Inquisitions and Scholarship

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Inquisitors engaged in mass censorship across the Iberian and Italian peninsulas; however, the effect it had on scholarship is debated. To test the effect of inquisitorial oppression a database of more than 2,000 top tier mathematicians, scientists, authors, artists and composers was created for sixteen European countries from 1000 to 1749. Italy and Iberia had large declines of high level scholars shortly after the establishment of the Inquisitions. In contrast, other countries – both Protestant and Catholic – had increases in top level scholars. Even though other countries had book burnings, religious persecution and intolerance; the presence of an institution designed to be intolerant and oppressive was a significant negative driver in the location of scientists and other geniuses over the sixteenth and seventeenth centuries.

Key Words: Inquisition, Human Capital, Persecution

1 Introduction

Inquisitors famously burned books. Writings were censored; books prohibited; ships, stores and libraries inspected; and onerous literary legislation enacted. This has led some historians to conclude that the Inquisition aided in the downfall of literature and learning. Others argue that censorship lacked strict enforcement, ports were porous and other countries engaged in book burning, religious discrimination and executions of offenders. Hence, the conclusion is drawn that the Inquisition did not damage scholarship relative to other countries.

To test the potency of the Inquisition on scholarship I offer a new approach. *The Complete Dictionary of Scientific Biography* (2008; hereafter CDSB) is a 27 volume encyclopedia set that includes more than 5,700 entries on "the lives and careers of great scientists, mathematicians, and natural philosophers." More than 1,200 individuals of the 5,700 lived in Europe from 1000 to 1749, the timeframe of this study. This is augmented with more than 800 top tier artists, authors and composers that lived over the same period (Murray 2003). To measure the effects of the Inquisition on scholarship the number of geniuses alive across countries is compared. For the purposes of this article, a genius is by definition any individual

included in CDSB or Murray. This measure allows for quantification of scholarship to some degree, which then can be used to measure how scholarship changed over time within a country and relative to other countries.

These sources are utilized to maintain a consistent definition on those included in the dataset. Composed over multiple decades with hundreds of contributors, the CDSB earned the Dartmouth Medal which "honors the creation of a reference work of outstanding quality and significance" in 1981.[1] Using this source eliminates any author bias and gives standardized data. The Murray data is described in more detail below.

In analyzing where these 2,000 highly accomplished individuals lived, I find that Inquisitions had a highly significant negative effect on the number of geniuses living in the inquisitorial countries of Portugal, Spain and Italy.[2] Not only did the number of geniuses decline in inquisitorial areas, it increased in other countries creating a divergence in high levels of human capital between inquisitorial countries and other areas.

The rise of systematic censorship occurred shortly following the invention of the printing press. Areas with printing had faster urban growth rates, around 60 percent more from 1500 to 1600 than comparable non-press cities (Dittmar 2011). With a novel and disruptive technology, elites who expected to lose power sought to suppress or control printing. The Ottoman Empire successfully prevented the printing press from majority usage as it would have disrupted political power. The elites were well aware of its benefits and allowed some minorities to publish, such as Armenians, but prevented Arabic presses as it would have eroded their control. Arabic printing only became acceptable after other forms of legitimization arose (Coşgel et al. 2012).

[1] Dartmouth Medal From the American Library Association web page: http://www.ala.org/Template.cfm?Section=bookmediaawards&template=/ContentManagement/ContentDisplay.cfm&ContentID=101398

[2] The use of Italy is anachronistic but will be used to describe areas that are located in Italy for ease. Historical boundaries are used; so a Venetian born in Crete is considered an Italian here. Spain is used similarly.

The printing press disruption affected the Christian world. A Dominican defender of the Inquisition complained: "Ever since they began to practice this perverse excess of printing books the church has been greatly damaged and every day it is confronted by greater and more obvious perils as men exchange the ancient and secure doctrine of the virtuous doctors for the sophisticated and adulterated one of the moderns." Books were known as "silent heretics" (Bosmajian 2006: 66). In 1584 Mendoza de Porres argued that astrology should be judged by scientists and not theologians. A censor replied it was the theologians' task to decide truth. In 1786 the chair of political economics, Fray Diego José de Cádiz, was denounced which delayed the introduction of economics in Spain (Pinto 1987: 318-9). In 1559 the Spaniard Antonio de Araoz said "The times are such that one should think carefully before writing books" (Kamen 1998: 103).

Kings, who to some extent derived legitimacy from religion, aided in censorship to maintain control. This benefited inquisitors as it allowed Catholic elites to maintain and display power, not only from religious rivals but from scientists who provided a substitute for or challenged religious explanations on nature (e.g. Galileo). Catholic elites had reason to fear the press; Protestants greatly used printing. Luther sold 300,000 copies of his writings between 1517 and 1520. Holy Roman Empire cities with a press in 1500 were around 40 percent more likely to be Protestant a century later. This eroded Catholic power as the church's wealth was generally confiscated or destroyed after a town accepted Protestantism (Rubin 2011). The Inquisition, in this aspect, can be interpreted as an organized Catholic reaction to Protestant printing power.

2 Inquisitorial Censorship

There were three major Inquisitions: the Portuguese, the Spanish and the Roman. Spain is the best studied with contradicting strands of thought on the impact of censorship. Traditionalists

assert no negative influence; literature flourished during the golden years concurrent with the Inquisition. Despite censorship few were denounced for prohibited books; not due to successful banning but rather an implicit agreement among intellectuals to conceal their libraries. Inquisitors complained about illicit books and their preservation, even in monastic libraries (Contreras 1987: 156). Marcelin Defourneaux (1963) argues Spanish censorship was less rigorous than Rome. Spain had weak information networks leading to limited censorship of literary and foreign works, excepting theological books. Books entered the country by smugglers through ports and frontier lands. Defourneaux concludes the Inquisition did not close Spain to European culture, and that the entire history of the seventeenth century shows this (p. 166). Henry Kamen takes a similar position. "The Inquisition's overseeing of literature, in short, looked imposing in theory but was unimpressive in practice" (1998: 133). An inquisitor commented in 1532 "From one hour to the next books keep arriving from Germany." In 1569 Barcelona bookshops sold "many forbidden books." English ships were protected against inspection after 1605. Inquisitors complained in 1606 "it is reported that many of the books ordered to be picked up are not being collected." Despite book smuggling being a capital offense, when a knight of the Order of Calatrava died a tenth of his library of 2,500 books was forbidden. Even though inquisitors engaged in simultaneous inspections of bookshops; they rarely occurred and only in larger towns (Kamen 1998: 118-120). The Index was expensive, out of date and difficult to enforce. Furthermore, most creative and scientific literature was not included. Historians, "treatises of mathematics, botany, metallurgy and shipbuilding" were never blacklisted and if one wanted a banned book it was easy to obtain (Kamen 1998: 131-133).

Taking the opposite view, more modern studies claim that Spaniards "virtually ceased to write and think" (Kamen 1998: 133). This dates to contemporaries of the institution. Rodrigo

Manrique, the nephew of a famous poet and son of the Inquisitor General, stated "it is increasingly evident that no one will be able to cultivate *belles lettres* in Spain without there immediately being found in him a multitude of heresies, errors, and Judaic defects. In this way silence has been imposed on the learned, and a tremendous terror has been inspired in those who would have called themselves scholars." The Spanish Humanist López Pinciano wrote thirty years later: "Worst of all is that [inquisitors] would have no one develop an interest in these human letters because of the dangers, they say, that are in them that just as a Humanist would alter a text by Cicero, he might alter one of the Holy Scriptures…. These and other similar stupidities upset me and take away my desire to continue" (Alcalá 1987a: 327). Antonio Marquez (1980) noted that books disappeared in the 16th century, with some books lacking reprinting for two centuries. José Tomás (1991) analyzed the sixteenth and seventeenth century lists of confiscated scientific books. There were 461 scientific authors between 1559 and 1707 with 759 scientific works cited either as expurgated or prohibited altogether. In 1634 a memoranda listed 3,021 confiscated books with 356 of them being scientific, with the majority not appearing in the indexes; implying that censorship went beyond what was formally required.

Studies in Italian censorship are rare; with most focusing on Venice and Naples; it is unknown how much censorship affected the rest of Italy. Paul Grendler (1977: 288) found the Roman Inquisition somewhat ineffective with persistent cultural links between Italy and the rest of Europe. This contrasts with António Rotondò (1973) who emphasized the split between Italian and European culture over this time. Erasmus was suppressed in Italy; in 20 inventories of confiscated books from 1555 to the second half of the eighteenth century there was a decline in the number of his books (Menchi 1987). Additionally, the Bible was eliminated in vernacular languages for several centuries in Italy (Bethencourt 2009: 235-6).

In explaining these conflicting views of inquisitorial effectiveness Francisco Bethencourt (2009) summarizes: "it is difficult to establish with any degree of certainty the effectiveness of these control mechanisms [on books]" (p. 232). To better grasp the effect of the Inquisition on scholarship I created a database of scholars across sixteen European countries covering 750 years. There are two types of top tier scholars: scientific (which includes chemists, mathematicians, physicists, biologists, etc.) and artists, authors and composers (AAC). Scientists come from *The Complete Dictionary of Scientific Biography* which provided (for almost everyone) the year of birth, death and years when moved countries. Using this information I compiled a database on how many scholars lived in each country for every year from 1000 to 1749. As an example, Abraham Zacuto was born circa 1450 in Spain, moved to Portugal in 1492 where he died circa 1522. This gives Spain a scholar from 1450 to 1491, and Portugal a scholar from 1492 to 1522. Attending a university was not counted as moving to a country as the dates for university attendance were not included. If the exact birth year is not known, as in Zacuto's case, the estimated year was used. Each of the more than 1,200 scholars was assigned to the country where lived for each year of their life in this manner, then aggregated.[3]

Charles Murray (2003) analyzed human accomplishment in various fields, including art, literature and music, which I use here. Murray consulted historical biographic encyclopedias and listed those mentioned in at least half of the sources (p. 79). He included 12 sources for (European) artists, 13 for authors and 13 sources for composers (p. 477). This resulted in more than 800 significant figures that lived from 1000 to 1749. I use his data as an outside source that minimizes bias and standardizes data. His data included the birth and death year of these

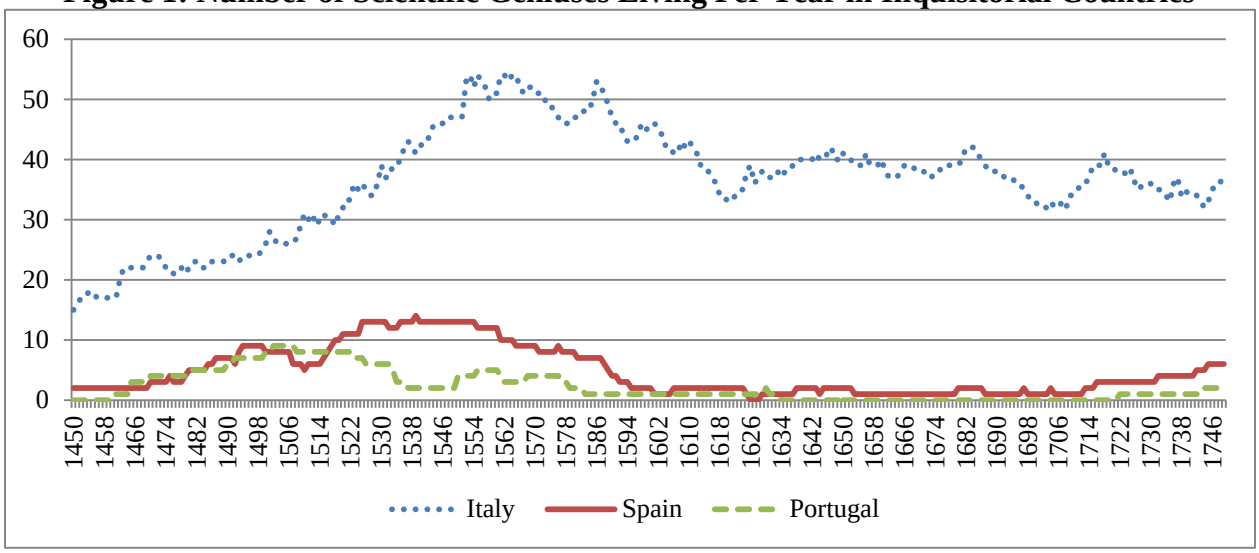
[3] Lifespans have been used elsewhere. Blaydes and Chaney (2013) compare lifespans of rulers in Western Europe and the Islamic world. De la Croiz and Licandro (2013) use a database of 300,000 famous people to analyze the change of life expectancy from Hammurabi to Einstein. Borowiecki and O'Hagan (2010, 2013) analyze the impact of clustering and war on composers, respectively.

individuals and their movements were tracked similar to scientists. Sources used to identify when the significant figures moved countries include the *Encyclopedia Britannica*, *Catholic Encyclopedia*, *Dictionary of Renaissance Art*, www.classical.net, www.allmusic.com and Wikipedia.

These two datasets combined provide more than 2,000 top tier scientific, artistic, literary and musical geniuses across Europe that lived for more than 100,000 cumulative years. This database allows for a comparison on how the highest intellectual achievers reacted to the Inquisitions within and across countries. The writings, compositions and output of scholars are not considered here. Scholarly output ranges from difficult to impossible to measure and compare across specialties. Instead of equating *Philosophiæ Naturalis Principia Mathematica* with a sonnet or the Mona Lisa with a sketch – or using a function to derive a relationship between output of geniuses across disparate fields – only the top achievers' lives will be counted. While not all scholars are equal allows for analysis on the inquisition's effect on scholarship.

Figure 1 shows the number of high level scientists living in inquisitorial countries per year. Italian scientific genius peaks in the early 1560s, about two decades after the creation of the Inquisition. Despite its relative inquisitorial tolerance, the assault on books and scholarship had an effect outside of theology. There was a near monotonic increase of genius in Italy from the mid fifteenth century until its acme; with an average of 52 scientific geniuses living in Italy from 1550 to 1569. Italian genius plummeted to 39 a year from 1600 to 1699 after the impact of censorship spread across the peninsula; a 25 percent decline from the peak. Like Italy, top tier scientific scholars were adversely affected in Iberia; however, it was more extreme. Portuguese scientific genius collapsed to zero and Spanish genius fell to pre-printing press levels and even reached zero. The collapse is even more severe than shown in the figure, as it does not control for population growth.

Figure 1: Number of Scientific Geniuses Living Per Year in Inquisitorial Countries



Source: *Complete Dictionary of Scientific Biography*

Note: Spanish scholars continued to increase following the formation of the Inquisition until books became first regulated (1533). Following the imposition of controls scientific scholars flat lined then declined as censorship increased. That is, it was not the inquisition in and of itself that caused the decline but the regulation of scholarship. Similarly, Italian genius continued its ascent following the creation of the Inquisition but shortly afterwards declined as book controls and censorship came into place.

2.1 Roman

The Pope established the Roman Inquisition in 1542, although an earlier Inquisition existed in medieval times. There was pressure for censorship since the 1540s which the book industry fought but lost. "In the 1560s the Italians reached the conclusion that their religious consciences were fundamentally Catholic and that heretics and heretical books should be suppressed" (Grendler 1977: 128). The preacher Francesco Panigarola explained that the Inquisition and Index of banned books guaranteed peace and security in a calamitous world (Grendler 1977: 181).

Regular bookshop inspections took place in the Papal States, as well at customs posts in the seaports. In other regions, inquisitors summoned booksellers and printers to the tribunal to impose measures of control and censorship. While intervention was less visible in Italy

compared to Iberia, inquisitors had better information on books printed in Protestant countries. Agents went to Frankfurt fairs to catalogue publications on new books and recommend immediate prohibitions; with this list being used in Iberia (Bethencourt 2009: 234).

Inquisitors issued hundreds of decrees on books. In 1559 the first Roman *Index Librorum Prohibitorum* was published. The majority of special edicts in Italy dealt with prohibited books along with rules for booksellers, printers, merchants, owners of libraries and anyone associated with printing (Bethencourt 2009: 209). For example, in Bologna there were edicts in 1607, 1614, 1638, 1652, 1670, 1682 and 1706. Owners of prohibited books faced excommunicated. Printers swore oaths that they followed regulations and were forbidden to work without a license. Bookshops were required to maintain lists of their stock, as did heirs and executors of libraries of the deceased. Even peddlers who sold and circulated booklets, songs, tales, comedies and engravings needed licenses (Bethencourt 2009: 210).

Table 1: Blind Breakpoint Tests on Scientific Scholars 1450 to 1749

	Italy	**Spain**	**Portugal**
Full	1588***	1515***	1550***
	0.002	0.000	0.000
Partial	1572***	1589***	1506***
	0.000	0.000	0.000

Value below year is the p-value, Significance: ***1%, **5%, ***10%.

Table 1 gives blind breakpoints for scientific genius by inquisitorial country (for 1450 to 1749). Annual regressions were run with a fully specified model (as below in the panel data regressions), or with a partially specified model of only a lag, time and inquisitorial dummy. Italy experienced a structural break sometime in the 1570s to 1580s.

After the inquisition was established it would not be expected for scholars to immediately decrease. Rules and censorship were implemented with a lag and it would take time for scholars

to react to the new bureaucracy. In Italy the scientific decline began about a generation after the Inquisition was in force.

2.2 Spain

The Spanish Inquisition began in 1487 and had early book burning. However, decades passed before inquisitors controlled censorship and acted in a systemic fashion differing from non-inquisitorial countries. A list of prohibited books did not appear until 1547; with additional lists in 1551, 1559, 1568, 1583-4, 1612, 1632, 1640, 1707, 1747, and 1790. The pronouncement of prohibited books was done with fanfare, accompanied by a parade and music (Bethencourt 2009: 205; Polastron 2007: 115).

Book imports were not formerly regulated until almost a half century after the Inquisition began; the first instructions appeared in 1533 and jurisdiction recognized in 1558. In regressions below, the year 1533 is used for the Spanish Inquisition as that is the first year of formal censorship and regulation. Inquisitors checked the cargo before customs officials and interrogated captains and officers. The rigor of the ships' visits relaxed somewhat at the end of the sixteenth century and died out in southern Spain (Bethencourt 2009: 230-34). In 1539 Pope Paul III allowed the Inquisitor General to sentence owners of books authored by heretics; Pope Julius III in 1550 broadened the jurisdiction to include those who owned or read forbidden books. By the mid sixteenth century the Inquisition had an efficient and monopolistic censorship system (Pinto 1987: 304-5).

In 1559 Fernando de Valdés published a list of prohibited books in the same year as the Roman *Index Librorum Prohibitorum*. It included about 700 prohibited books and was formulated from prior lists. It forbad books written by heretics, religious books authored by the inquisitorially condemned, heretical and vernacular translations of the Bible, devotional works in

the vernacular, all books on magic, books with profane Biblical quotations, books printed since 1515 without the author and publisher, all anti-Catholic books, and any book with religiously disrespectful pictures or figures (Kamen 1998: 109). In 1583 Biblical stories in literary works, especially theater, became banned (Pinto 1987: 317).

The regulations adversely impacted scholarship: from 1600 to 1699 Spain averaged just 1.4 scientific geniuses per year, whereas over the prior century it was greater than nine; a spectacular 85 percent decline. Spanish blind breakpoints tests (Table 1) give a wider range than Italy; from 1516 to 1562; with Spanish control of censorship growing and changing over this time. Similar to Italy the impact was not immediate; the implementation of censorship took decades before becoming fully implemented, and the decline of scholars correspondingly lagged the creation of the Inquisition.

2.3 Portugal

Established in 1536 to combat crypto-Judaism, the Portuguese Inquisition quickly turned to censorship. Edicts prohibiting books appeared in 1547, 1551, 1559, 1561, 1564, 1581, 1597 and 1624. The 1551 edict authorized the inspection of bookshops and libraries in Portugal. Additionally, inquisitors issued isolated edicts for specific books between publications of the lists (Bethencourt 2009: 196, 205).

Inspectors went to libraries and printing-houses. The Lisbon Academy of Sciences library had inspections in 1566, 1573, 1574, 1575, 1625, 1626, 1629, and 1633 (Bethencourt 2009: 227). Visits to bookshops became regular up to at least the beginning of the seventeenth century. A visitation in 1606 went across all of Portugal and booksellers had to present under oath a list of books in their shops. Bookshop inspection did not seem to continue for long, self-censorship was used; only a few dozen book professionals existed in the country until the eighteenth century.

Inquisitors vigilantly inspected ships. Upon the arrival of a foreign boat, an inspector and translator gathered names of the ship, captain, and passengers; the ship's origin and cargo carried; as well as the ages, nationalities and religious affiliation of everyone onboard. The ship was then inspected for books; especially Bibles (Amiel 1986: 89-90).

Scientific scholars in Portugal are directly related to the Jewish/New Christian population. Of the eight Portuguese born geniuses over this time, five have Jewish descent.[4] However, the collapse in Portuguese genius appears before the Inquisition began. A massive New Christian massacre occurred in 1506 led to an outmigration, which continued over the centuries. This decade corresponds to peak scientific scholars in Portugal, with a general decline afterwards. Nobility pushed for years to create an Inquisition, with it being prevented by New Christian wealth buying off the Vatican. After it was established in 1536, it is not surprising that an institution designed to persecute New Christians and learning would have such a notable and drastic effect on top tier scholarship in the country. From 1634 to 1699 there no top tier scientists lived in the country. Breakpoints for Portugal range from 1524 to 1551. The inquisitorial effect happened sooner in Portugal than Spain or Italy relative to the establishment of the institution, but kings had attempted for decades to implement the institution giving New Christians time to flee the country before it began.

3 Inquisitorial Intellectual Impact

An argument against significant inquisitorial impact on scholarship is the presence of censorship and intolerance spanning Europe. Inquisitorial countries did not monopolize censorship or book burning; other countries likewise had oppression even if lacking a devoted bureaucracy. Legislation existed censoring books and universities took part; in 1683 Oxford

[4]Four were identified as being Jewish/New Christian in the CDSB (Francisco Sanchez, Amatus Lusitanus or João Rodrigues, Garcia D'Orta, Pedro Nuñez Salaciense); additionally João Baptista Lavanha was a New Christian; see http://galileo.rice.edu/Catalog/NewFiles/lavanha.html.

University issued a decree for a public book burning. Ironically, this decree was condemned by Parliament in 1710 and sentenced to be burnt. An author who offended Queen Mary was hung, quartered and had his head set on London Bridge. Queen Elizabeth had raids to destroy books. France executed publishers by Notre Dame as their books burned next to them. A printer who wrote against the Cardinal of Lorraine in 1560 was killed. Book burning was common across Europe in the sixteenth and seventeenth centuries (Bosmajian 2006). Oddly, no author or printer in Spain was put to death – except Protestant heretics – whereas England and France had worse punishments, meaning inquisitorial countries were in some sense *more* lenient than non-inquisitorial ones (Kamen 1998: 106).

Section 2 analyzed geniuses living in inquisitorial countries individually, finding a break in scholarship shortly following the establishment of Inquisitions. Inquisitorial countries are analyzed here along with thirteen others[5] that also experienced censorship and slaughter but without a formal institution designed to persecute. Data is averaged over 25 year blocks from 1000 to 1749. The following controls are included: time, warfare (Kohn 1986), population (McEvedy and Jones 1978), urbanization and institutional quality (Acemoglu et al/ 2002), universities (Rashdall 1895, Rüegg and Ridder-Symoens 1996 and Cantoni and Yuchtman 2012) and printing presses (Claire 1976 and Febvre and Martin 1976).

Panel unit root tests following Im, Pesaran, and Shin (2003) or Maddala and Wu (1999) reject unit roots with three lags and a linear trend for all scholars and for scientific ones. Unit roots are rejected with one lag and a linear trend for artists, authors and composers. The appropriate lags are included in all regressions.

[5] The sixteen total countries used: Austria, Belgium, Czechoslovakia, Denmark, France, Germany, Italy, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, United Kingdom.

Table 2: Top Tier Scholars 1000 to 1749

	Sci	Sci/Pop	AAC	AAC/Pop	All	All/Pop
	1	**2**	**3**	**4**	**5**	**6**
Inquisition	-4.7***	-1.0	-3.4***	-0.6***	-7.2***	-1.7**
	0.000	0.171	0.000	0.002	0.000	0.033
War	0.13	-0.18	0.07	0.10	0.22	0.18
	0.819	0.622	0.840	0.345	0.752	0.663
University	0.059	-0.018	0.170***	0.011	0.210***	-0.022
	0.271	0.567	0.000	0.223	0.002	0.546
Institutional	1.0***	0.5**	0.4**	0.1	1.3***	0.7***
	0.001	0.033	0.034	0.306	0.001	0.003
Urbanization	-0.09**	-0.02	-0.01	0.03***	-0.09**	0.04
	0.013	0.491	0.608	0.000	0.035	0.113
Presses	0.063*	0.021	-0.037*	-0.002	0.012	0.039
	0.060	0.313	0.072	0.793	0.774	0.110
Time	0.040	0.080***	0.003	0.002	0.037	0.085***
	0.184	0.000	0.850	0.746	0.300	0.000
Population	0.093		0.017		0.101	
	0.117		0.606		0.154	
R^2	0.918	0.372	0.935	0.796	0.951	0.513

Note: Value below the coefficient is the p-value, significance: ***1%, **5%, ***10%. Panel unit roots are rejected with tests from Im, Pesaran, and Shin, and Maddala and Wu. The appropriate number of lags and a constant are included in all regressions

Table 2 measures genius in both absolute and per capita terms. Regressions (1) and (2) only are scientific scholars, (3) to (4) are artists, authors and composers (AAC), and the last two columns are both combined.

The Inquisition is negative for all kinds of scholars and only not statistically significant for scientists per capita. In absolute terms, inquisitorial countries lost seven top tier scholars, artists, authors and composers per quarter century.

War is insignificant for the most part, similar to Simonton (1997: 17) and Murray (2003: 332). Universities are mostly positively but not always significantly related to genius. Institutional quality is highly correlated with genius except AAC in per capita terms. Population

is positively related but outside of statistical significance. Unexpectedly urbanization is mostly negatively related to scholarship.

Figure 2: Top Tier Scientific Scholars living in Europe 1000 to 1749

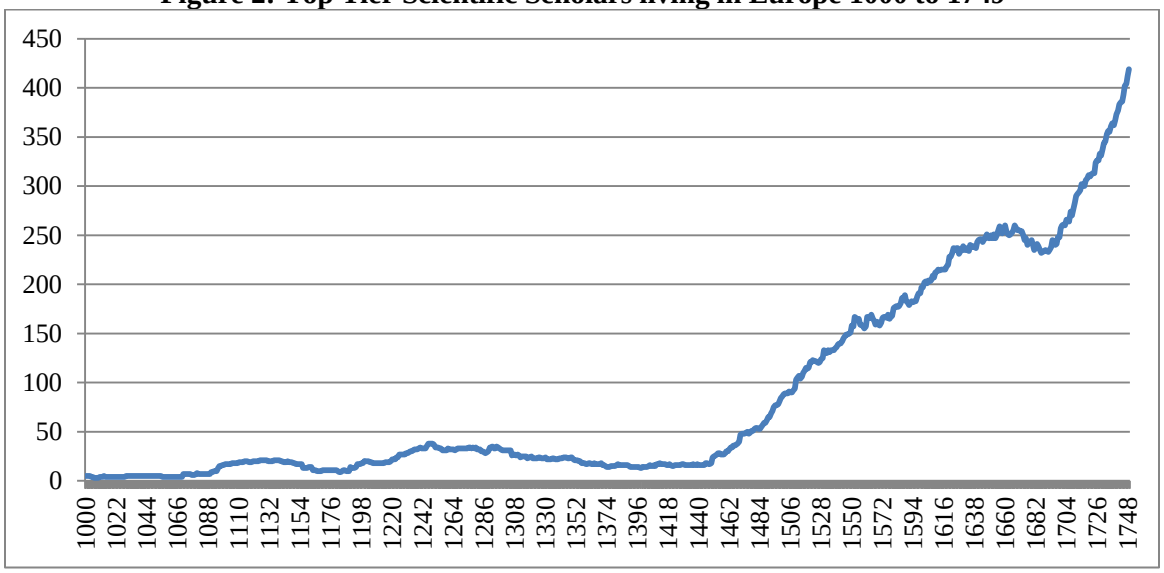
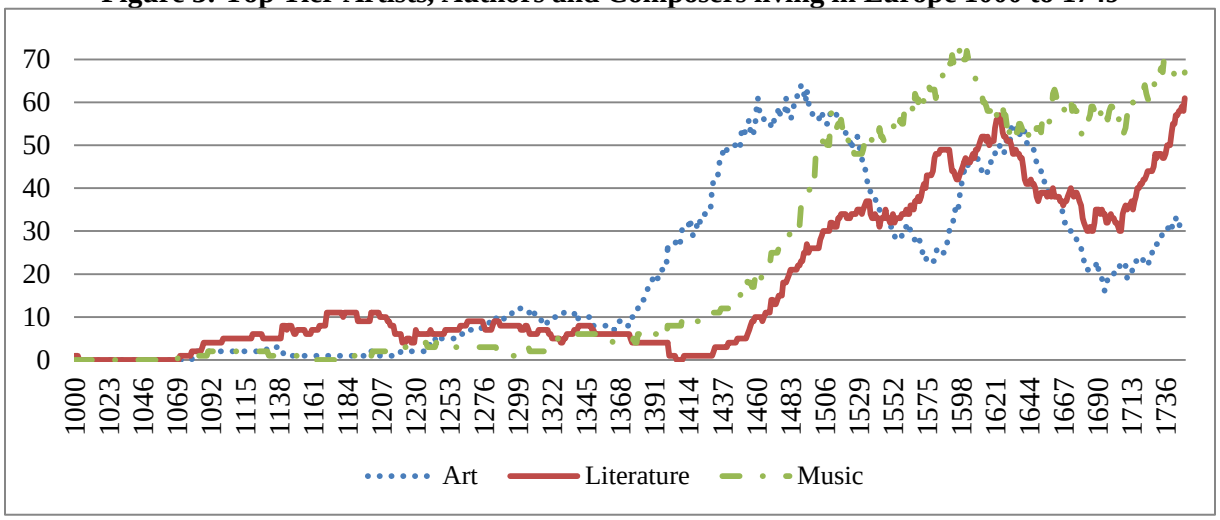


Figure 2 shows the number of scientific geniuses living in the sixteen country sample by year, with a clear shock at the mid-fifteenth century following the invention of the printing press. Presses are measured as zero before its invention, than counted by country until 1500 and afterwards the 1500 level is constant to the end of the series. While the coefficient on the press is mostly insignificant, it only has two time periods of variance. Restricting the sample to end in 1524 the press is significant at the 1 percent level for repeated regressions of (1), (2) and (5) and at the 2 percent level for (6). For artists, authors and composers presses are negatively related. However, this is partly driven by artists, which peaked in the fifteenth century before declining by more than half (see figure 3). Repeating the regressions with only authors and musicians presses becomes positive and significant for (3) but remains negative and insignificant for (4).

Figure 3: Top Tier Artists, Authors and Composers living in Europe 1000 to 1749



Source: Murray (2003)

The advent of the printing press was an exogenous shock with immediate effects of increased scientific scholars. Shortly following this rise, Inquisitions were established to censor and oppress various forms of learning. This negative learning shock led to a significant decline in high achievers.

Table 3 is similar to Table 2 but focuses on the Inquisition. In almost all regressions the inquisition is significant at the 1 percent level and is always negative. Regressions (2) and (3) add a Catholic dummy, which is highly insignificant even when dropping the Inquisition variable. Since Iberia was at a much lower level of scholarship than Italy (4) removes Iberia from the regression and the inquisitorial effect is roughly twice as large for scientific scholars and overall. Column (5) drops Italy and the effect is smaller. Column (6) includes the three Catholic inquisitorial countries and the Catholic countries of France, Belgium, Austria and Poland which results in a stronger inquisitorial effect for scientists. Column (7) compares Inquisition countries to four Protestant countries that border the four Catholic countries used in (6) (allowing for the UK to border France and Germany to be Protestant). The effects are slightly smaller than in comparison to Catholic countries and insignificant at standard levels for scientists.

Table 3: Effects of the Inquisition on Top Tier Scholars

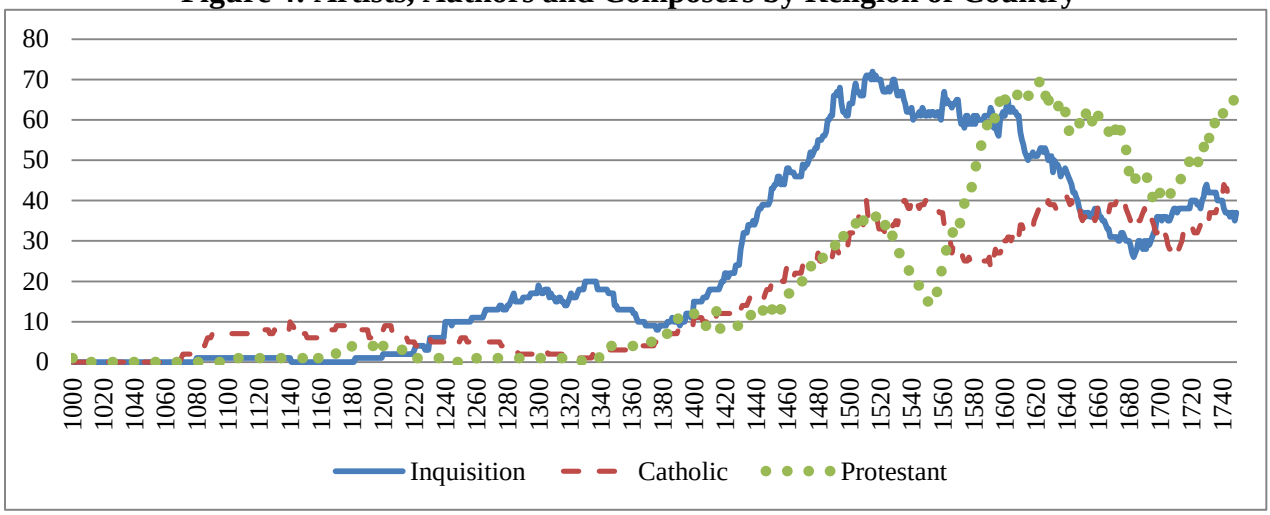
Dependent	Sci	Sci	Sci	Sci	Sci	Sci	Sci
	1	**2**	**3**	**4**	**5**	**6**	**7**
Religion/Area	All	All	All	Not Iberia	Not Italy	Cath+Inq	Inq+Pro
Inquisition	-4.70***	-4.77***		-10.53***	-2.99**	-4.62***	-2.43*
	0.000	0.000		0.000	0.021	0.000	0.061
Catholic		0.21	-0.04				
		0.647	0.935				
R^2	0.918	0.918	0.914	0.922	0.909	0.965	0.938
Dependent	AAC	AAC	AAC	AAC	AAC	AAC	AAC
Religion/Area	All	All	All	Not Iberia	Not Italy	Cath+Inq	Inq+Pro
Inquisition	-3.37***	-3.40***		-2.58***	-6.37	-3.31***	-3.13***
	0.000	0.000		0.003	0.331	0.000	0.003
Catholic		0.09	-0.08				
		0.711	0.746				
R^2	0.935	0.935	0.931	0.923	0.982	0.953	0.931
Dependent	All	All	All	All	All	All	All
Religion/Area	All	All	All	Not Iberia	Not Italy	Cath+Inq	Inq+Pro
Inquisition	-7.16***	-7.25***		-15.27***	-4.55***	-7.24***	-4.30**
	0.000	0.000		0.000	0.003	0.000	0.010
Catholic		0.27	-0.12				
		0.616	0.831				
R^2	0.951	0.951	0.948	0.954	0.937	0.974	0.965

For Religion/Area:
Inq = Inquisition = Italy + Spain + Portugal
Pro = Protestant = UK + Netherlands + Switzerland + Germany
Cath = Catholic = France + Belgium + Austria + Poland
All = Inq + Cath + Pro + Norway+ Sweden + Denmark + Russia + Czechoslovakia

For Dependent Variable
Sci = Top tier scientific scholars
AAC = Top tier artists, authors and composers
All =Sci + AAC

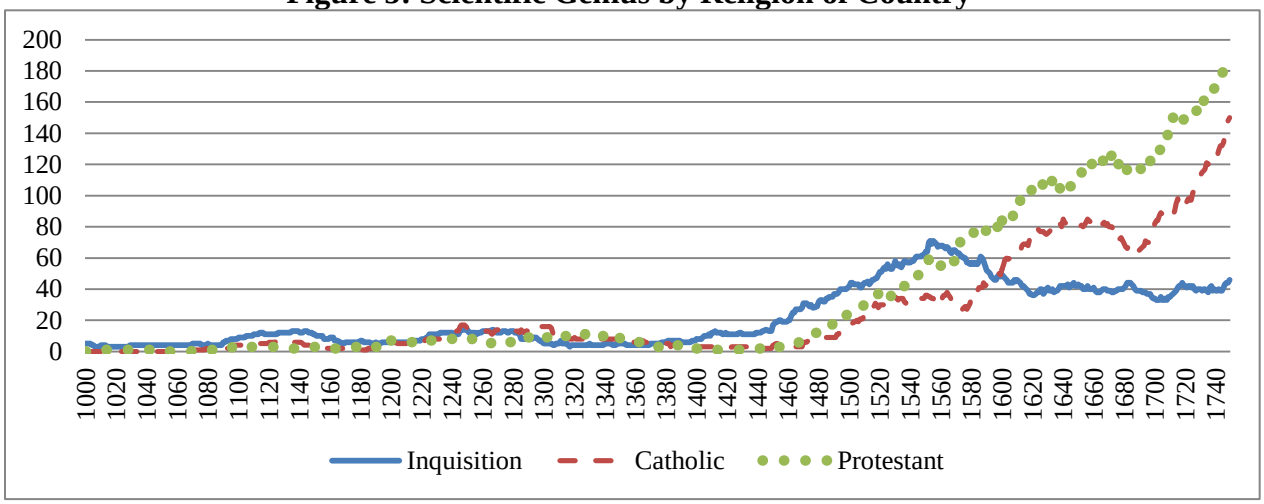
The following controls are included in all regressions: constant, lags, war, urbanization, institutions, university, presses, population and time; p-values are below the coefficients and stars have same meaning as above.

Figure 4: Artists, Authors and Composers by Religion of Country



Note: while inquisitorial countries had a high level of AAC even after the establishment of the Inquisitions, there was a relative decline of artists, authors and composers over the time period of increased inquisitorial censorship.

Figure 5: Scientific Genius by Religion of Country



Note: in mid-fifteenth century when the printing press was invented the three Inquisition countries combined had at least four times more scientific scholars than the four Protestant or four Catholic countries. In 1749 the inquisitorial countries with systematic censorship and printing controls had less than a third of the scholars of other Catholic countries and less than a fourth of Protestant.

GDP is excluded in all regressions as estimates back to the year 1000 are unreliable. A potential explanatory relationship is that national wealth leads to higher levels of scholars living in the country, and diminished wealth a decrease. Yet looking closer at individual economic histories, GDP cannot explain the fall of scientific scholars in inquisitorial countries.

From 1494 and 1559 the Italian peninsula experienced some combination of famine, plague and war for almost all years (Alfani 2010: 31-32). By the early seventeenth century Italy had "a healthy and very advanced economy." It was not until around the 1620s when the Italian economy began to decline (Alfani 2013: 171-2). The Italian economy was probably harmed in the seventeenth century by plagues; which were worse in Italy than Northern Europe over this time (Alfani 2013). Despite the advanced Italian economy in the early 1600s human capital had already been collapsing for three decades. This is in stark contrast to the time of calamity where scientific scholars increased from 24 in 1494 to 51 in 1559 and peaking shortly thereafter. Thus a worsening economy cannot describe the decrease of scholars in Italy as the decline began more than a generation before the economy faltered but scholarship had substantially increased during persistent war, plague and famine.

Portugal's Golden Age lasted from 1500 to 1580, with Portugal dominating European trade with Asia. Despite Portugal's economic power and a global empire, top level scholars nearly disappeared from the country prior to post-Golden Age economic decline, meaning the decline in scholars living in Portugal cannot be fully explained by losing wealth in the late sixteenth century as scholarship had long been reduced by then.

The Spanish empire is typically seen as reaching its peak during the reign of Philip II (1556 to 1598) with an empire on which the sun never set. Spain monopolized New World trade and imported vast quantities of silver. Much of this wealth went to warfare, and Philip defaulted various times. While the death of Philip II is often given as the beginning of Spanish decline, the economy worsened earlier in the 1570s (Drelichman 2005a, 2005b). However, by this time Spain was already a few decades off its peak scientific genius level, falling from 14 in 1539 to an average of 8.2 over the 1570s. By the time Philip II died in 1598, only two were left. Spain's

economy improved during the reigns of Philip IV (1621 to 1665) and Charles II (1665 to 1700) concurrent with political decline (Philips 1987: 532). However, during this eight decade timespan scientific genius peaked at two and averaged about 1.3. Spanish Artists, Authors and Composers collapsed later than did their scientists. Over the Golden Age AAC peaked at 17 in the late 1540s, only surpassed by Italy and France. Spain then began a slow descent to zero in 1691. Despite Spain's high level, its decline contrasted to other countries that increased. Note that the level is not necessarily what is of interest, but rather the relative rate. The glories of the Golden Age notwithstanding, Spain lagged relatively behind other countries following inquisitorial control of censorship.

GDP did not drive the rise of scholars in other countries. The Dutch economy improved in the 1590s preceding the Dutch Golden Age during the seventeenth century (Israel 1995: 241). However, Holland increased in scientific genius nearly a century before its economic rise. By the 1570s – when both Spain and Portugal were world powers and Holland fighting Spain for independence –more top tier scientific scholars resided in the Netherlands than all of Iberia. By 1600 Holland was at near peak scientific scholar levels.

England followed Holland's path to some degree. England did not begin to become an empire until later in the sixteenth century. By this time scholarship had already been increasing for a century, reaching 23 in 1588 – nearly four times the Iberian level – when England defeated the Spanish Armada. England did not experience modern growth until 1630 to 1690, with Malthusian stagnation in prior times (Clark 2005). Yet by 1630 the United Kingdom had reached a level of 60 top tier scientific scholars – higher than any other country except France.

Genius collapsed in Spain and Portugal even as they ruled vast wealthy empires. Italy's economy was advanced in the early seventeenth century while its scholarship declined. Holland

and England increased in high level human capital before their economies/empires expanded. Thus the state of the economy cannot explain the shift of scholarship from the southern peninsulas to Northern Europe; but rather the imposition of inquisitions and systemic censorship is correlated with the decline of scholarship in Iberia and Italy.

4 Discussion

The Inquisitions were devised to combat heresy and extended to persecution of science and other fields of study. This caused top level scholars to decline both absolutely and relative to other areas which increased in scholarship. It is plausible that the decline in high levels of scholarship would negatively impact economies with the onset of the industrial revolution that relied more on human capital relative to Malthusian economies. While not shown analytically, narratives are given to support this possibility.

The Inquisition can be related to Oded Galor's unified growth theory. He models two identical Malthusian economies except in "characteristics that contribute to human capital formation" (Galor 2011: 191-93). The economy with the higher human capital potential has a lower threshold for takeoff. Once growth fueled by human capital begins, the high human capital economy will grow, while the other remains Malthusian. Consistent with Galor, inquisitorial countries with suppressed scholarship lagged economically behind northern Europe following the Industrial Revolution when human capital became more valuable.

Despite the narrowness of this measure of human capital, the oppression of a small elite can have large impacts on society. Russian areas with larger Jewish populations before World War II have subsequently performed worse economically following the Russian Holocaust. Over two thirds of Jews held white collared jobs, as compared to about 15 percent of non-Jews. It is postulated that the elimination of a productive class of people, even though small, caused the

long term decline (Acemoglu, Hassan and Robinson 2011). Following the American Revolutionary War there was a large economic decline comparable to the Great Depression. A potential causal factor for the large recession was the "crisis at the top." While skilled loyalists who fled comprised only 3 percent of the free population, urban areas had a concentrated decline, contributing to the large recession (Lindert and Williamson 2013). Similar to these studies, the Inquisition oppressed elite scholars, leading to a large and significant decline in their population. This could potentially have impacted subsequent growth, or lack thereof, through a couple of channels: decreased participation in the enlightenment and worse institutions.

Joel Mokyr (2002, 2005, 2009) contends that the growth of learning and knowledge during the enlightenment paved the way for the Industrial Revolution through various mechanisms – reduced rent seeking, freer trade, institutions promoting technology, advancement of science, etc. As the Inquisition had a negative effect on scholars living in Italy and Iberia, it is quite possible that the centuries long persecution of scientists and others led to a delay of development in these areas. Indeed, while Italy was at the forefront of the Renaissance, it lagged scientifically during the Enlightenment and subsequently industrialized later than other countries.

A differing approach to economic growth is through improved institutions (Acemoglu and Robinson 2012); although this mechanism is influenced by scholarship to some extent (Mokyr 2002). The Inquisitions were extractive institutions with confiscations, lengthy incarcerations and influenced by rent seeking inquisitors. Hence, if one accepts the institutional channel for growth it should be expected for inquisitorial countries to fare worse than those without a systemic extractive institution.

In general, higher human capital from 1450 to 1800 is related to higher growth. Joerg Baten and Jan van Zanden (2008) constructed a database of book production across eight

Western European countries. Book production correlates with literacy and with faster real wage growth. They conclude that human capital is a "crucial determinant of long-term growth." It is of note that Italy was a high book producing country to the mid-sixteenth century, but in 1750-99 was the third lowest. The decline coincides with the inquisition and suppression of scholars. While Spain was the second to third lowest book producer from 1450 to 1600, it lagged significantly behind all other book producers from 1600 to 1700 following the consolidation of inquisitorial censorship and remained the lowest country until the end of the data series (p. 220).

Persecution of scholars is known to have negative effects on various outcomes.[6] Indeed, Jordi Vidal-Robert (2013) finds that areas in Spain that had more inquisitorial trails have less patent production and a negative attitude towards new technologies. More generally, the Inquisition led to a decline of scholars living in Italy and Iberia; and they lagged economically behind other areas of Europe following the Industrial Revolution; which is consistent with the role of human capital in economic growth.

5. Conclusion

Various historians have asserted that Inquisitions were not detrimental to intellectuals in general;[7] however, these claims are not supported with a rigorous comparative approach.

[6] Mevlude Akbulut-Yuksel and Mutlu Yukse (2013) find that Jewish persecution in Nazi Germany had significant negative effects on human capital of school age German children, including less schooling in general and less college education. Similarly, Fabian Waldinger (2010) finds that the expulsion of mathematics professors in Nazi Germany lowered faculty quality which decreased the probability of students publishing their dissertation in a top journal, becoming a full professor and lowered citations. Waldinger (2013) finds a 10% decline in human capital reduced scholarly output by 0.2 standard deviations during the Nazi university Jewish expulsion, with the shock lasting into the long run. A key mechanism for the persistent effect was the lack of star scientists in attracting others and a lack of training of students. For an opposite finding, MIT in the 1930s was "nowhere" for economic research, but reached top tier status by the 1950s. Roy Weintraub (forthcoming) gives its openness to Jewish professors as a major contributing factor. For an older example, Muslims granted religious freedom and had competition for social standing. This brought about a flourishing of scientific thought. As areas under Muslim rule became more homogenized, religious authorities increased opposition and scientific learning declined (Chaney 2008).

[7] For examples beyond those given above, Kamen (1998: 133) claims, in discussing Spain, "no evidence has ever emerged that the book controls eliminated promising new life among intellectuals, or prejudiced existing schools of thought." In *Science in the Spanish and Portuguese Empires 1500-1800* there are only three references to the Inquisition in the index (Bleichmar et al. 2009: 142, 143, 321). The book concludes: "More important, the

Contrary to these assertions, Inquisitions had a negative impact on top tier scholarship. Using more than 2,000 top tier geniuses from 1000 to 1749 as my dependent variable, I find that both scientific scholars and notable artists, authors and composers declined. The timing of the decline within inquisitorial countries coincides with the institution's systematic persecution of scholars. Other Catholic countries did not see such a decline; implying that it was not just religion itself that saw the northward shift of scholarship but rather the inquisitorial institution.

It is quite plausible that having a persecuting bureaucracy would delay economic development. Human capital is well known to be correlated with growth. The Inquisition drastically decreased the number of scholars living in their areas and was a highly exclusive and exploitative institution. Hence, the influence of the Inquisition could have had further reaching effects then just religious.

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widespread image of Spain and Portugal as backward and intolerant societies dominated by the Inquisition led to the belief that no scientific endeavors took place in the Iberian realms. Although much work… has been done in recent decades refuting this stereotype, it has not yet reached the wider academic audience" (Cook and Cook 2009: 321). While noting the oppressive nature of the Index and inquisitors, Grendler cautions to not exaggerate the effect to non-religious areas of study. "With a few exceptions, the censors found nothing objectionable in works of classical scholarship, history, law literary criticism, logic, mathematics, medicine, philology, and rhetoric. Scholars carried on their study of these disciplines with little interference, making notable contributions in some cases" (1977: 288).

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Brief Biographies of Persecuted Scholars

To demonstrate the effect of intolerance on scholarship, some examples of persecution are given here.[8] Galileo Galilei is the most famous example of inquisitors and scholars clashing. In 1632 Galileo was put on trial where his book *Dialogue* was banned and he was given life imprisonment; which was reduced to house arrest.

Italy

The philosopher Giordano Bruno is one of the most famous inquisitorial victims. While in Naples he fell under heretical suspicions; he moved to Rome then Switzerland then France and then England in 1583. His books were clandestinely published with false imprints. He returned to France but was forced to flee to Germany. He lived in various cities before relocating to Venice. He was imprisoned by inquisitors, with his trial being sent to Rome where it lasted for eight years before he was burned alive as a heretic.

Tommaso Campanella was an Italian natural philosopher born in 1568. He entered the Dominican order and moved to Naples where he met a Jewish astrologer and became part of a group that engaged in experimentalism. His views became heretical and he was denounced to the Inquisition in 1592. In addition to being tortured he was incarcerated in Naples from 1599 to 1626 and in Rome from 1626 to 1629. He managed to write in prison, with his works being

[8] All information in this section comes from *CDSB's* entry for the given individual.

smuggled to Germany to be published since they were banned in Italy. He eventually fled to France to escape further punishment from inquisitors.

The mathematician and astronomer Franciscus Barocius was born in Venetian Crete in 1537. He was accused of sorcery and causing a terrible rainstorm in Crete by inquisitors in 1587. He had to pay 100 ducats worth of silver crosses and remain in jail at the inquisitors' pleasure.

Born in Yugoslavia in 1560, Marko Antonije Dominis was a physicist educated in Italy. He was archbishop of Split but had to flee to England for his religious views. He returned to Rome and was thrown in jail by inquisitors where he died. Nonetheless, he was still found guilty of heresy and his body was burned.

The mathematician, physicist and philosopher Girolamo Cardano, was imprisoned by the Roman Inquisition in 1570 for heresy for casting the horoscope of Christ and attributing events of Christ's life to the stars.

The natural philosopher and theologian Paolo Sarpi was born in Venice in 1552. He was appointed as state theologian of Venice in 1606 and counseled to defy the bull of interdict and excommunication against Venice. He did not go to his inquisitorial hearing and was excommunicated. In 1607 he was almost assassinated, which Sarpi accused the Roman Curia of doing.

Moving to inquisitorial countries was hazardous. Volcher Coiter was born in the Netherlands in 1534 and was notable in anatomy, physiology, ornithology, embryology and medicine. He went to Italy to teach and "a brilliant career seemed assured" but he was arrested by inquisitors and imprisoned in Rome and Bologna; most likely for being Protestant. He eventually left and died in France.

Portugal

Francisco Sanchez was Portuguese, most likely of Jewish descent, born about 1550. His family fled to Bordeaux, a common destination for Portuguese New Christians. There he was a professor of both philosophy and medicine, rector of a university and director of a hospital.

Amatus Lusitanus, or João Rodrigues, was Portuguese of Jewish descent born in 1511. A doctor, he migrated to Antwerp, most likely due to harassment. He then became a professor in Ferrara and practiced medicine around Italy. When a new pope increased marrano persecution, he fled to Salonika and became an open Jew.

Garcia D'Orta was born in Portugal of Spanish Jews who fled Spain to escape forced baptism. He was born in 1500 and hence a Christian by force of law in Portugal. He was an expert in botany, pharmacology, tropical medicine and anthropology. He moved to with his sisters to escape the Inquisition. D'Orta admired Chinese medicine and civilization and he used Arab authors and challenged authority of classical texts. He was eventually investigated by the now established Goan Inquisition, but his prestige possibly kept his family safe. After he died his sister was slaughtered by order of the Inquisition, with his remains being exhumed and burnt and the rest of his family deported to Portugal.

Spain

The Jewish astrologist Abaham Bar Samuel Bar Abraham Zacuto was born in Spain in 1450. In 1492 he fled to Portugal to escape forced baptism; but ended up having to become a Christian when Portugal required the same.

The Geographer al-Hasan ibn Muhammad al-Wazzān al-Zayyāatī; al-Gharnātī, better known as Leo the African, was born in Grenada around 1485. After the fall of the kingdom his

family fled to Fez. He extensively traveled and was captured by Italian pirates and became a slave to Pope Leo X. He converted to Catholicism (and took the pope's name as his own): In 1529 Leo returned to North Africa and to Islam.

France

Inquisitorial countries did not monopolize intolerance towards intellects of the wrong religion. The mathematician and linguist Antoine Arnauld was born in Paris in 1612. He earned a doctorate in theology in 1641 but was expelled from the Sorbonne in 1656 for his Jansenist views and died in self-imposed exile in Belgium.

The mathematician Albert Girard was born in France in 1595. However, he was a member of the Reformed church and fled to the Netherlands.

Louis Bourguet was born in France in 1678 but his family fled to Switzerland following the revocation of the Edict of Nantes. He was skilled in archaeology, philology, philosophy, biology, geology, crystallography and physics.

Joannes Guinter was born in Germany in 1505 and known for his skill in medicine. He worked in Paris but had to flee due to religious intolerance to Strasbourg.

John Theophilus Desaguliers was born to Huguenot parents in 1683 and they fled France when he was three. He lived in England for the rest of his life.

Abraham De Moivre was born in France in 1667 and known for his work in probability. After the Revoking of the Edict of Nantes in 1685 he fled to England. Some say he was imprisoned in France until 1688 for his religion, whereas other sources have him in England in 1686. Either way, he joined the Royal Society of London and died there in 1754.

The French natural historian Bernard Palissy became a Protestant in 1546 and was imprisoned in Bordeaux about 1559. He would have been executed if not for Medici intervention.

Gaspard Bauhin was born in Switzerland in 1560 since his Protestant father had to flee France. He became notable for anatomy and botany.

Joseph Duchesne or Josephus Quercetanus was a French chemist who left the country due to religious persecution. After living in Germany and Switzerland, he returned to France to be a physician to King Henry IV.

The son of a Protestant; Nicolas Lemery was a French chemist and pharmacist born in 1645. He was forced to flee to England for religious reasons but returned after failing to receive an appointment. After the Revoking of the Edict of Nantes he became a Catholic to regain his rights and continue his work.

Joseph Saurin, a French born mathematician and cosmologist had to flee to Switzerland due to his sermons. He became a Catholic in 1690 and lived the rest of his life in France.

Other Countries

The theologian Sebastian Franck was born in Germany in 1499. He entered the Catholic priesthood, but turned to Protestantism. He moved from one town to another across Germany, being banned from cities for his writings. He was allowed to stay at Ulm if he submitted to censorship, although he eventually was banished from there as well and moved to Switzerland.

Sebastian Münster was a German geographer born in 1489 who became a Protestant and moved to Switzerland.

Leonhard Rauwolf, was a botanist born in Augsburg, Bavaria in 1535. The leaders of Augsburg switched to Catholicism, while Rauwolf headed the Protestants against Catholic

festivals led to his being forced out of the city. He went to Linz, Austria before being killed while at war in Hungry.

England was not exempt from intolerance. William Ames was an English theologian and natural philosopher born in 1576. He was educated at Christ's College in Cambridge where he had controversial theological views. He was a leading Puritan at Cambridge, and as a result was expelled in 1609 and moved to the Netherlands in 1610.

Richard Norwood was a mathematician and surveyor also famous for navigation. As a nonconformist he fled England for Bermuda in 1638; where he died a few decades later. The botanist Robert Morison was a Scotsman born in 1620. He had to flee to France during the civil war as a loyalist. He later returned after the Restoration.

The 1561 Belgium born Philip Van Lansberge had to flee to France then England for religious reasons when young. After the Spanish conquest of Antwerp in 1585 he moved to the Netherlands where he became known for geometry and astronomy.