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Spatial competition and human capital

How did the proximity of Protestant universities affect the written output of Jesuit scholars in their universities?

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1. Introduction

In economic history, the study of factors influencing human capital - the collective skills, knowledge, and abilities of an individual or society - is essential for understanding societal and economic evolution. This thesis investigates the impact of religious rivalry during the Reformation and Counter-Reformation on the 16th to 18th century intellectual landscape, while focusing on the production of human capital by Jesuit scholars.

The Protestant-Jesuit era provides an opportunity to examine the interplay between religious contention and academic development. The rivalry between Catholic and Protestant scholars shaped a competitive religious landscape, with Jesuit scholars at the core.

A central question of this thesis is the proximity effect: how did a Jesuit's geographical proximity to a Protestant university influence his production of human capital? This investigation aims to explore, through a literature review and economic analyses, how competition between religiously affiliated institutions may have affected the quality and quantity of human capital produced by Jesuit scholars.

We also aim to enhance our historical understanding of this period, linking and analyzing it through the lens of economic principles. The focus on Jesuit scholars highlights the significant contributions of this academic and religious community to education and intellectual development during this time. Ultimately, its main goal is to provide a relevant and interesting contribution to the literature.

We will see that it is difficult to identify the direct impact of distance on the production of human capital with the different analyses carried out, specially the econometric ones. We shall see, however, that different economic effects and principles come into play in the production of human capital by Jesuit scholars. This will provide us some clues to help our understanding of the different phenomena surrounding academics' written production in their universities.

1.1. Motivation of this thesis

The motivation behind choosing the thesis topic was sparked by several factors. Of course, my interest in this topic was significantly influenced by my supervisor, who initially proposed the idea. His expertise in the field inspired me to delve deeper into the subject matter and explore the various aspects of the intellectual landscape during the early modern period.

Firstly, the captivating historical dimension of this topic piqued my interest. It is also crucial to acknowledge the significant impact Jesuits had on European civilizations, particularly on teaching methods, as they established some of the world's most prestigious universities. Understanding the influence that direct competition with the Reformation had on their output also sheds light on the possible conditions for their rapid evolution and introduces an intriguing economic model.

In our various bachelor courses, we have observed that competition affects the behaviour of firms, their pricing, and their production levels. The theories of Cournot and others have allowed us to analyse these different types of imperfect competition. Therefore, it is both interesting and relevant to view Jesuit professors as 'firms' and examine if their behaviour can be compared to the one of firms and see the impact that the proximity of their competition had on their human capital output. Universities may have strategically differentiated themselves to attract students and scholars, resulting in a higher level of written production to showcase their intellectual prowess. This analysis can contribute to our understanding of the competitive dynamics in the market for education and knowledge during this pivotal period in European history.

Furthermore, examining the impact of proximity to Protestant universities on Jesuit teachers' written production can offer valuable insights into the broader academic discourse on the intellectual history of Europe. By investigating the factors that may have influenced the level of written production among Jesuit teachers, we can better comprehend the interplay of ideological, educational, and economic forces that shaped the development of European thought and the dissemination of knowledge.

In conclusion, the motivation for choosing this thesis topic lies in its potential to shed light on the complex interrelationships between Jesuit and Protestant institutions, the role of imperfect competition in early modern education, and the broader intellectual history of Europe. By

exploring these aspects and building on the initial idea proposed by my advisor, this study aims to contribute to our understanding of the factors that influenced the level of written production of Jesuit teachers and the intellectual landscape of early modern Europe.

1.2. Problem statement, objectives and issues we could face

It is therefore interesting to try to understand what links these two movements, and how they have influenced each other. In this dissertation, we will focus on the aspect of human capital production.

The problematic we will work on in this thesis will therefore be to try to calculate, and then analyse, the impact that the geographical proximity of Protestant universities may have had on the level of written production and human capital produced by Jesuit scholars in their universities. This problematic will allow, through its main objective, to highlight part of the history of European education, its development but also the role of competition in shaping the intellectual landscape.

It's important to remember that our research topic focuses on a historical context, which can make obtaining reliable data challenging. This may present difficulties when conducting the econometric portion of our study, as we might occasionally encounter insufficient or less relevant data. Consequently, we should always keep in mind that our findings may reveal discernible trends but won't represent absolute truths. Numerous factors could influence the outcomes of these analyses.

1.3. Hypotheses and research questions

Our main hypothesis is that the proximity to Protestant universities, and so the competition arisen from that closeness, can affect the output of Jesuit' scholars in their European universities. We will address several questions that seek to provide answers and insight into the relationship between Jesuit universities and the expansion of Protestantism in Europe.

Firstly, were Jesuit universities strategically established in specific locations to counteract the growing influence of Protestantism in certain regions of Europe? A thorough literature review should help provide an answer to this question.

Secondly, do significant differences exist in the literary output of Jesuit teachers based on their geographical locations and can we observe notable disparities among teachers across Europe, even without considering their proximity or connection to Protestant territories? To answer these questions, we will need to carefully examine the available database and conduct analyses using R software.

Lastly, is it possible to analyse Protestant and Jesuit universities through the lens of imperfectly competitive firms under an adapted mathematical model? What other factors might contribute to the varying levels of written production by Jesuit teachers at their universities? In this context, we will primarily focus on the proximity of Jesuit institutions to their Protestant counterparts.

1.4. Structure of the thesis

To begin, I will conduct a comprehensive review of the existing literature on the Order of Jesus' global history and their relationship with the Counter-Reformation and Protestantism. This will help me gain a better understanding of the background and context of my research question and identify any gaps in the literature that my thesis could contribute to filling.

After the literature review, I will present the methodology I will employ in my study. This section will detail the sources and database used, outline the research model and variables, and describe the statistical analysis utilized to carry out the empirical analysis.

Following the methodology, I will move on to the empirical analysis. Using the dataset provided by my supervisor, I will calculate the potential effects of proximity to Protestant lands on the production level and human capital of Jesuit scholars. This process will involve using the R programming language to perform calculations such as regressions and analyze the results.

Finally, the last part of this work will consist of the interpretation of the results provided by the empirical analyses carried out and the answers to the various questions posed previously. This last part will also highlight the various possible limitations of this work, the questions that may remain unanswered and the potential avenues for improvement of this thesis.

Overall, this thesis will consist of four main components: a literature review, a methodology, an empirical work, and a presentation and interpretation of the results. The first component will provide a foundation for my research, the second will explain the approach taken, the third will

allow me to test my hypotheses, and finally, the fourth will be dedicated to drawing potential conclusions based on the results.

2. Literature review

2.1. Historical context

In the heart of the 16th century, a profound shift happened through the Christian world, a period of tumult and transformation known as the Protestant Reformation, initiated by the actions of Martin Luther and other reformers. Twenty years later, in the halls of the University of Paris, Ignatius of Loyola and his companions were on the verge to founding the Society of Jesus, an order destined to play a pivotal role in the ensuing Counter-Reformation (Mark, 2021; O'Malley, 2014).

The Society of Jesus, a powerful Roman Catholic missionary order, dedicated itself to the vows of poverty, chastity, and obedience to the Pope. Following the approval of Pope Paul III in 1540, the Society began its work. It quickly distinguished itself as a force in the Counter-Reformation, leading aggressive proselytization missions across the globe and establishing footholds in hostile environments. All these efforts combined to establish the Society of Jesus as one of the most efficient, impactful, and notable orders created by the Roman Church (Guillermou, 1999; Barkan, 1990).

However, as the term 'Jesuit-Jesuit' implies, the Jesuit order was born in a context of religious rivalry. An intense one with Protestantism provided the backdrop against which their mission unfolded. The Jesuits engaged in spirited public debates with Protestant leaders, generated substantial literature to articulate and defend Catholic doctrines, and journeyed into Protestant regions to convert the populace back to Catholicism. This was not just a religious duel but a clash of ideologies, values, and worldviews, reflecting the broader socio-political changes of this era (Hsia, 2005).

The exceptional growth of the Order of Jesus is also due to the exceptional leaders who helmed the organization during that century-long span. In total, there were only five: Jacques Laynez (1558-1565), François de Borgia (1565-1572), Everard Mercurian (1573-1580), Claude Aquaviva (1581-1615), and Mutius Vitelleschi (1615-1645). For example, under Jacques Laynez's leadership, the Society of Jesus saw a significant increase in the number of foundations from one hundred to one hundred and thirty, highlighting the commitment to high-level education, and the number of Jesuits from one thousand to two thousand within just seven years (Guillermou, 1999; O'Malley, 1993).

Yet, the 18th century ushered in a period of suppression and dissolution for the Jesuits. The dissolution, issued by Pope Clement XIV in his papal brief “Dominus ac Redemptor”, was largely a consequence of growing political pressures and tensions between the Jesuits and certain European monarchies. These powers, including those of France, Spain, and Portugal, perceived the Jesuits as a threat to their authority due to the Order's international network, its substantial influence, and its independent streak (O’Malley, 2014). The Enlightenment era brought with it a heightened critique of religious institutions and an anti-clerical sentiment. It took the order forty-one years to resurrect under Pope Pius VII in 1814 (Guillermou, 1999).

Despite not being the first or the only order serving the Catholic Reform, the Society of Jesus's impact was unmatched, earning it recognition as the most influential order established by the Roman Church in its struggle against Protestantism (Guillermou, 1999). Integral to the Society's success was its emphasis on education and evangelization, reflected in its establishment of numerous schools, colleges, and universities worldwide. This commitment to education played a central role in the spread of Catholicism, particularly in South America and Asia, and contributed to the emergence of modern humanism (Goujon, 2011).

2.2. The emergence of universities

Universities dating back to the Middle Ages were recognized as innovative, and even now, contemporary universities, though vastly different, remain deeply influential institutions within our societies (Brockliss, 2000). During the Middle Ages, universities were less numerous and smaller in size, and they hadn't yet assumed a prominent role in research (Scott, 2006).

The earliest institution that could be regarded as a university was a medical school in Salerno, Italy, established in the 9th century. However, the first official European university was founded in Bologna during the 11th century (De Ridder-Symoens, 1992). In Western Europe, the University of Paris, established in the 12th century, was the first to be recognized as a university dedicated to teaching theology.

Initially, these institutions were largely self-organized corporations of students and masters (Ruegg, 1992). However, it wasn't long before political and religious authorities started establishing their own universities. Notably, Pope Gregory IX founded the University of Toulouse in 1229 through a papal decree. As stated in the Britannica article, these religious universities were granted the freedom to self-govern, provided they did not promote heresy or

atheism. Following this, numerous universities were established across Europe in major cities such as Montpellier, Padua, Rome, Florence, Prague, and others.

2.3. Protestant Reformation, Counter-Reformation, and their impact on universities networks

During the Protestant Reformation, the Catholic Church experienced a profound competitive shock as Protestantism emerged as a new religious movement (Becker, Pfaff & Rubin, 2016). This led to a competition between the two religious groups for followers, resources, and influence (Cantoni, Dittmar, & Yuchtman, 2017). The authors argue that the introduction of religious competition during the Protestant Reformation changed the political markets where religious authorities provided legitimacy to rulers in exchange for control of resources. Before the introduction of religious competition, religious elites had a monopoly on the provision of this political legitimacy. However, when religious competition emerged during the Protestant Reformation, it disrupted this market by offering political leaders an alternative to the legitimacy provided by religious elites. Political leaders began to look for other sources of legitimacy to maintain their power. They began to allocate more resources to secular rather than religious uses in order to strengthen their own political position (Cantoni, Dittmar, & Yuchtman, 2017).

The Protestant Reformation and the Catholic Church's Counter-Reformation had a significant impact on various universities across Europe. The term "Counter Reformation" was first coined by historians in Germany during the latter part of the 18th century. It was used to signify the efforts, which included political, diplomatic, and military strategies, put forth by Catholics during the 16th and 17th centuries in a bid to counteract the Reformation movement in Germany (O'Malley, 1982). Germany, the birthplace of Protestantism, was the cradle of several new Protestant universities. Existing institutions, on the other hand, were largely overrun by Protestants. Meanwhile, remaining Roman Catholic universities stood as defenders of traditional Catholic church learning (Becker, Pfaff, & Rubin, 2016). By the 17th century, both 'types' of universities were almost entirely devoted to defending their religious principles. This era showed a decline in the influence of universities, largely because they were too entrenched in defending their dogmas and rejected scientific advancements.

In their working paper, David de la Croix and Pauline Morault (2022) suggest that the relationship and network effect between Protestant and Catholic universities might have been

more regular had religion not intervened. The geographical location of the universities also played a role in how networks were formed (de la Croix & Morault, 2022). Indeed, networks were shaped by the mobility of scholars, who used to travel from one university to another. They would then talk to other scholars and share knowledge. This mobility created bonds between universities which would ease the diffusion of knowledge. Moreover, these increased academic activities were not merely a function of isolated institutions, but a synergistic effect of their close proximity and their network. Knowledge spillovers significantly contributed to the vibrancy of intellectual life during this era.

The concept of "knowledge spillovers," originating from the work of Kenneth Arrow (1962) and Paul Romer (1989), was instrumental in this context. It entails that the benefits of knowledge and innovation could not be wholly appropriated by the innovator, which facilitated the dispersion of knowledge to other scholars, universities, and the broader public (Carlino, 2001). Such spillovers were particularly prominent in densely populated urban environments where Protestant or Jesuits universities were often located. Here, scholars, students, and the people in general were more likely to interact, fostering a robust exchange of ideas and knowledge. These exchanges could take various forms - casual conversations among academics, collaborations on research projects, or participation in academic conferences or seminars.

In particular, Jacobs spillovers, a subtype of knowledge spillovers, could be key to understanding the growth of closely located universities of the same network (Carlino, 2001). The knowledge accumulated by one university could find its way to a neighboring one, through the students or townsfolk, thereby stimulating intellectual growth and higher scholarly output. In the period under discussion, the spread of knowledge was primarily facilitated by personal interactions, manuscripts, and scholarly exchanges as stated previously. For instance, two scholars from two different but geographically proximate universities could interact and exchange ideas, leading to mutual growth and increased academic output.

This dynamic can be further understood considering the economic principle of 'agglomeration economies,' as discussed by Edward L. Glaeser (2007). This principle refers to the benefits that accrue when businesses, or in this case, universities, and individuals are located in close proximity within cities or clusters. Agglomeration economies, resulting from reduced transportation costs associated with the exchange of goods, people, and ideas, could be distinctly observed in the case of these universities. Specifically, the close proximity of these

institutions could have decreased the "transportation" costs of knowledge, making knowledge exchange more accessible and thereby facilitating knowledge spillovers Glaeser (2007). Consequently, the Reformation, catalyzing both intellectual competition and cooperation between universities, arguably led to a more robust network and productive academic landscape (de la Croix & Morault, 2022).

The authors add, however, that this geographical effect could not reverse the impact of belonging to a different, competing religious movement. Proximity between universities indeed facilitates connections and knowledge exchange, but the influence network among universities was thus much more present among those belonging to the same religious trend.

The Reformation had positive effects on the productivity of Protestant educators. The strength of the Protestant network allowed for an increase in publications among top scholars at Protestant universities, highlighting the role of the network (de la Croix & Morault, 2022). However, Post-Reformation, it became more common for graduates from Protestant universities to enter secular professions rather than religious ones. Additionally, there was a notable shift in their human capital investments, moving away from theological degrees and focusing more on broader, non-religious areas of study (Cantoni, Dittmar, & Yuchtman, 2017).

As previously outlined, the Reformation also introduced a dynamic of religious rivalry. Therefore, the impact of the Counter-Reformation on medieval universities was mainly to have limited interactions between the two academic rivals, without directly tarnishing the level of Catholic education or even the quality of their human capital, even if the number of publications by the Catholic scholars had reached its peak before the Jesuit (de la Croix & Morault, 2022).

2.4. Strategic locations of Jesuit universities and their role in human capital development

Jesuit universities' historic context plays an important role in understanding their human capital contribution. Founded by the Society of Jesus, these institutions emerged during the Counter-Reformation as part of the Catholic Church's broader intellectual and spiritual renewal (Guillermou, 1999; O'Malley, 1993). As outlined in the historical introduction of this thesis, which provides an overview of the historical context, Jesuit universities significantly contributed to the development of the European educational system (Sauvé, 2010).

Human capital is another essential concept for understanding the impact of Jesuit and Protestant universities on the development of the European educational system. Introduced by Theodore Schultz and further developed by Gary Becker, 'human capital' is the sum of an individual's knowledge, skills, and abilities that can be employed to produce goods and services (Vignolles, 2012).

There exist various forms of human capital (Vignolles, 2012). Becker defines it as every way to "improve health, increase income, or appreciation of literature for most of one's life" (Becker, Murphy, & Tamura, 1994). He acknowledges that human capital is composed of a large number of factors, yet he asserts that the most important component of human capital is education and training. Educational human capital refers to the knowledge and skills a person obtains through formal education, such as schooling, college, and university. This may encompass various skills like reading, writing, numeracy, problem-solving, and critical thinking (Vignolles, 2012).

Measuring and quantifying an individual's human capital is a complex task, though common methods often involve evaluating the level of education, typically based on the number of years of schooling. In this case, we will use the amount of publications as a proxy for human capital. This metric reflects the knowledge and skills acquired and developed within these institutions, and its dissemination speaks about the level of education of the university.

In the context of Jesuit universities, education was a central aspect of their approach. As described in Paul F. Grendler's book, these institutions offered exceptional teaching quality and a rigorous curriculum focusing on classical languages, philosophy, theology, as well as scientific research. This comprehensive education equipped students with a wide range of skills. Such an educational approach significantly contributed to their human capital, thus fostering their ability to contribute to society and the economy (Grendler, 2018). Jesuit universities fostered a strong sense of community by consolidating the church, college, and residences within one area. This enabled students to easily and quickly access all necessary resources.

The strategic locations of these Jesuit universities then played a significant role. The order's founder, Ignatius of Loyola, advocated for universities to be centrally situated within cities, close to the 'place of conversation.' This strategic positioning, often in major cities, allowed them to attract numerous students from across Europe and foster dialogue with various intellectuals (Carlsmith, 2002). Moreover, Jesuit universities often emerged in locations with initially limited access to education. This strategic choice allowed them to facilitate easier

conversion while also enhancing the lives of nearby residents, promoting greater social mobility, and contributing to the overall development of human capital in these regions (Grendler, 2018). Significantly, the book highlights that the most successful Jesuit universities were typically situated in areas with a robust Catholic presence, which ensured strong connections with local elites and authorities. This provided them with security and increased funding. However, this was not always the case.

Taking the University of Braniewo in Poland as an example, formerly known as Braunsberg in Germany, the Jesuits (primarily through Johannes Rode) founded their college there in 1568 with the intention of making it a preparatory school for the University of Vilnius, another Jesuit university established in 1579 (Grendler, 2018). They were invited to establish a college there by the Bishop of Warmia, Stanislaus Hosius. The bishop was a strong supporter of the Jesuits and believed that they could help to promote Catholicism in the region, which was predominantly Protestant. He also saw the need for a Catholic university in Prussia that could provide high-quality education to young men who wished to enter the priesthood or pursue other careers. Due to the success of Braniewo College, it eventually expanded into a full university program. The university's faculty and students were deeply committed to the Catholic faith, and they worked to promote Catholicism in a region that was predominantly Protestant (Grendler, 2018). There was thus a will to counter the reform by installing this university in a key location.

The Jesuit university model was widely adopted by other institutions which led to a more cosmopolitan approach to education (Guillermou, 1999).

2.5. Role of proximity and mathematical model

Understanding the strategic locations of universities, the power of network, knowledge spillovers, and the competition induced by the Reform and Counter-Reform, we are led to question how this competitive dynamic among universities impacts the written output by professors at these various institutions. The role of proximity in the competition between these two entities, the Protestant and Jesuit universities, holds particular interest for us.

The competition in question can be characterized by imperfect competition, a market scenario that lacks the idealized characteristics of perfect competition. This type of competition grants a degree of market power to sellers, allowing them to influence prices and output. For instance,

in a monopoly, the consumer is left with a single choice - to consume the product or not. If there was only one Jesuit university in the vicinity for a student, the choice would be similarly straightforward.

However, our current scenario presents us with a different dynamic, where multiple universities - both Protestant and Jesuit - are in operation. This constitutes an oligopolistic market, characterized by multiple demanders - in this case, students - and a handful of suppliers, in this case, the Protestant and Jesuit universities. Under such circumstances, the condition of atomicity, where individual sellers are too small and numerous to exert any significant influence on market function and prices, is not met. In this oligopolistic environment, each institution - each university - is fully aware of its competitors and adjusts its strategy accordingly.

Models of imperfect competition, like the Hotelling linear city model and Salop's Circular City model, consider the distance between different market actors. In Salop's model, all firms offering differentiated goods are located equidistantly around a circle. In this case, universities are spread all over Europe. Consumers make their choices based on various factors such as brand preference, distance, transportation costs, and prices, while seeking to maximize their utility (Greenhut, Norman, & Hung, 1987).

In the context of universities, location plays a crucial role in competition. Institutions strategically situate themselves to attract students, influence the diffusion of knowledge, and stimulate intellectual productivity, as measured by the written output of their faculty members. Therefore, exploring the nuances of competition in this imperfect market provides valuable insights into how proximity affects the rivalry between Protestant and Jesuit universities and subsequently influences the production of human capital.

2.5.1. Salop’s circular city adapted model

Initiating our discussion with the Salop model, we will seek to adapt it to our context and evaluate its applicability. For this adaptation, we conceptualize universities - both Protestant and Jesuit - positioned at a distance of 1/n (with 'n' denoting the number of universities) from each other in a circular market. It's important to note that there are not just two universities, but a multitude of Protestant and Jesuit ones. This circular market symbolizes space, embodying the notion of distance between these universities. A higher publication count corresponds to a lower price in the original model, thus signalling greater attractiveness. Each university offers an education level 'W', which aligns with their level of scholarly production -

the more publications a university generates, the higher its education level, as we stated when we defined the human capital. We thus consider the appeal of universities during this era to be the level of education they offer.

The agents in this model are students, evenly spread around the circle, who must decide whether to pursue higher education and, if so, which university to attend. These students are dispersed around the circular market, located at varying distances from each university. In deciding their university of choice, students consider two factors: the university's education level and its distance from their preferred university, assumed to be the nearest one. In this model, we have substituted the price from the original Salop model with the level of education.

The student's utility function is denoted as follows:

$$U = [-V + W_i - c\delta ij] \quad (2.1)$$

Where 'V' symbolizes the minimum education level the student expects, below which they prefer not to attend university; 'W_i' represents the education level of university 'i', which is determined by its publication output; and 'cδij' corresponds to the additional "transport cost" the student would bear if they chose university 'i' over the nearest university 'j'.

Assuming a university and its professors provide an education level 'W_i', and that neighbouring universities (at a distance of 1/n) offer a level 'W_n', there exists an education level 'W_c' that enables a university achieving it to 'reach' the market of neighbouring universities. If 'W_i' is lower than 'W_c', the university essentially enjoys a monopoly in its region, attracting all students for whom the distance to university 'i' generates a non-negative utility function (1).

The maximum distance ('δm') that these students are willing to travel to attend the university (when the university is a monopoly) is defined as

$$\delta m = \frac{(-v + W_i)}{c} \quad (2.2)$$

Any student located at a distance greater than 'δm' will not attend university 'i'. With a number of students 'L' dispersed in the circular market and a supply from university 'i' extending a maximum distance of 'δm' on both sides of the latter, the monopoly demand for university 'i' is thus:

$$q_{monopoly} = \frac{2L(-v + Wi)}{c} \quad (2.3)$$

However, if the university aims to enhance its attractiveness and thus increase its publication output (equivalent to the education level 'W_i') to 'W_c' or more, the university will no longer enjoy a monopoly and will have to compete with neighbouring universities. Students will then choose the university that maximizes their utility as per equation (1).

In a situation where universities are separated by a distance of $\frac{1}{n}$, and our university 'i' is offering 'W_i'> 'W_c' while neighbouring universities offer 'W_n' < 'W_c', the new maximum distance of attraction ('δc') of students for university 'i' is determined by:

$$-v + W_i - c\delta \geq -v - c\left(\frac{1}{n} - \delta\right) + W_n \quad (2.4)$$

This leads to a 'δc' (c for competitive) for which the equality holds:

$$\delta c = \frac{(-W_n + \frac{c}{n} + W_i)}{2c}. \quad (2.5)$$

The demand for university 'i' in this competitive market, therefore, is 'q_c' = 2Lδc, which simplifies to

$$q_{competitive} = \frac{L(-W_n + \frac{c}{n} + W_i)}{c}. \quad (2.6)$$

In a scenario where 'W_i' (education level of university 'i') equals 'V', the university attracts zero students. However, as the university and its professors produce more scholarly work and 'W_i' increases, so does demand. As the education level rises and reaches 'W_c' or more, demand continues to escalate but follows the competition equation. University 'i' begins to encroach on the market of other universities because its 'W_i' is higher than 'W_c'. A "kinked equilibrium" occurs when 'W_i' equals 'W_c'. If 'W_i' continues to grow, even students whose preferred university is 'J' may be incentivized to switch to university 'i' due to its superior education level, thus

compensating for transport costs and offering higher utility. If 'W_i' surpasses 'W_{sc}', the representative university becomes supercompetitive and dominates all neighbouring markets.

We can then define the two demand slopes, monopoly:

$$Sl(Dm) = \frac{c}{2L}. (2.7)$$

And competitive:

$$Sl(Dc) = \frac{c}{L}. (2.8)$$

Demand is thus more elastic when university 'i' is in its monopoly region, which is intuitive since it is not subject to competition from neighbouring universities. An increase in 'W_i' will attract more new students in a monopoly than when the university is in competition with neighbouring universities. This can also explain why Jesuit universities were often located in big cities, allowing them to reach more people.

The value of 'W_c' is determined by the point at which, due to the increase in 'W_i', university 'i' begins to penetrate the market of neighbouring universities and then start to compete with them. This value can be found by equating the two demand equations (2.3) and (2.6), which gives a 'W_c' of:

$$W_c = 2v - W_n + \frac{c}{n}. (2.9)$$

If neighbouring universities enhance their education level ('W_n'), or if universities become closer to each other (with 'n' increasing but 1/n decreasing), then the education level 'W_c' at which the markets of different universities begin to overlap will decrease, thereby shrinking the monopoly area. This is because universities offering a higher education level will expand their radius of attraction. The negative impact caused by the additional transport costs will be compensated by the superior education level provided, attracting students from further away. As 'W_n' increases, 'W_c' decreases, which could eventually lead to the disappearance of the university monopoly region.

According to this adapted Salop model, the location and proximity of universities significantly impact their competition and, consequently, their efforts to attract students. If Protestant

universities are closer to Jesuit universities, the competition intensifies, leading to various outcomes as described by the model.

Firstly, the "monopoly region" of each university shrinks. In the original Salop model, the monopoly region is an area where a firm (in this case, a university) doesn't face competition. When universities are closer to each other, students have more options within the same geographical distance. The monopoly power of a university is reduced as the proximity of alternative options (other universities) increases.

Secondly, when the monopoly region shrinks, universities can no longer solely rely on the monopoly effect and must compete more quickly, leveraging their educational quality to attract students. In this context, the quality of education is represented by the publication count of the universities. The universities are incentivized to increase their educational standards, resulting in a higher publication count, to attract more students. This leads to an increased effort on their part.

Thirdly, the equation given by the model:

$$W_c = 2v - W_n + \frac{c}{n} \quad (2.10),$$

tells us that as 'n' increases (i.e., universities become closer, reducing the value of '1/n'), 'W_c' decreases. 'W_c' is the critical level of education (publication count) at which a university starts encroaching on the market of neighbouring universities. Therefore, the closer the universities, the lower the publication count needed to start competing for each other's potential students, prompting all universities to boost their efforts.

After this adaptation of Salop's model, it might be interesting to continue exploring it and try to find the different equilibrium equations (monopoly, kinked, competitive) in order to identify the optimal written production effort of a university. However, the various assumptions made at the outset to help transform the model make it more complicated to implement and interpret. This is why, although they have been tried, these equations raise several questions which perhaps merit further reflection and a new adaptation of Salop's model.

2.5.2. The different equilibriums

We've observed several demand curves that can be utilized to extrapolate the zero-profit equilibrium. Our assumption is that all universities bear the same production costs. The total cost of production is expected to be as follows:

$$C = F + mq \quad (2.11)$$

We will view fixed costs as the financial investment required to employ an academic working for the institution. Regardless of any other activities, universities continue to function with educators on staff, and this is what we identify as a fixed cost. The additional cost associated with the university producing a new book is recognized as the production cost of that new book (materials and so forth).

There's a symmetric zero-profit equilibrium in which all universities are evenly distributed and generate an equal number of publications. Three specific equilibriums exis. These are termed as monopoly equilibrium, kinked equilibrium, and competitive equilibrium, or M, k, and c, respectively.

Monopoly equilibrium: consumers outside of a university's sphere of influence may simply opt out of attending university. Every university has the freedom to set its level of W_i, with its sole competition being the 'external good', which is essentially the option of not attending university.

Kinked equilibrium: university markets touch each other. As noted before, the production level is greater than that in a monopoly, rendering the university more appealing and attracting more students.

Competitive equilibrium: The markets overlap. The production level might be higher or lower than that in a monopoly, primarily contingent on demand and technology.

Now, we imagine a university market where the participating universities yield a 'profit': they draw in more students than their level of production should allow. The benefit they receive from the influx of students surpasses the detriment incurred from the costs associated with publication production. One could imagine that new universities would enter this market, gradually gaining a share of it, until we achieve a stage where each university secures the number of students it should have with this level of production. We then reach W_c and a number of universities n_c in a competitive market.

The SZPE satisfies two conditions: the marginal revenue that comes from a new publication (which attracts new students) is lower than or equal to the marginal cost, and the level of writing output is equal to the average 'cost'.

$$W + q\frac{dW}{dq} \leq m \quad (2.12)$$

$$W = m + \frac{F}{q} \quad (2.13)$$

We presume that both marginal and fixed costs impact the volume of publications a university can generate. Fixed costs are distributed amongst all students, hence the larger the student body, the lower the cost per student.

This implies that if either marginal costs or fixed costs, or both, are elevated, it might restrict the university's capacity to produce publications, subsequently limiting its appeal to potential students. On the flip side, if either marginal costs or fixed costs, or both, are low, this could empower a university to produce a greater number of publications, thereby enhancing its attractiveness to students. If the equilibrium has no gaps, with n universities, then the number of students per university is:

$$q = \frac{L}{n} \quad (2.14)$$

The slope of dW/dq of the demand function is given by (2.7) or (2.8). If we substitute (2.7), (2.13) and (2.14) into (2.12) we have the monopoly amount of publications and the maximum number of universities:

$$W_m = m + \frac{c}{2n_m} \quad (2.15)$$

$$N_m = \frac{1}{\sqrt{2}}\sqrt{\frac{cL}{F}} \quad (2.16)$$

If we want the competitive equilibrium, we have to use (2.8) rather than (2.7):

$$W_c = m + \frac{c}{n_c} \quad (2.17)$$

$$n_c = \sqrt{\frac{cL}{F}} \quad (2.18)$$

The kinked equilibrium lies between these values. This equilibrium is given by:

$$W_k = v - \frac{c}{n_k} \text{ (2.19)}$$

$$\frac{F}{L} n_k + \frac{c}{n_k} = v - m \text{ (2.20)}$$

The monopoly equilibrium necessitates a strict condition where the curve of the average cost is tangential to the demand curve, specifically within the monopoly's segment of the demand curve. This requires:

$$v - m = \sqrt{\frac{2cF}{L}} \text{ (2.21)},$$

The competitive equilibrium occurs when:

$$v - m \geq \frac{3}{2}\sqrt{\frac{cF}{L}} => competitive \text{ (2.22)}$$

And the kinked equilibrium occurs when

$$\sqrt{\frac{2cF}{L}} \leq v - m \leq \frac{3}{2}\sqrt{\frac{cF}{L}} \text{ (2.23).}$$

The difficulty in adapting these equilibria to our model arises from the fact that a university's number of publications cannot be interpreted in the same way as a price. For example, equation (2.15) tells us that the equilibrium production level in monopoly varies as a function of the marginal cost of a new publication, positively with the constant linked to transport costs and negatively with the number of universities.

Intuitively, a higher marginal production cost should limit the number of optimal (more expensive) publications. A higher transport cost constant for students would lead to a reduction in the university's attraction area, enhancing it to increase its level of production to counter this problem. However, a greater number of universities should lead to fiercer competition between universities to reach more students. Even if the model could be adapted again to help gain a better understanding of the equilibrium, its first part still provides us a good economical insight to our problematic.

3. Methodology

3.1. Sources and database

In order to effectively address our research questions and conduct the necessary analyses, we require a database containing the most pertinent information within this research context. The focus is on identifying Jesuit teachers, their institutions and most importantly, their levels of literary production. To accomplish this, we will utilize a portion of my supervisor's database (de la Croix, 2021), thanks to the ERC funding under the European Union's Horizon 2020 research and innovation programme.

To enrich the database with information relevant to our research, we have compiled the names of Jesuit teachers from the Collegium Hosianum in Braniewo. Different sources were used but the most useful one was the "Bibliothèque de la Compagnie de Jésus" from Carlos Sommervogel (1960). This institution is situated in close proximity to Protestant lands, as mentioned in the literature review, making its data valuable to our study. Incorporating additional data will allow for a more robust and reliable analysis.

With the list of names in hand, we conducted additional research on the internet to identify which Jesuits had a VIAF page, which provided access to their number of publications. This is a key part in the empirical work that will be done in the next point. Having that database, we will only use a subset of it. For the purposes of our thesis, we will consider Jesuits who were scholars or rectors across Europe and have a VIAF link, as this information will be used to compute their number of publications and so calculate the potential impact of their proximity to Protestantism. Scholars without a VIAF link or with an amount of publications equal to 0 will also be considered, but this will be discussed later. Other researchers and scholars that are not Jesuits will not be considered.

The subset used for this thesis has different fields that can be found in the first annex (*Annex 1*).

3.2. Selection of relevant data

As mentioned earlier, data sorting has already been performed on the initial database, retaining in this subset only information about Jesuit scholars who worked in European

universities. However, it is essential to emphasize which data will be most significant for the various analyses in this dissertation.

Firstly, the specific Jesuit teacher and their workplace are crucial. This information enables us to associate the teacher with a location, which will later facilitate the calculation of their distance to competitors. Besides linking the teacher to a location, it also helps connect the location to the number of publications (the one provided by the teacher in question, found in the "titles" column), which is vital for the analysis.

Secondly, the university's location is essential. Each university is associated with a city, which in turn is connected to a country. We will primarily use the city and its geographical coordinates, once passed on R, to determine the distance to the reference point representing Protestantism. This aspect of the database is particularly valuable, as it will help us answer the central research question.

Additionally, the place of birth may be of interest: will a Jesuit born near Protestant lands tend to produce more than one born in predominantly Catholic territory, less influenced by the Reformation? These hypotheses, questions, and data will be elaborated upon in greater detail during the empirical analysis section. The primary goal here is to highlight the data most relevant to our research question and provide a general overview of the process that will be undertaken in subsequent parts.

3.3. Regressions with RStudio

3.3.1. Regressions with distance to Wittenberg

To initiate this analysis in R, we will first import the database containing all Jesuit scholars into the software. After successfully importing the data, we will install the necessary packages required for executing our various processes.

It is crucial to acknowledge that a single teacher may be affiliated with multiple universities throughout his career. It is not unusual for scholars to teach at two or more different institutions. This situation could potentially raise concerns about the relevance of some information, as it is unclear when most of an author's writings were produced. For instance, did the peak of their production occur during a period when they were situated near Protestant territories? Unfortunately, the available data does not provide this insight. Since the database contains the

same scholar several times, we'll use the lm_robust(y ~ x, clusters=jesuits$PKey) function. This function indicates that the data are grouped or "clustered" by the PKey variable. In other words, it is assumed that observations for each specific 'PKey' (in our case, a particular Jesuit scholar) are potentially correlated, while observations from different 'PKey' are independent of each other. Standard errors will then be adjusted to account for this intra-cluster correlation, giving more accurate estimates of the variability and standard errors associated with the regression coefficients.

To compute the distances between two geographic coordinates, we will employ the distGeo function from the geosphere package. This function calculates the straight-line distance, considering the Earth as an ellipsoid, by taking two distinct geographic coordinates. Dividing it by 1000, we get our value in kilometres. The parameters for this function are explained in the appendices (*Annex 2*).

At first, only the distance from the university to Wittenberg will be considered. This choice is based on the fact that Wittenberg is considered the starting point of Protestantism, but also because a renowned Protestant university is located there. Cantoni (2011) tells us that the spread of Protestantism across Germany was greatly influenced by the distance of the province in question from Wittenberg. It therefore seems relevant to analyse the effect of proximity to Wittenberg in this analysis.

All the regressions carried out in the following section used both the absolute value and the logarithm of the dependent variable. After comparison, the use of absolute values will be preferred for its potential better results and greater simplicity of interpretation.

We consider the dummy variable representing the teacher's country of birth and another variable, which is their longevity. Longevity certainly has a role to play in the number of publications; a longer life might inevitably lead to a higher output. The dummy variable of place of birth allows us to control for systematic effect of the country of birth of the scholar. We will also analyse their coefficients to look for first insights at the impact of proximity. In this case, if the coefficient of this variable is positive, it would suggest that, on average, scholars born in the country of the variable have a higher amount of production compared to those born in other countries, after controlling for other variables in the model. We will also delete the intercept in every regression we make by adding “0 +” in every of our regressions. Our regression line will

start at the origin (0,0), and the coefficient on x now represents the change in y per unit change in x from the origin, rather than the intercept.

	Amount of publications		
Independant variables	**(1)**	**(2)**	**(3)**
Longevity	0,082***	0,066***	0,127***
Distance to Wittenberg		0,001***	0,001**
Controlling for country of birth			X
Observations	4257	4257	4257
R^2	0,168	0,172	0,225
Adjusted R^2	0,168	0,171	0,218

Table 1: regressions results of the three first models with all the scholars.

The above table outlines the findings from three distinct regression models (*Annex 3*), each examining the contributory factors that shape a teacher's publication count.

The first model exclusively focuses on a teacher's 'longevity' as the independent variable. According to the results, there's a significant, positive correlation between a teacher's longevity and their publication output. Specifically, for every additional year in a teacher's longevity, there is a corresponding rise in their publication count by 0.082, assuming all other variables remain constant. This model is effective in accounting for approximately 16.8% of the observed variability in the number of publications.

The second model expands upon the first by introducing 'distance from Wittenberg' as an added independent variable. Both longevity and distance from Wittenberg exhibit a positive correlation with publication count. Longevity continues to significantly influence the outcome, although the effect lessens slightly to 0.066. Conversely, every kilometre increase in the distance from Wittenberg results in an average increase in the number of publications by 0.001. This augmented model explains 17.2% of the variability in the number of publications.

In the final model, the teacher's country of birth is incorporated as a control variable. This inclusion doesn't diminish the significant, positive influence of longevity on the number of publications, now measured at 0.127. If could mean that a scholar would need 7,87 years to produce a new publication. However, the significance of distance from Wittenberg weakens to a 5% confidence level (0.001**), suggesting its effect on publication count might be less stable once the teacher's country of birth is factored in. This comprehensive model can explain 22.5% of the variability in the number of publications.

In summary, all three models endorse the assertion that a teacher's longevity positively impacts their publication count. However, the influence of distance from Wittenberg on the publication count appears to lessen when the teacher's country of birth is considered.

Our subsequent analyses will exclude teachers without a VIAF and those with a 'Titles' value of 0. The rationale behind this exclusion is that it remains uncertain whether teachers with a 'Titles' value of 0 lack information or simply have no publications to their name. Consequently, we will transform the 'Titles' variable's 0 values into NAs, effectively omitting them from the regression analysis. This approach allows us to concentrate solely on teachers who have at least some documented literary output.

	Amount of publications		
Independant variables	**(1)**	**(2)**	**(3)**
Longevity	0,172***	0,134***	0,169***
Distance to Wittenberg		0,003***	0,001
Controlling for country of birth			X
Observations	1896	1896	1896
R^2	0,354	0,361	0,408
Adjusted R^2	0,353	0,361	0,397

Table 2: regressions results of the three following models with only productive scholars.

In the first model (*Annex 4*), longevity continues to be a pivotal determinant. Specifically, for every extra year in a teacher's career, we see a more pronounced increase of 0.172 in the number of publications when all other variables are constant. With this adjustment, the model now explains approximately 35.4% of the observed variability in publication output.

The second model introduces the variable 'distance from Wittenberg' alongside longevity. It confirms the positive influence of both these factors. The effect of longevity decreases slightly to 0.134, but remains significant, while each unit increase in distance from Wittenberg contributes to a slight rise of 0.003 in the number of publications. This model enhances the previous one's explanatory power, accounting for 36.1% of the variability in publication count.

In the final model, we consider the teacher's country of birth. Longevity's impact persists with a significant, positive effect of 0.169. However, the influence of distance from Wittenberg loses its significance, indicating that its impact might be once again less discernible once we

control for the country of birth. This model offers the highest explanatory power, elucidating 40.8% of the variability in publication count.

In conclusion, the different models reaffirm the pivotal role of a teacher's career length on their publication output. The distance from Wittenberg's effect, on the other hand, seems to intertwine with the teacher's country of birth. Notably, the decision to exclude scholars without any publications appears to enhance the model's precision. Even though its influence was not significant in the final model, the potential positive effect of distance from Wittenberg remains noticeable.

All these coefficients will be interpreted in the next chapter.

3.3.2. Regressions with distance to the closest Protestant university

We will now conduct a new regression, maintaining the number of publications as the dependent variable. This time, however, we will aggregate all publications associated with the university in question.

As previously mentioned, a scholar can be affiliated with several universities while maintaining a single number of titles throughout their career. To more accurately reflect reality, we have divided the number of publications associated with each scholar-university pair by the number of institutions in which the scholar has worked. Simply put, if a scholar has 15 publications and has worked at 3 universities, we will assign a value of 5 publications per scholar-university pair.

In addition, we will replace the independent variable, which previously included the distance to Wittenberg, with a new variable representing the distance from this university to the nearest Protestant university. To achieve this, we will select some of the most important and influential Protestant universities in Europe based on their significance and potential proximity to the Jesuit institutions in our database. Once these universities have been chosen, we will incorporate the coordinates of their respective cities.

Firstly, we established a new, albeit smaller, database that includes the names and geographical coordinates of the Protestant universities that we will utilize in the upcoming regression. The universities we have chosen are Marburg, Strasbourg, Wittenberg, Geneva, Heidelberg,

Konigsberg, Halle, Leiden, Utrecht, Lund, Uppsala, Rostock, Groningen, Jena, and Oxford. Our intent here was to gather the most influential Protestant universities.

Upon integrating this database into RStudio, we executed a loop for each Jesuit university in our original database to calculate the distance to all its religious rivals. We then retained only the closest university. To calculate this distance, we once again employed the distGeo function, which gives the distance between two geographical points. We will again express it in kilometers.

Initially, we intended to consider the longevity of each university and its country of origin in our regression. However, due to insufficient data regarding the start and end dates of these universities, we had to exclude 46 out of 96 observations from the regression. As some of these are still active, this could have skewed the results of the longevity variable because we are focusing only on universities up to the 18th century.

	Amount of publications	
Independant variables	**(1)**	**(2)**
Distance	0,283***	0,133
Controlling for country of university		X
Observations	96	96
R^2	0,221	0,421
Adjusted R^2	0,213	0,33

Table 3: regressions results of the two final models with distance to closest Protestant university.

In the initial model (*Annex 5*), the sole predictor is the distance to the nearest Protestant university. This model reveals a significant positive correlation between this distance and the number of publications from the Jesuit university. Specifically, for each additional kilometer between the Protestant and the Jesuit university, there is an expected increase of 0.283 in the number of publications, holding all other factors constant. This model accounts for about 22.1% of the observed variability in the number of publications.

The second model introduces the country of the Jesuit university as a control variable. Here, while the distance to the nearest Protestant university maintains its positive correlation with the number of publications, this relationship is no longer statistically significant, as the coefficient drops to 0.133. This could suggest that the influence of distance may be offset when considering the country of the Jesuit university. Importantly, this model enhances the explanatory power of the regression, accounting for approximately 42.1% of the variability in publication output.

In summary, these models suggest that while distance from the nearest Protestant university initially appears to influence the number of publications from a Jesuit university, this effect might be mitigated when adjusting for the country of the Jesuit university.

4. Interpretation of the results

4.1. First pair of regressions: scholars' distance to Wittenberg

Before moving on to the analysis of the regressions we have carried out, it may be interesting to carry out a simple descriptive analysis of the data in the database. If we simply look at the origins of the scholars producing the most, we can see that France, Spain, Italy and Germany are the most represented countries here. This result is logical, as these countries are the largest in Western Europe but also countries with great Catholic heritage.

We are now going to analyze the different regressions made and results obtained in the previous part of this thesis. We'll also be taking a deeper look at the coefficients for scholars' countries of birth, as well as universities' countries of residence later on. This will allow us to try and find explanations and leads for the different results obtained. The tables containing the coefficients of the complete regressions will all be available in the appendices.

With the first regressions carried out, we indeed noticed that certain countries "offered" very different levels of production from one another. If we take up the first regression incorporating the distance to Wittenberg, thus including scholars with a Titles of 0, we find among the significant ones a very large number of negative coefficients, even for the European countries central to the reform and the counter-reform, such as France with a coefficient of -3.65. This coefficient can be interpreted as: when the scholar is born in France, the expected value of our dependent variable that is the amount of works provided is -3,65 units lower than when he is not French. This is also the case for countries such as Germany with -5,82 or the Czech Republic with -6 ,39. The longevity variable has a coefficient of 0.127. This coefficient can be interpreted as: for every one-year increase of lifespan, our dependent variable that is the amount of works provided is expected to increase by 0.127, assuming all other variables in the model are held constant. This would mean that a Jesuit scholar writes a new book every 8 years. In this case, the variable distance to Wittenberg is indeed significant at the 5% level but gives us a coefficient at 0.0014. This would mean that increasing the distance to Wittenberg by 1 kilometer would add 0.0014 publication to the scholar. This would take a distance of 714 kilometers to provide a new scholar's publication. The rather low r-squared of 0.2251 shows that the model can be improved.

When we no longer take into account scholars with no publications in our database, the results are not very different. The number of significant variables has dropped drastically. Germany still has a negative coefficient, around -4,35, but the Netherlands has a positive coefficient of 8. For longevity, the coefficient value is higher, rising to 0.169 and increasing the number of years it would take a scholar to deliver a new book to 7. The distance to Wittenberg variable is no longer significant this time. The r-squared increases to 0.4079, which means that this model might be more precise for this subset of data than the one performed before.

We can therefore conclude after these first two regressions that the predominance of the most represented countries (France, Spain, Italy, Germany) is likely due to their size and the strength of their Catholic heritage, which would have influenced the distribution and influence of Jesuit scholars. However, the negative coefficients for France, Germany, and the Czech Republic suggest that being born in these countries is associated with lower levels of written production for Jesuit scholars. This is a bit counter-intuitive. This could be due to many factors, such as different national contexts, including varying levels of religious tensions, educational systems, or sociopolitical circumstances but also to a lack of relevance of the data.

The positive coefficient for the longevity variable supports the intuitive assumption that a longer lifespan would lead to more written production, as it allows more time for scholarly activity. This could be an interesting point to discuss in the context of life expectancy during the period of study and the typical career trajectory of a Jesuit scholar.

The significance of the distance to Wittenberg in the first model suggests that geographical proximity to a Protestant center could have an influence on Jesuit scholarly production. However, we are facing here a positive relationship, meaning that being far away of Wittenberg could give higher human capital output. This could be indicative of the network effect discussed in the literature review. However, as the variable is no longer significant in the second model, it implies that this effect is not consistent across different subsets of our data.

4.2. Second pair of regressions: Jesuit universities to closest Protestant universities

Before analyzing the results we were given by the different regressions, we can first perform a descriptive analysis of the results obtained for each university.

AUT	BEL	CZE	DEU	ESP	FRA	ITA	LTU	POL	PRT	SVK	UKR
4	1	2	14	18	21	24	1	5	3	2	1

Table 4: number of universities per country in the database.

Italy, France, and Spain are the most represented countries in the database, with 24 Italian, 21 French, and 18 Spanish universities respectively. Germany closely follows with 14 universities. This is a strong indication of the countries most impacted by Jesuit universities. It follows the results we saw earlier with the most represented scholars' countries of origin. We can see that countries with the most Jesuits universities are countries where Catholicism has had a prominent place throughout history.

	country	Total_Publications
	<chr>	<dbl>
1	AUT	1530
2	BEL	454
3	CZE	531
4	DEU	3486
5	ESP	2567
6	FRA	4816
7	ITA	4874
8	LTU	875
9	POL	852
10	PRT	846
11	SVK	739
12	UKR	213

Table 5: number of publications per country.

Examining the number of publications attributed to each country, we find that this order is largely maintained. Indeed, France, Italy, Spain, and Germany are again the most represented countries. However, this time Germany surpasses Spain, with almost 1000 more attributed publications. Spain holds a bigger number of universities in this database than Germany. Nevertheless, their amount of publications is way lower than for the German universities, who accounts for “only” 14 universities. This could be a great point for our initial hypothesis. Spain, which is not a direct neighbor to Germany and is more "backward" in this conflict, may experience less of a competitive effect on its universities than the other countries discussed here. Also, the Inquisition in Spain did a great job to clear the whole territory of any Protestant hotspots (Edward, 2002). Germany, on the other hand, is at the heart of Protestantism. It could be a factor as of why it has a number of publications higher than Spain. In the literature review, we noted that during the Reformation, Protestants established universities and also 'captured' pre-existing schools to incorporate them into the Protestant educational movement. It was also

suggested that the remaining Catholic institutions served as fervent defenders of the Catholic cause, which may account for the high number of publications in contrast to relatively isolated Spain. Another notable observation is the relatively high number of publications (1530) in Austria despite having only 4 universities. In comparison, Poland (5 universities) and Portugal (3) each have around 850 publications. Austria was therefore highly productive.

To determine which countries were the most productive relative to their number of universities, we will analyze the university/publication ratio.

	country	Moyenne_Publications
	<chr>	<dbl>
1	AUT	382.
2	BEL	454
3	CZE	266.
4	DEU	249
5	ESP	143.
6	FRA	229.
7	ITA	203.
8	LTU	875
9	POL	170.
10	PRT	282
11	SVK	370.
12	UKR	213

Table 6: average publications number per country.

Lithuania takes first place with an average of 875 publications per university, which is easily explained by the presence of only one Lithuanian university in this database. Regarding our previous top countries, France and Italy hover around 200 publications per university. Spain falls slightly lower at 143, further confirming its lower productivity compared to its neighbors, while Germany is at 249, preliminarily validating its high productivity level akin to its French and Italian neighbors. It is more challenging to analyze countries with a very low number of universities because the interpretation of data may be skewed by the lack of data. A larger number of universities allows for more easily interpretable results.

Let’s now take a look at the different regressions we made.

The result of the first regression, considering only distance from the nearest Protestant university, gives us a significant coefficient of 0.283. Once again, we find a positive relationship between distance and the number of written publications. Jesuit universities further away tend to have a higher number of total publications, once again contradicting our initial hypothesis. However, when we apply a country-fixed effect, the independent variable corresponding to

distance loses significance. There is therefore no clear evidence of an effect of proximity on human capital output. This next regression considers the distance in kilometers to the closest university. We note that the number of significative coefficients is lower than prior. Only Germany, France and Lithuania have significative coefficients at 5%. What is interesting here is that the gap between France and Germany, highlighting even more the productivity of German universities. The dummy variable of Germany is now 232,74 while the one of France is 187,817. These coefficients can be interpreted as: when a new university arises in Germany, the expected value of our dependent variable that is the amount of works provided by the whole university would be 232,74 units higher than if the university was located elsewhere. For France, it would be 187,817. This shows here that these countries might have provided higher written outputs. The R^2 is almost identical, adding the country-fixed effects has allowed for a more precise model.

As we said in the descriptive analysis, this could be because of their proximity between each other and to the Reformation. We can still wonder what effect is the stronger. In the literature review, David de la Croix and Pauline Morault (2022) told us that network effect was really strong between close universities of the same religion. France, Italy and Germany are all very close countries that might have had a strong network, encouraging so mobility between scholars, discussions and knowledge spillovers. What is interesting here, is to see that Germany is the most prolific country (for its lower Roman Catholic universities number). This could indeed highlight the role of competition between these two religious' trend. Why would German universities publish more? There could be other factors as well such as different national contexts, including varying levels of religious tensions, educational systems, or sociopolitical circumstances.

This final regression didn't really bring up any new conclusions to the research question, only leads to follow. This will be discussed in the conclusion of this thesis.

5. Conclusion

This dissertation's conclusion seeks to consolidate the responses provided to the research questions proposed in the introduction. By reviewing the literature, we have gleaned an understanding of the historical context and the intellectual environment during the time of the Reformation and Counter-Reformation. Additionally, we have conducted econometric analyses that, albeit simple, have furnished us with intriguing responses and new avenues for future exploration.

The primary research question concerned the strategic choice of locations for Jesuit universities. The literature review revealed that these institutions were typically positioned in large cities, ideally where educational access was limited. The objective was to extend their reach to students from across Europe, while ensuring local populations also had easier educational access. Our database indicated a significant Jesuit presence in France, Italy, Spain, and Germany. This concentration of well-established universities can be attributed to support from local communities and authorities who shared the same religious beliefs. We also know that some universities were also created in places with the aim to stop the spread of Protestantism, such as the Collegium Hosianum in Braniewo. Consequently, the choice of university locations was largely strategic.

The secondary research question revolved around the written production of Jesuit faculty across Europe and potential disparities based on proximity to Protestant territories. There are indeed disparities across Europe but we couldn’t really highlight the effect of proximity and competition from the Protestant institutions. We hypothesized that the competition between these two religious groups would spur universities to augment their written output to attract more students, especially in the context of the Counter-Reformation. A survey of the database did show elevated written output in some countries; however, a correlation based on the geographical distance to Wittenberg and major Protestant universities proved insignificant most of the time. When it did show itself significant, the effect was reversed; a higher distance to Wittenberg provided a higher level of publications.

Yet, this lack of correlation doesn't negate the potential impact of proximity to Protestant regions. For instance, our data analysis reveals that Germany, the birthplace of Protestantism, had Catholic universities that were considerably more productive than their counterparts in Spain and France. This observation is echoed in the literature review, which suggests that

Germany's remaining Catholic universities were seen as upholders of Catholic pedagogy, potentially explaining their slightly elevated output.

The literature review's highlighted network effect can also bring answers. It suggests that the proximity to other Jesuit, and therefore Catholic, universities could facilitate knowledge transmission, resulting in higher human capital production through concepts such as knowledge spillovers. However, the schism between Protestants and Catholics would have held back cooperation between these two rivals, diminishing the effects of networking and cooperation.

The strategic choice regarding the location of Jesuit universities is clear, driven by various factors: reaching a broader audience, fostering scholarly exchanges, positioning within city centres, and engaging in competition with Reformation universities to prevent their expansion and potential loss of influence for the Catholic Church.

Regarding how this competition, influenced by proximity, affects their productivity level, we lack concrete evidence in the data and econometric analyses. We have some indications that countries closer to the Reformation lands have had more productive universities. Yet, these countries also had a larger number of universities due to strategic location choices, which could explain the bigger human capital output. Contrarily, the literature review suggests that proximity to Protestant territories could have weaken the network effect, as scholars were minimally present in universities of both religious movement due to this rivalry. Thus, in places where both movements are present, Jesuit universities are less prominent. This is evident in Germany, which has the fewest represented universities in our database among the major Christian countries of Western Europe (France, Italy, Spain, and Germany). This reduced presence implies a weaker network, diminishing the effects of knowledge spillovers and complicating the identification of the competition effects, if any.

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7. Annexes

A1

- P-Key: Containing the identifiers of all Jesuit teachers, consists of surname, initial and year of birth (if available). Example: Youngson-A-16?

- PName: Contains all surnames

- FirstName: Contains all first names

- AlternativeName: Contains the alternative name of the scholar

- BirthPlace: Contains all cities of birth, if available.

- Locations_Country2016: Contains the city of birth with the country.

- DeathPlace: Contains the cities of death, if available.

- Locations_1_Country2016: Links the place of death with the country.

- Jesuit: Dummy variable that just says if the scholar is a Jesuit.

- Headquarter: Contains the code of the city in which the deceased worked.

- Locations_2_Country2016: Links the city in which he/she worked with the country.

- IKey: Contains the code of the university where the teacher worked. For example: Uaix-1409 -> University of Aix-en-Provence, founded in 1409.

- IName: Contains the official name of the university where the teacher worked. For example: the university of Aix-en-Provence is called Universitas Aquensis.

- WeakLink: Dummy variable that indicates if the scholar has a weak link with the university he is linked with. For example, not really a teacher at that school or not a Jesuit university.

- Locations_2_Latitude: Contains the latitude of the city containing the university.

- Locations_2_Longitude: Contains the longitude of the city containing the university.

- Locations_1_Latitude: Contains the latitude of the city where the teacher died, if available.

- Locations_1_Longitude: Contains the longitude of the city where the teacher died, if available.

- Beginning: Date of the beginning of his/her work in the university, if available.

- End: The end date of the teacher's work at the university, if available.

- DateApprox: Approximation of the end date if not precisely available.

- YearBorn: Year of birth of the Jesuit teacher, if available.

- YearDied: year of death of the Jesuit teacher, if available.

- Wikipedia: Wikipedia link of the scholar, if available.

- VIAF: Viaf link of the scholar, if available.

- Field: Teaching field.

- Field2: Secondary education field.

- Field3: Tertiary education field.

- Locations_Latitude: Latitude of the city the scholar was born in.

- Locations_Longitude: Longitude of the city the scholar was born in.

- CreationDate: Creation date of the university.

- EndDate: End date of the university.

- Titles: The amount of works associated with the scholar (found with its VIAF).

- Longevity: Number of years lived by the author.

- Refdate: Beginning year of collaboration of the scholar and the institution.

A2

`distGeo` *Distance on an ellipsoid (the geodesic)*

Description

Highly accurate estimate of the shortest distance between two points on an ellipsoid (default is WGS84 ellipsoid). The shortest path between two points on an ellipsoid is called the geodesic.

Usage

```
distGeo(p1, p2, a=6378137, f=1/298.257223563)
```

Arguments

p1	longitude/latitude of point(s). Can be a vector of two numbers, a matrix of 2 columns (first column is longitude, second column is latitude) or a Spatial-Points* object
p2	as above; or missing, in which case the sequential distance between the points in p1 is computed
a	numeric. Major (equatorial) radius of the ellipsoid. The default value is for WGS84
f	numeric. Ellipsoid flattening. The default value is for WGS84

Details

Parameters from the WGS84 ellipsoid are used by default. It is the best available global ellipsoid, but for some areas other ellipsoids could be preferable, or even necessary if you work with a printed map that refers to that ellipsoid. Here are parameters for some commonly used ellipsoids. Also see the `refEllipsoids` function.

ellipsoid	a	f
WGS84	6378137	1/298.257223563
GRS80	6378137	1/298.257222101
GRS67	6378160	1/298.25
Airy 1830	6377563.396	1/299.3249646
Bessel 1841	6377397.155	1/299.1528434
Clarke 1880	6378249.145	1/293.465
Clarke 1866	6378206.4	1/294.9786982
International 1924	6378388	1/297
Krasovsky 1940	6378245	1/298.2997381

more info: https://en.wikipedia.org/wiki/Reference_ellipsoid

A3

```
lm_robust(formula = jesuits$titles ~ 0 + jesuits$longevity, clusters = jesuits$PKey)

Standard error type:  CR2

Coefficients:
                  Estimate Std. Error t value  Pr(>|t|) CI Lower CI Upper   DF
jesuits$longevity  0.08192   0.005191   15.78 8.702e-53  0.07173   0.0921 1885

Multiple R-squared:  0.1682 ,   Adjusted R-squared:  0.168
F-statistic:   249 on 1 and 2844 DF,  p-value: < 2.2e-16
```

```
Call:
lm_robust(formula = jesuits$titles ~ 0 + jesuits$longevity +
    unlist(jesuits$DistanceToWitt), clusters = jesuits$PKey)

Standard error type:  CR2

Coefficients:
                            Estimate Std. Error t value  Pr(>|t|)  CI Lower CI Upper     DF
jesuits$longevity           0.066216  0.0059404  11.147 1.606e-27 0.0545611 0.077871 1194.0
unlist(jesuits$DistanceToWitt) 0.001365  0.0005238   2.605 9.362e-03 0.0003364 0.002393  726.1

Multiple R-squared:  0.1715 ,   Adjusted R-squared:  0.1712
F-statistic: 138.2 on 2 and 2844 DF,  p-value: < 2.2e-16
```

```
Call:
lm_robust(formula = jesuits$titles ~ 0 + jesuits$longevity +
    unlist(jesuits$DistanceToWitt) + jesuits$Locations_Country2016,
    clusters = jesuits$PKey)

Standard error type:  CR2

Coefficients:
                                  Estimate Std. Error t value  Pr(>|t|)   CI Lower  CI Upper      DF
jesuits$longevity                 0.126874   0.020230  6.2715 5.425e-10  8.717e-02  0.166574 948.403
unlist(jesuits$DistanceToWitt)    0.001431   0.001187  1.2054 2.291e-01 -9.058e-04  0.003767 275.634
jesuits$Locations_Country2016AGO -12.194241   3.043786 -4.0063 7.162e-05 -1.818e+01 -6.213247 473.623
jesuits$Locations_Country2016ALB  -6.641848   1.463040 -4.5398 6.400e-06 -9.513e+00 -3.770467 896.850
jesuits$Locations_Country2016AUT  -5.927311   1.484458 -3.9929 7.256e-05 -8.842e+00 -3.012509 663.526
jesuits$Locations_Country2016BEL   1.720017   2.707901  0.6352 5.264e-01 -3.636e+00  7.076499 132.036
jesuits$Locations_Country2016BLR   8.812266   8.098835  1.0881 2.866e-01 -7.838e+00 25.462195  25.919
jesuits$Locations_Country2016BRA -12.522132   3.348077 -3.7401 2.426e-02 -2.224e+01 -2.805529   3.601
jesuits$Locations_Country2016CHE  -5.555038   1.847657 -3.0065 3.476e-03 -9.229e+00 -1.881256  84.770
jesuits$Locations_Country2016CZE  -6.391976   1.356027 -4.7138 3.685e-06 -9.060e+00 -3.723755 308.798
jesuits$Locations_Country2016DEU  -5.816522   1.255384 -4.6333 4.162e-06 -8.281e+00 -3.352516 852.572
jesuits$Locations_Country2016ESP  -0.553186   3.521186 -0.1571 8.752e-01 -7.473e+00  6.366578 456.033
jesuits$Locations_Country2016EST  -5.534194   1.443507 -3.8339 1.401e-04 -8.369e+00 -2.698977 572.433
jesuits$Locations_Country2016FRA  -3.646721   1.713510 -2.1282 3.366e-02 -7.011e+00 -0.282541 706.551
jesuits$Locations_Country2016GBR   1.809779   5.131584  0.3527 7.271e-01 -8.716e+00 12.335227  27.204
jesuits$Locations_Country2016GRC  11.659607  15.961069  0.7305 5.489e-01 -6.564e+01 88.956062   1.784
jesuits$Locations_Country2016HRV   7.489600  10.047785  0.7454 4.685e-01 -1.409e+01 29.069538  13.798
jesuits$Locations_Country2016HUN  -5.598518   1.745019 -3.2083 1.670e-03 -9.050e+00 -2.147226 134.221
jesuits$Locations_Country2016IRL  -6.448632   2.662779 -2.4218 3.970e-02 -1.252e+01 -0.382014   8.600
jesuits$Locations_Country2016ITA  -2.436453   2.074679 -1.1744 2.406e-01 -6.510e+00  1.636662 722.937
jesuits$Locations_Country2016JAM  -8.493897   2.652179 -3.2026 1.480e-03 -1.371e+01 -3.278650 369.702
jesuits$Locations_Country2016LTU  -2.837008   2.138978 -1.3263 1.897e-01 -7.115e+00  1.440991  60.408
jesuits$Locations_Country2016LUX  -4.600776   2.431072 -1.8925 1.134e-01 -1.074e+01  1.534025   5.330
jesuits$Locations_Country2016LVA  -6.415212   1.587757 -4.0404 1.454e-01 -2.449e+01 11.662991   1.049
jesuits$Locations_Country2016MAR -10.249468   2.931089 -3.4968 1.455e-01 -3.616e+01 15.661147   1.186
jesuits$Locations_Country2016MLT  -2.784162   7.922166 -0.3514 7.823e-01 -9.116e+01 85.596627   1.059
jesuits$Locations_Country2016NA   -6.773096   1.596130 -4.2434 3.130e-05 -9.917e+00 -3.629121 243.626
jesuits$Locations_Country2016NLD   2.539857   4.231393  0.6002 5.524e-01 -6.067e+00 11.146966  33.175
jesuits$Locations_Country2016NOR   1.010245   2.113290  0.4780 6.327e-01 -3.138e+00  5.158128 849.352
jesuits$Locations_Country2016POL  -3.063690   1.777123 -1.7240 8.597e-02 -6.564e+00  0.436646 245.761
jesuits$Locations_Country2016PRT  -8.231736   3.057811 -2.6920 7.341e-03 -1.424e+01 -2.223925 497.629
jesuits$Locations_Country2016ROU  -0.099523   5.497417 -0.0181 9.857e-01 -1.152e+01 11.320359  21.388
jesuits$Locations_Country2016RUS  -5.002845   1.928860 -2.5937 7.638e-02 -1.096e+01  0.952610   3.171
jesuits$Locations_Country2016SRB  -1.544951   1.740936 -0.8874 3.751e-01 -4.962e+00  1.871707 921.631
jesuits$Locations_Country2016SVK  -3.882312   2.233230 -1.7384 8.391e-02 -8.290e+00  0.525445 173.717
jesuits$Locations_Country2016SVN  -6.623162   1.788172 -3.7039 1.258e-03 -1.033e+01 -2.912053  21.730
jesuits$Locations_Country2016UKR   1.184390   4.273930  0.2771 7.853e-01 -7.887e+00 10.255779  15.763

Multiple R-squared:  0.2251 ,   Adjusted R-squared:  0.2183
F-statistic:    NA on 37 and 2844 DF,  p-value: NA
```

Table 1

	Dependent variable:		
	titles		
	(1)	(2)	(3)
longevity	0.082***	0.066***	0.127***
	(0.003)	(0.005)	(0.014)
DistanceToWitt)		0.001***	0.001**
		(0.0003)	(0.001)
Locations_Country2016AGO			-12.194
			(11.720)
Locations_Country2016ALB			-6.642
			(11.618)
Locations_Country2016AUT			-5.927***
			(1.153)
Locations_Country2016BEL			1.720
			(1.563)
Locations_Country2016BLR			8.812***
			(2.536)
Locations_Country2016BRA			-12.522**
			(6.060)
Locations_Country2016CHE			-5.555***
			(1.580)
Locations_Country2016CZE			-6.392***
			(1.301)
Locations_Country2016DEU			-5.817***
			(0.986)
Locations_Country2016ESP			-0.553
			(1.589)
Locations_Country2016EST			-5.534
			(11.611)
Locations_Country2016FRA			-3.647***
			(1.178)
Locations_Country2016GBR			1.810
			(2.212)
Locations_Country2016GRC			11.660**
			(5.323)
Locations_Country2016HRV			7.490**
			(2.983)
Locations_Country2016HUN			-5.599***
			(1.549)
			*

Locations_Country2016IRL			-6.449
			(3.531)
Locations_Country2016ITA			-2.436*
			(1.321)
Locations_Country2016JAM			-8.494
			(11.683)
Locations_Country2016LTU			-2.837
			(2.053)
Locations_Country2016LUX			-4.601
			(3.582)
Locations_Country2016LVA			-6.415
			(6.765)
Locations_Country2016MAR			-10.249*
			(6.041)
Locations_Country2016MLT			-2.784
			(8.304)
Locations_Country2016NA			-6.773***
			(1.427)
Locations_Country2016NLD			2.540
			(1.877)
Locations_Country2016NOR			1.010
			(11.658)
Locations_Country2016POL			-3.064**
			(1.383)
Locations_Country2016PRT			-8.232***
			(1.817)
Locations_Country2016ROU			-0.100
			(2.641)
Locations_Country2016RUS			-5.003
			(5.870)
Locations_Country2016SRB			-1.545
			(11.636)
Locations_Country2016SVK			-3.882***
			(1.457)
Locations_Country2016SVN			-6.623***
			(2.400)
Locations_Country2016UKR			1.184
			(2.423)
Observations	4,257	4,257	4,257
R^2	0.168	0.172	0.225
Adjusted R^2	0.168	0.171	0.218
Residual Std. Error	11.945 (df = 4256)	11.922 (df = 4255)	11.578 (df = 4220)

A4

```
Call:
lm_robust(formula = jesuits$titles ~ 0 + jesuits$longevity, clusters = jesuits$PKey)

Standard error type:  CR2

Coefficients:
                  Estimate Std. Error t value  Pr(>|t|) CI Lower CI Upper  DF
jesuits$longevity   0.1723   0.009785   17.61 3.491e-59   0.1531   0.1915 827

Multiple R-squared:  0.3537 ,    Adjusted R-squared:  0.3534
F-statistic: 310.1 on 1 and 1196 DF,  p-value: < 2.2e-16
```

```
Call:
lm_robust(formula = jesuits$titles ~ 0 + jesuits$longevity +
    unlist(jesuits$DistanceToWitt), clusters = jesuits$PKey)

Standard error type:  CR2

Coefficients:
                              Estimate Std. Error t value  Pr(>|t|)  CI Lower CI Upper    DF
jesuits$longevity             0.134123   0.012699  10.562 1.413e-23 0.1091699 0.159076 477.7
unlist(jesuits$DistanceToWitt) 0.003302   0.001197   2.759 6.208e-03 0.0009453 0.005659 266.7

Multiple R-squared:  0.3615 ,    Adjusted R-squared:  0.3608
F-statistic: 177.6 on 2 and 1196 DF,  p-value: < 2.2e-16
```

```
Call:
lm_robust(formula = jesuits$titles ~ 0 + jesuits$longevity +
    unlist(jesuits$DistanceToWitt) + jesuits$Locations_Country2016,
    clusters = jesuits$PKey)

Standard error type:  CR2

Coefficients:
                                 Estimate Std. Error  t value  Pr(>|t|)   CI Lower  CI Upper      DF
jesuits$longevity                1.692e-01   0.042345  3.99594 7.841e-05   0.085929  0.252487 354.255
unlist(jesuits$DistanceToWitt)   5.968e-04   0.001861  0.32073 7.489e-01  -0.003083  0.004277 135.789
jesuits$Locations_Country2016ALB -8.814e+00   2.878611 -3.06205 2.369e-03 -14.476114 -3.152785 348.003
jesuits$Locations_Country2016AUT -4.716e+00   3.164633 -1.49036 1.376e-01 -10.954202  1.521303 214.549
jesuits$Locations_Country2016BEL  5.295e+00   4.043618  1.30948 1.934e-01  -2.729910 13.319984  97.496
jesuits$Locations_Country2016BLR  9.529e+00   9.991633  0.95366 3.472e-01 -10.803511 29.860773  32.829
jesuits$Locations_Country2016CHE -4.028e+00   3.533471 -1.14009 2.613e-01 -11.178799  3.121817  38.464
jesuits$Locations_Country2016CZE -7.014e+00   2.968384 -2.36306 1.975e-02 -12.892308 -1.136656 118.745
jesuits$Locations_Country2016DEU -4.346e+00   2.717833 -1.59909 1.108e-01  -9.692421  1.000306 331.684
jesuits$Locations_Country2016ESP  3.989e+00   5.682170  0.70207 4.834e-01  -7.209152 15.187740 220.023
jesuits$Locations_Country2016EST -6.493e+00   2.538504 -2.55792 1.107e-02 -11.490941 -1.495649 271.598
jesuits$Locations_Country2016FRA  1.378e+00   3.569251  0.38608 6.997e-01  -5.646421  8.402437 294.923
jesuits$Locations_Country2016GBR  6.585e+00   7.830256  0.84093 4.121e-01  -9.943127 23.112469  16.901
jesuits$Locations_Country2016GRC  2.428e+01   3.576009  6.79055 5.112e-11  17.248752 31.317362 334.436
jesuits$Locations_Country2016HRV  1.840e+01  16.139896  1.13978 2.924e-01 -19.878299 56.670198   6.903
jesuits$Locations_Country2016HUN -1.576e+00   4.132699 -0.38147 7.055e-01 -10.006528  6.853553  30.878
jesuits$Locations_Country2016IRL -4.190e+00   3.901866 -1.07388 3.996e-01 -21.739560 13.359291   1.912
jesuits$Locations_Country2016ITA  1.196e+00   3.722169  0.32136 7.482e-01  -6.127907  8.520242 308.240
jesuits$Locations_Country2016LTU -2.522e+00   3.541668 -0.71202 4.794e-01  -9.616584  4.573129  55.985
jesuits$Locations_Country2016LUX  5.928e-02   4.041365  0.01467 9.905e-01 -43.172092 43.290651   1.079
jesuits$Locations_Country2016LVA -8.912e+00   3.129264 -2.84804 1.924e-01 -39.737318 21.912764   1.123
jesuits$Locations_Country2016MAR -1.093e+01   4.921916 -2.22015 2.744e-02 -20.627841 -1.226895 218.638
jesuits$Locations_Country2016MLT  2.148e+00   4.197274  0.51183 6.091e-01  -6.108235 10.404802 332.958
jesuits$Locations_Country2016NA  -5.522e+00   3.105054 -1.77837 7.852e-02 -11.685703  0.641844  95.648
jesuits$Locations_Country2016NLD  7.998e+00   6.648036  1.20312 2.414e-01  -5.767790 21.764584  22.594
jesuits$Locations_Country2016NOR -1.769e+00   4.065690 -0.43516 6.637e-01  -9.766279  6.227813 340.316
jesuits$Locations_Country2016POL -2.199e+00   3.245110 -0.67751 4.990e-01  -8.604920  4.207751 168.410
jesuits$Locations_Country2016PRT -1.796e+00   5.597456 -0.32093 7.486e-01 -12.834930  9.242148 197.252
jesuits$Locations_Country2016ROU  2.550e+01  14.274012  1.78648 1.678e-01 -18.774190 69.774533   3.144
jesuits$Locations_Country2016RUS -6.734e+00   3.112911 -2.16310 1.085e-01 -16.008775  2.541687   3.403
jesuits$Locations_Country2016SRB -4.353e+00   3.480801 -1.25045 2.120e-01 -11.198379  2.493243 351.568
jesuits$Locations_Country2016SVK  2.415e+00   5.228891  0.46193 6.461e-01  -8.086435 12.917150  50.143
jesuits$Locations_Country2016SVN -3.919e+00   4.584056 -0.85493 4.300e-01 -15.550116  7.712001   5.228
jesuits$Locations_Country2016UKR  8.437e+00   7.377282  1.14368 2.800e-01  -8.053575 24.928050   9.767

Multiple R-squared:  0.4079 ,    Adjusted R-squared:  0.3971
F-statistic:    NA on 34 and 1196 DF,  p-value: NA
```

Table 2

	Dependent variable:		
	titles		
	(1)	(2)	(3)
longevity	0.172***	0.134***	0.169***
	(0.005)	(0.010)	(0.030)
DistanceToWitt)		0.003***	0.001
		(0.001)	(0.001)
Locations_Country2016ALB			-8.814
			(15.364)
Locations_Country2016AUT			-4.716*
			(2.483)
Locations_Country2016BEL			5.295*
			(2.839)
Locations_Country2016BLR			9.529**
			(4.023)
Locations_Country2016CHE			-4.028
			(3.150)
Locations_Country2016CZE			-7.014**
			(2.757)
Locations_Country2016DEU			-4.346**
			(2.140)
Locations_Country2016ESP			3.989
			(3.018)
Locations_Country2016EST			-6.493
			(15.331)
Locations_Country2016FRA			1.378
			(2.483)
Locations_Country2016GBR			6.585*
			(3.899)
Locations_Country2016GRC			24.283***
			(9.127)
Locations_Country2016HRV			18.396***
			(5.599)
Locations_Country2016HUN			-1.576
			(3.549)
Locations_Country2016IRL			-4.190
			(7.137)
Locations_Country2016ITA			1.196
			(2.610)
Locations_Country2016LTU			-2.522

			(3.467)
Locations_Country2016LUX			0.059
			(8.966)
Locations_Country2016LVA			-8.912
			(9.055)
Locations_Country2016MAR			-10.927
			(9.391)
Locations_Country2016MLT			2.148
			(15.501)
Locations_Country2016NA			-5.522*
			(2.981)
Locations_Country2016NLD			7.998**
			(3.488)
Locations_Country2016NOR			-1.769
			(15.487)
Locations_Country2016POL			-2.199
			(2.578)
Locations_Country2016PRT			-1.796
			(3.647)
Locations_Country2016ROU			25.500***
			(7.092)
Locations_Country2016RUS			-6.734
			(7.864)
Locations_Country2016SRB			-4.353
			(15.425)
Locations_Country2016SVK			2.415
			(3.202)
Locations_Country2016SVN			-3.919
			(6.004)
Locations_Country2016UKR			8.437*
			(4.723)
Observations	1,896	1,896	1,896
R^2	0.354	0.361	0.408
Adjusted R^2	0.353	0.361	0.397
Residual Std. Error	15.779 (df = 1895)	15.688 (df = 1894)	15.236 (df = 1862)
F Statistic	1,037.170*** (df = 1; 1895)	536.137*** (df = 2; 1894)	37.730*** (df = 34; 1862)
Note:			*p<0.1; **p<0.05; ***p<0.01

A5

```
Call:
lm_robust(formula = results$Publications ~ 0 + results$distance)

Standard error type:  HC2

Coefficients:
                  Estimate Std. Error t value  Pr(>|t|) CI Lower CI Upper DF
results$distance    0.2833     0.055   5.152 1.396e-06   0.1742   0.3925 95

Multiple R-squared:  0.2214 ,    Adjusted R-squared:  0.2132
F-statistic: 26.54 on 1 and 95 DF,  p-value: 1.396e-06
```

```
Call:
lm_robust(formula = results$Publications ~ 0 + results$distance +
    resultat$Locations_2_Country2016)

Standard error type:  HC2

Coefficients:
                                Estimate Std. Error t value Pr(>|t|) CI Lower CI Upper DF
results$distance                  0.1328        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016AUT 329.9198        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016BEL 435.7523        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016CZE 223.1404        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016DEU 232.7437        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016ESP  19.3800        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016FRA 187.8170        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016ITA 125.3948        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016LTU 834.1299        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016POL 131.3326        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016PRT  92.1615        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016SVK 291.0368        NaN     NaN      NaN      NaN      NaN 83
resultat$Locations_2_Country2016UKR 134.2833        NaN     NaN      NaN      NaN      NaN 83

Multiple R-squared:  0.4208 ,    Adjusted R-squared:  0.3301
F-statistic:    NA on 13 and 83 DF,  p-value: NA
```

Table 3

	Dependent variable:	
	Publications	
	(1)	(2)
distance	0.283***	0.133
	(0.055)	(0.168)
Locations_2_Country2016AUT		329.920*
		(168.536)
Locations_2_Country2016BEL		435.752
		(310.658)
Locations_2_Country2016CZE		223.140
		(225.501)
Locations_2_Country2016DEU		232.744***
		(85.306)
Locations_2_Country2016ESP		19.380
		(171.917)
Locations_2_Country2016FRA		187.817**
		(85.555)
Locations_2_Country2016ITA		125.395
		(116.732)
Locations_2_Country2016LTU		834.130***
		(314.072)
Locations_2_Country2016POL		131.333
		(147.071)
Locations_2_Country2016PRT		92.162
		(299.130)
Locations_2_Country2016SVK		291.037
		(240.435)
Locations_2_Country2016UKR		134.283
		(325.363)
Observations	96	96
R^2	0.221	0.421
Adjusted R^2	0.213	0.330
Residual Std. Error	335.764 (df = 95)	309.802 (df = 83)
F Statistic	27.008*** (df = 1; 95)	4.639*** (df = 13; 83)
Note:		*p<0.1; **p<0.05; ***p<0.01