPSTER, Thomas (c.1579-1625). Né dans le Aberdeenshire. Écos. Professeur d'humanités à Pise et à Bologne.

- ***Antiquitatum romanarum corpus absolutissimum, in quo praeter ea quae Ioannes Rosinus*** [Johann Rossfeld (1551-1626)] ***delineaverat, infinita supplentur, mutantur, adduntur ex criticis et omnibus utriusque linguae auctoribus collectum.***
  Paris, Jean Le Bouc, 1613, in-fol., [22], 828, [71] p. Paris, BN.
  Donec corrig. ***Decr.*** **08-04-1617.**
- ***Scotia illustrior, sive Mendicabula repressa, modesta parecbasi Thomae Dempsteri... Qua libelli famosi impudentia detegitur; mendacia ridicula confutantur; Scotiae Sancti sui vindicantur, ac bona fide asseruntur.*** **[Réponse à D. Roche,** ***Brigida Thaumaturga*****].**
  Lyon, Pierre Rousier, [1620], in-8°, [8], 83, [5] p. Paris, BN.
  Decr. **27-10-1623.**
- **v.** ***Hiberniae sive Antiquioris Scotiae vindiciae.***

Five periods

periods: 1:1400-69, 2:1470-1539, 3:1540-1609, 4:1610-79, 5:1680-1749

Indexes progressively established here and there at the end of period 2, but covering past books as well.

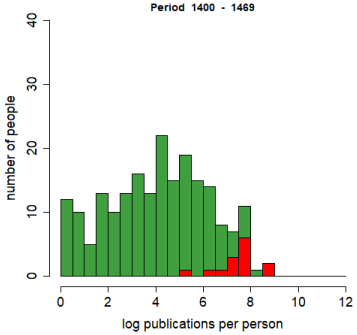
Council of Trent, established in 1564 the *Index Librorum Prohibitorum*.

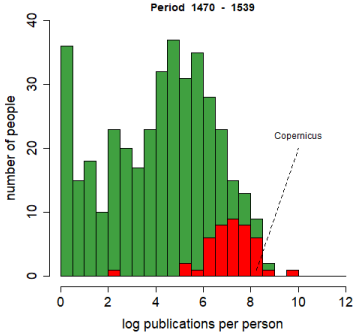
The last version of the Index was published in 1948.

Total number of scholars & publications by period

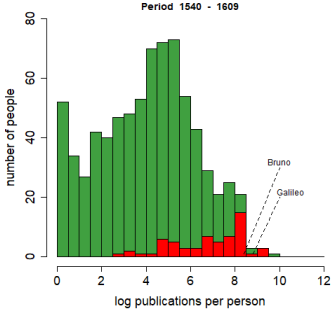
	Nb. of published scholars					Median nb. publications per p.				
Period	1	2	3	4	5	1	2	3	4	5
Ubologna-1088	56	86	79	56	67	34	57	37	16	7
Unapoli-1224	10	20	26	20	18	97	69	17	17	41
Upadua-1222	76	131	131	76	79	32	39	41	30	12
Upavia-1361	38	71	50	16	8	44	58	36	16	7
Uroma-1303	42	61	60	44	40	204	97	67	41	59
Upisa-1343	12	38	68	58	36	32	40	20	31	10
UGregoriana-1556	0	0	64	54	51	0	0	118	55	15
StudFlorence-1321	42	21	13	14	33	53	116	72	83	12
AcadRicovrati-1599	0	1	71	115	189	0	2	28	36	27
AcadCrusca-1583	0	2	38	106	119	0	294	29	30	40
Italy	206	388	758	751	768	52	60	49	29	20
Europe	413	1252	2835	3727	5390	30	50	54	46	44

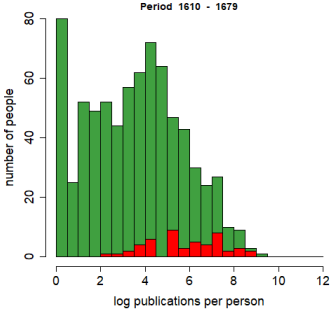
Distribution of published authors by quality. Red: censored. Green: non-censored.

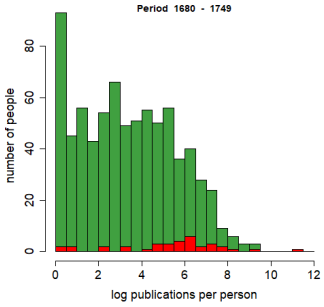




Censorship concentrated on top scholars for the first periods, then became more uniformly distributed


Period 1540 - 1609
number of people
log publications per person
Bruno
Galileo


Period 1610 - 1679
number of people
log publications per person


Period 1680 - 1749
number of people
log publications per person

Key statistics (moments we will fit)

Moment description	Period				
	1400-69	1470-1539	1540-1609	1610-79	1680-1749
Nb published scholars	206	388	758	751	768
% censored scholars	6.8	11.08	7.92	6.66	4.56
Median p_{it} (all)	4.33	4.51	4.26	3.69	3.26
Median p_{it} (censored)	7.71	7.05	7.05	5.64	5.91
75 percentile p_{it} (all)	5.77	5.86	5.56	5.04	5.14
75 perc. p_{it} (censored)	7.87	7.85	8.13	7.27	6.81

p_{it}: log publications per scholar

More facts

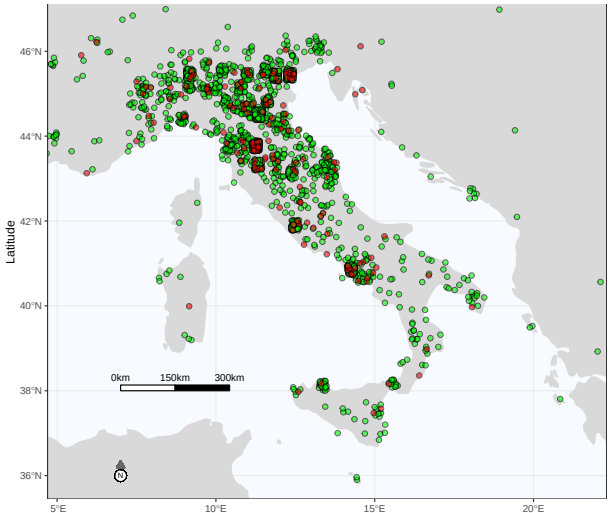
After the second period, the percentage of censored authors is shrinking over time.

Overall quality, measured by median publications per person, is declining over time as well.

Also holds for the top of the distribution, as the 75 percentile also diminishes over the last four periods.

Compatible with the idea of the top innovators' books becoming progressively compliant and of lower quality over time.

Place of birth of censored (red) and non censored (green) scholars



Our data cover the whole peninsula and its islands.

Censorship seems to affect all regions rather uniformly.

Persons and Books

Time is discrete.

At each date t one generation of S persons is alive.

Knowledge is embodied in books.

At the beginning of each period, individuals learn from μ_t books.

μ_t: exogenous number of books one can buy during her life.

Books include more or less relevant content to produce goods and services.

Each book i has a negative feature h_i, say irrelevance. The quality of a book is a decreasing function of its irrelevance, with elasticity θ:

$$q_i = h_i^{-\theta}, \quad \theta \in (0,1). \tag{1}$$

Two types of Books

Books are of two types.

Compliant, superscript C

Revolutionary, superscript R

At the beginning of time t, the irrelevance of book i of type j follows an exponential distribution with scale parameter k_t^j:

$$h_i^j \sim \exp(k_t^j), \quad \text{with } j \in \{C, R\}. \tag{2}$$

As

$$\mathsf{E}[h_i^j] = \frac{1}{k_t^j},$$

k_t^j measures the average usefulness of knowledge in sector j.

The Fréchet Distribution

The distribution of book quality represents the technology frontier.

Since the irrelevance of books h_i is exponentially distributed and given Equation (1), the distribution of book quality q_i follows a Fréchet distribution with scale parameter $k^{j\theta}$ and shape parameter $1/\theta$.

Book quality q^j by sector as:

$$E(q_i^j) = \Gamma(1-\theta)\ (k^j)^\theta \text{with } j \in \{C, R\}, \tag{3}$$

where $\Gamma(\cdot)$ is the Euler gamma function.

Best books

Share of printers that produced revolutionary books in the previous generation is denoted by m_t.

An individual reads $\mu_{t+1} m_t$ revolutionary books and $\mu_{t+1}(1 - m_t)$ compliant books, drawn from their respective distribution.

Each individual s retains the best book coming from each one of the two distributions:

$$\hat{h}_s^C = \min\{h_1^C, .., h^C_{(1-m_t)\mu_{t+1}}\},$$
$$\hat{h}_s^R = \min\{h_1^R, .., h^R_{m_t \mu_{t+1}}\}.$$

The exponential distribution satisfies the minimum stability postulate: if x and y are mutually independent random variables, exponentially distributed with parameter λ, then $\min(x, y)$ is exponentially distributed with parameter 2λ.

$$\min\{h_1^C, .., h_{(1-m_t)\mu_{t+1}}^C\} \sim \exp(k_t^C(1-m_t)\mu_{t+1}), \quad \text{and}$$
$$\min\{h_1^R, .., h_{m_t\mu_{t+1}}^R\} \sim \exp(k_t^R m_t \mu_{t+1}).$$

Distribution of actual relevance of the best book read by person s follows

$$\hat{h}_s^j \sim \exp(b_{t+1}^j), \quad \text{with } j \in \{C, R\}, \tag{4}$$

where b_{t+1}^C and b_{t+1}^R are defined as

$$b_{t+1}^C = k_t^C(1-m_t)\mu_{t+1},$$
$$b_{t+1}^R = k_t^R m_t \mu_{t+1}.$$

New books

Later in life, the generation $t+1$ writes new books, combining their inherited knowledge with a new idea. This new idea is drawn from a distribution whose scale parameter depends on the average quality of the books they have read:

$$h_{sN}^{j} \sim \exp(\nu b_{t+1}^{j}), \quad \text{with } j \in \{C, R\}.$$

Taking the best of their acquired and new knowledge leads to a book with irrelevance distributed as:

$$\tilde{h}_{s}^{j} = \min(h_{sN}^{j}, \hat{h}_{s}^{j}) \sim \exp((1+\nu) b_{t+1}^{j}). \tag{5}$$

We can now summarize the dynamics of the two types of knowledge by the dynamics of the scale of their distribution:

$$k_{t+1}^{C} = (1+\nu) k_{t}^{C} (1 - m_t) \mu_{t+1}, \tag{6}$$

$$k_{t+1}^{R} = (1+\nu) k_{t}^{R} m_t \mu_{t+1}. \tag{7}$$

Occupational Choice

Printers decide whether to be active in the compliant sector or in the revolutionary sector at the beginning of their activity.

Once they have chosen a sector, they would print any author they meet randomly.

They will determine their sector of activity based on the first author s they meet. This author has written two book projects of quality q_s^C and q_s^R. The best will be printed.

Relative price at which revolutionary books are sold is p (exogenous)

Occupational Choice (2)

The probability that the revolutionary book is best is:

$$\text{Prob}\{q_i^C < pq_i^R\} = \text{Prob}\{\tilde{h}_s^C > p^{-1/\theta}\tilde{h}_s^R\} = \frac{b_t^R}{b_t^R + b_t^C p^{-1/\theta}} = m_t. \tag{8}$$

Using the law of large numbers, this probability also defines the share of printers active in the revolutionary sector m_t.

$\hat{p} = p^{-1/\theta}$.

The dynamics of knowledge quality (6) and (7), together with the occupation choice, imply a static relationship:

$$m_t = \frac{k_t^R}{k_t^R + \hat{p}k_t^C} \tag{9}$$

and initial conditions k_1^C and k_1^R, determine m_1 .

The Equilibrium under an Exogenous Church's Behavior

We start defining $z = k^R/k^C$: From equation (9) we get

$$m_t = \frac{z_t}{\hat{p} + z_t}. \tag{10}$$

We decided to make m_t rather than z_t our main variable for describing the model dynamics because its domain is a bounded set.

We treat β as if it was exogenous, and we study the dynamics under this assumption.

Censorship limits the number of revolutionary books that individuals in $t+1$ encounter during their life to $\mu_{t+1} m_t (1-\beta)$ and therefore alters the process of accumulation of revolutionary knowledge, which now follows

$$k^R_{t+1} = (1+\nu)(1-\beta) k^R_t m_t \mu_{t+1}, \quad \text{with } \beta \in [0,1]. \tag{11}$$

The Dynamics under an Exogenous Church's Behavior

Dividing Equation (11) by (6) side by side, and substituting the resulting z_{t+1} in (10) at time $t+1$, we get the equation that governs the equilibrium dynamics of m:

$$m_{t+1} = \frac{(1-\beta)m_t^2}{1 - m_t((\beta-2)m_t + 2)} = f(m_t; \beta). \tag{12}$$

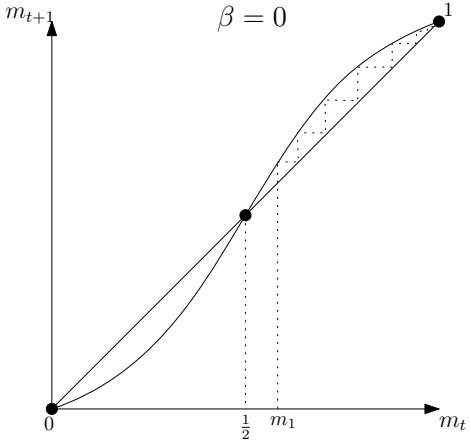
Proposition

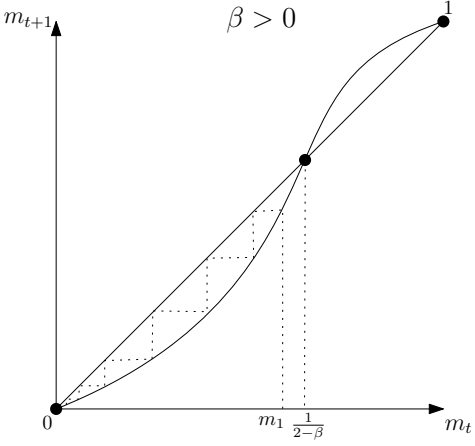
Given the initial $m_1 \in [0,1)$, the long run share of revolutionary authors, $m \equiv \lim_{t\to\infty} m_t$, is given by

i) $m = 0$ *if* $m_1 < 1/(2-\beta)$ *(Compliant steady state),*

ii) $m = 1$ *if* $m_1 > 1/(2-\beta)$ *(Revolutionary steady state),*

iii) $m = m_1$ *if* $m_1 = 1/(2-\beta)$ *(Unstable steady state).*


m_{t+1}
$\beta = 0$
1
0
$\frac{1}{2}$
m_1
m_t


m_{t+1}
$\beta > 0$
1
0
m_1
$\frac{1}{2-\beta}$
m_t

The Equilibrium under Optimizing Church's Behavior

Endogenize the timing of censorship: Church cannot enforce any censorship before having paid a fixed cost ψ.

After having paid ψ, she can impose a rate of censorship up to $\overline{\beta}$.

The Church cares about the share of compliant books in the economy: $u(1-m_t)$.

$$
\begin{aligned}
V(m_t) &= \max[V^N(m_t), V^C(m_t) - \psi], \\
V^N(m_t) &= u(1-m_t) + \delta V(m_{t+1}) \quad \text{s.t.} \quad m_{t+1} = f(m_t; 0), \\
V^C(m_t) &= \max_{0 \leq \beta_t \leq \overline{\beta}} u(1-m_t) + \delta V^C(m_{t+1}) \quad \text{s.t.} \quad m_{t+1} = f(m_t; \beta_t).
\end{aligned}
$$

the Church has to choose between paying a fixed cost today for enjoying a lower share of revolutionary books in the future and postponing such payment.

The Dynamics under Optimizing Church's Behavior

The Church's decision to start censoring also depends on the initial level of revolutionary books m_1.

Proposition

7 If $\psi > 0$, then there exist $\tilde{m} > 0$ and $1 > \breve{m} > 0$ such that

i) *If $m_1 < \min(1/2, \tilde{m})$ then $\beta_t = 0$ for each $t \geq 1$ (No need to censor),*

ii) *If $m_1 > \max(1/2, \breve{m})$ then $\beta_t = 0$ for each $t \geq 1$ (Too late to censor).*

Proposition

There exists $\overline{\psi}$ such that for each $\psi < \overline{\psi}$, there also exists $\overline{m}, \hat{m}$ such that for $\hat{m} > m_1 > \overline{m}$, $\beta_1 = \overline{\beta}$ holds (window of censorship).

Mapping Model to Data

Specify the relationship between model periods and their empirical counterpart:

t	years	rate of censorship β	share of censored authors	μ_t
1	1400-1469	0	0	1.000
2	1470-1539	0	$m_2\overline{\beta}$	0.878
3	1540-1609	$\overline{\beta}$	$m_3\overline{\beta}$	0.787
4	1610-1679	$\overline{\beta}$	$m_4\overline{\beta}$	0.828
5	1680-1749	$\overline{\beta}$	$m_5\overline{\beta}$	0.851

note: censorship in period 3 affects books written in period 2.

Estimation strategy

Set one parameter following the literature (δ).

Estimate six parameters using a minimum distance estimation procedure, under the assumption that censorship kicks in mid 16^{th} century as in the data.

$$\vartheta = [k_1^C, k_1^R, \theta, \overline{\beta}, \nu, p]$$

Set parameter ψ to match the timing of the introduction of censorship.

Minimum Distance Estimation

Minimizing the distance between 14 empirical and theoretical moments, implying thus 8 (=14-6) overidentifying restrictions.

$$\Omega(\vartheta) = (\mathbf{m} - \mathbf{m}_\vartheta)' \mathbf{W} (\mathbf{m} - \mathbf{m}_\vartheta), \tag{13}$$

Moments $\mathbf{m}$ to match:

Five moments are the median of the quality of all authors, and five other moments are their 75^{th} percentile. The last four moments are the share of censored authors $m_t \overline{\beta}$ for $t = 2, 3, 4, 5$.

Distribution of the quality of all authors, q_{it}, obtained by drawing with probability m_t from the distribution of q_t^R (i.e. a Fréchet$((k_t^R)^\theta, 1/\theta)$) and with probability $(1 - m_t)$ from the distribution of q_t^C.

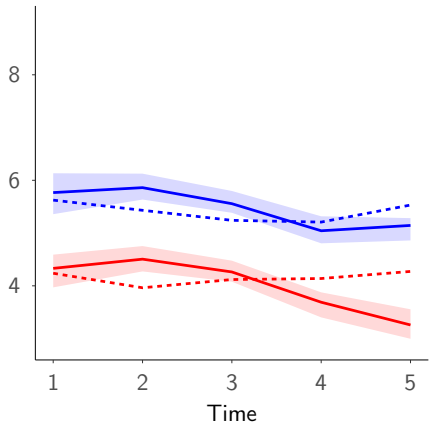
Estimation Results

Calibrated Parameters		Value	Std. Errors	Target
Discount Factor	δ	0.06	-	RBC lit.
Fixed Cost of Censorship	$\hat{\psi}$	(1.031 - 1.034)	-	Index set-up
Estimated Parameters		**Value**	**Std. Errors**	**Target**
Compliant knowledge in 1	k_1^C	16.6	1.21	$\Omega(\vartheta)$
Rev. knowledge in 1	k_1^R	117.5	10.86	$\Omega(\vartheta)$
Productivity of books	θ	0.34	0.017	$\Omega(\vartheta)$
Max Censorship	$\overline{\beta}$	0.19	0.015	$\Omega(\vartheta)$
Knowledge Growth	ν	1.45	0.071	$\Omega(\vartheta)$
Price of rev. books	p	0.52	0.019	$\Omega(\vartheta)$

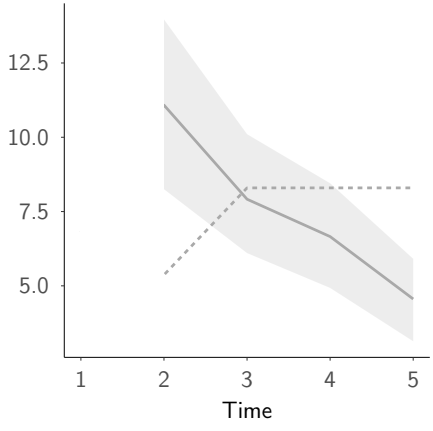
Model fit - Data (solid) and simulations (dashed)

Overall scholars

quality: median, 75^{th} percentile

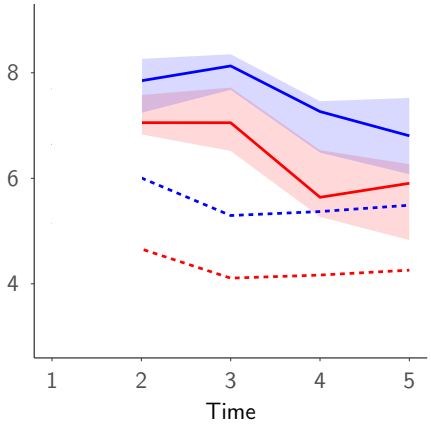


% censored scholars

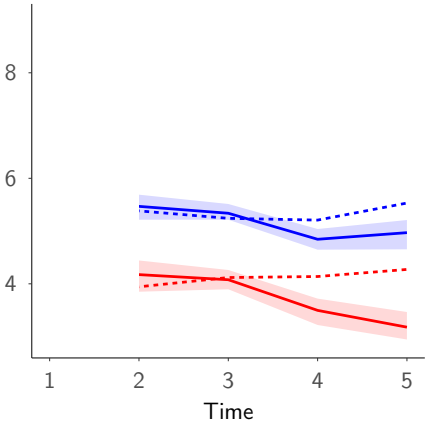


over-identification checks - Data (solid) and simulations (dashed)

Censored scholars
quality: median, 75^{th} percentile

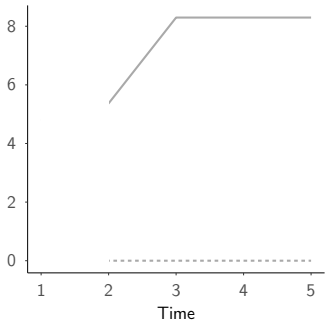


Non-censored scholars
quality: median, 75^{th} percentile

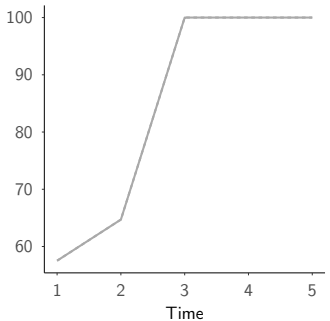


With and without censorship

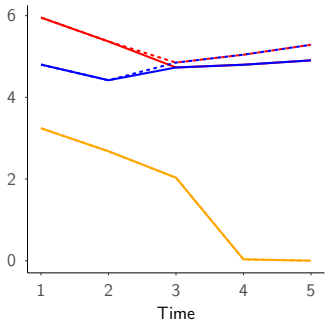
(a) % censored authors



(b) % revolutionary authors



(c) Overall, revolutionary compliant quality (averages)



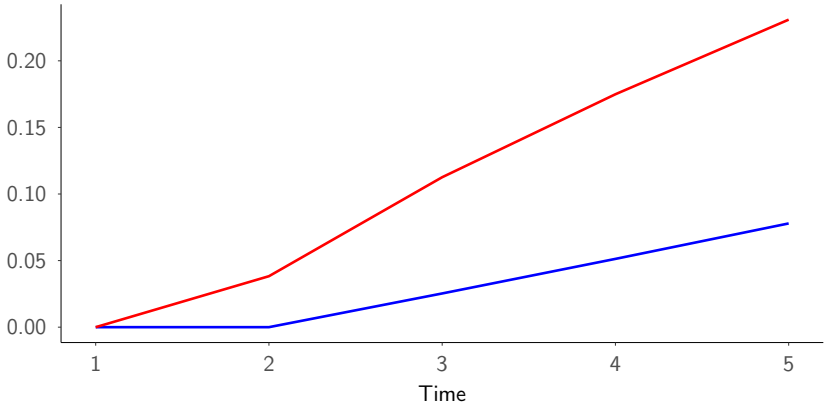
Decomposition of effect of censorship

The loss in the overall quality is driven both by a reduction in the stock of available knowledge and by the distortion in occupational choice:

$$\underbrace{q_5 - \hat{q}_5}_{=-1.41\ (100\%)} = \underbrace{\hat{m}_5[q_5^R - \hat{q}_5^R] + (1-\hat{m}_5)[q_5^C - \hat{q}_5^C]}_{=-1.03\ (72\%);\ (a)} + \underbrace{[m_5 - \hat{m}_5]\hat{q}_5^R + [(1-m_5) - (1-\hat{m}_5)]\hat{q}_5^C}_{=-1.26\ (89\%);\ (b)} + \underbrace{(m_5 - \hat{m}_5)[(q_5^R - q_5^C) - (\hat{q}_5^R - \hat{q}_5^C)]}_{=0.87\ (-61\%);\ (c)}. \tag{14}$$

Shutting down Macroeconomic Shocks

Gains in Average quality (in %) with respect to baseline.
Blue: no censorship ($\beta = 0$). Red: no macroeconomic decline ($\mu_t = 1 \ \forall t$)



Robustness

	The role of censorship in: overall quality $\frac{q_5-\hat{q}_5}{q_5}$	% heretic scholars $\frac{m_5-\hat{m}_5}{m_5}$	Rate of censorship $\overline{\beta}$	% her schol m_5
Benchmark	-8%	0%	8%	100
Only Italian born scholars	-107%	-23%	13%	82%
Only Southern Ital. scholars	-48%	-99%	18%	34%
Only Northern Ital. scholars	-25%	-116%	16%	24%
Only $t \leq 4$	-19%	-150%	20%	19%
No weak links to institution	-37%	-115%	17%	27%
All publications Length Wikipedia page	-49%	-112%	17%	27%
Imperfect censorship	-25%	-119%	19%	23%
Universities only	-23%	-117%	16%	23%

Results are not driven by a subgroup or a specific assumption

Conclusion

Censorship has a direct effect on knowledge accumulation by making censored material less available to scholars.

It also discourages writers and printers from engaging in non-compliant work.

$\rightarrow$ new method that considers these two channels.

$\rightarrow$ link censorship to upper-tail human capital production.

Application to the Catholic Church's censorship under the Counter-Reformation.

Sizeable effect supports a claim that the Church's censorship was one of the main drivers of Italy's decline.

Half of this drop stems from the induced reallocation of talents towards compliant activities.