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LESSONS FROM THE PAST: THE VENETIAN REPUBLIC'S TAILORING OF PATENT PROTECTION TO THE CHARACTERISTICS OF THE INVENTION

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Cover Page Footnote

Senior Lecturer in Law, Notre Dame Law School. I am thankful to Mark A. Lemley, Ted Sichelman, Mark McKenna, Toni Veneri and Josh Sarnoff for their invaluable comments. I am also thankful to Carol Shabrami, Jake Crammer and Rachel Miller for excellent research assistance. Finally, I am grateful to DePaul University College of Law, especially Deans Gregory Mark and Bruce Ottley, for obtaining the generous funding for this project. Any remaining mistakes are mine.

N O R T H W E S T E R N
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*Stefania Fusco**

ABSTRACT—In recent years, much discussion in patent law has revolved around granting tailored protection to provide better incentives to inventors in different industries and to increase patent quality. For example, the deliberations that led to the enactment of the Leahy-Smith America Invents Act (AIA) focused specifically on the role of the patent system in different industries as well as on modifying remedies and patent terms to reflect the needs of distinct technology sectors. Whereas in the literature there seems to be substantial agreement on the fact that tailored protection would be beneficial for the effectiveness of the patent system, there is no consensus with respect to which entity should be vested with the authority to produce tailored patent policies, standards, and rules based on the needs of the various industries. Currently, the United States Court of Appeals for the Federal Circuit and the United States Patent and Trademark Office (USPTO) are the two principal candidates for this role. Some of this debate is connected to the broader issue in legal academia of granting general regulatory authority to administrative agencies with highly specialized knowledge. Contrary to other administrative agencies, such as the United States Environmental Protection Agency (EPA), the Securities and Exchange Commission (SEC) or the Occupational Safety and Health Administration (OSHA), Congress has never granted such authority to the USPTO; scholars have criticized this inconsistency. The strongest argument that patent experts, such as Jonathan Masur and Sarah Tran, have used to question the current status of the USPTO refers to the fact that much could be gained from the information that this agency has

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accumulated through years of experience working with inventors in different industries, particularly with respect to tailoring patent protection.

Historically, the Venetian Republic provided tailored patent protection based on the characteristics of the invention. In that context, the entity entrusted with the power to tailor the protection granted in each case was the Senate, **the issuing authority**. Moreover, although the Venetian Republic enacted what is widely recognized as the first Patent Act in the world in 1474, the Venetian Senate continued its practice of granting tailored patents until the end of the Republic in 1797. In fact, as explained by Luigi Sordelli in 1974, following the enactment of the 1474 Act, inventors could obtain protection in Venice in two ways: through the newly created statutory system or through the much older customary system of senatorial grants. Conclusive evidence that Sordelli's view was correct is provided in a separate paper that I co-authored with Ted Sichelman and Toni Veneri, in which we shed important new light on the true origin of patent law. In this article, I focus instead on tailoring patent protection. Specifically, I use original documents from the Venetian State Archives to present a detailed account of how the Venetian Republic used its **customary patent system** to tailor protection to the unique characteristics of an invention.

Furthermore, I provide a full analysis of what can be learned from the Venetian experience to inform the modern debate on tailoring patent protection. Until now, only two other legal scholars have conducted extensive examinations of the original Venetian patents: Ted Sichelman and Sean O'Connor. The Venetian patent system appears to have been a very successful one; it operated for more than 300 years and during the 16th century helped Venice to transform itself from being a nation of sailors to being a nation of artisans and engineers, and ultimately the center of technological development in Europe. Thus, the Venetian customary patent system offers important lessons on how tailored patent protection and higher patent quality can be achieved. An accurate description of this system is crucial to further understanding the specific steps that we should take to reach these goals today.

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INTRODUCTION

Is the U.S. patent system providing the optimal level of protection to *all* of the industries that it covers? At least in theory, patent law in the United States provides uniform, technology-neutral protection to all kinds of inventions.¹ This is true, notwithstanding the fact that technology is definitely not uniform.² Consequently, Dan Burk and Mark Lemley argued in 2003 that there is no reason to believe that our current patent system is performing optimally.³ In fact, according to Burk and Lemley, patent protection should be tailored to the characteristics of the respective industries.⁴ Prior to the work of Burk and Lemley, other scholars had proposed a tailored patent system,⁵ but it was following their contribution that the debate on this issue became substantial in the United States. While there appears to be some consensus among patent scholars on the question

¹ Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1577 (2003).

² *Id.*

³ *Id.*

⁴ *Id.* at 1579.

⁵ See, e.g., Himanshu S. Amin, *The Lack of Protection Afforded Software Under the Current Intellectual Property Laws*, 43 CLEV. ST. L. REV. 19 (1995); Jane C. Ginsburg, *Copyright, Common Law, and Sui Generis Protection of Databases in the United States and Abroad*, 66 U. CIN. L. REV. 151 (1997); Peter S. Menell, *Tailoring Legal Protection for Computer Software*, 39 STAN L. REV. 1329 (1987); John C. Phillips, *Sui Generis Intellectual Property Protection for Computer Software*, 60 GEO. WASH. L. REV. 997 (1992); Leo J. Raskind, *The Uncertain Case for Special Legislative Protecting Computer Software*, 47 U. PITT. L. REV. 1131 (1986); J.H. Reichman & Pamela Samuelson, *Intellectual Property Rights in Data?*, 50 VAND. L. REV. 51 (1997); Pamela Samuelson, *Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025 (1990).

of whether tailored protection would be beneficial to enhancing the effectiveness of the patent system, there is no agreement about how to achieve this result and, in particular, about which entity should be vested with the authority to produce tailored patent policies, standards and rules based on the needs of the various industries.⁶ Burk and Lemley explained in their paper that their preference would be for the courts to conduct the tailoring activity in patent law.⁷ However, they concluded that this task could also be assigned to other entities such as the United States Patent and Trademark Office (USPTO).⁸ Ultimately, the two principal candidates for this role in the literature currently seem to be the United States Court of Appeals for the Federal Circuit and the USPTO.⁹

Part of this debate is connected to the broader issue in legal academia of granting general regulatory authority to administrative agencies with highly specialized knowledge. Contrary to other administrative agencies, such as the United States Environmental Protection Agency (EPA), the Securities and Exchange Commission (SEC) or the Occupational Safety and Health Administration (OSHA), Congress has never granted such authority to the USPTO—an inconsistency often criticized by scholars.¹⁰ The strongest argument that patent experts, such as Jonathan Masur and Sarah Tran, have used to condemn the current status of the USPTO refers to the fact that much could be gained from the information that this agency has accumulated through years of experience working with inventors in different industries, particularly when it comes to tailoring patent protection.¹¹

In contrast, the Venetian government began providing tailored patent protection at the beginning of the 15th century¹² when the desire for new technologies and methodologies of production in the Republic became

⁶ See, e.g., DAN L. BURK & MARK A. LEMLEY, *THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT* (2009) (arguing that the court should play a central role in patent policy); Burk & Lemley, *supra* note 1 (arguing that the Federal Circuit is essential to patent policy); Jonathan S. Masur, *Regulating Patents*, 2010 SUP. CT. REV. 275 (2010) (arguing for a Congressional grant of substantive rulemaking authority to the PTO as a central step toward more efficient patent policy); Sarah Tran, *Policy Tailors and the Patent Office*, 46 U.C. DAVIS L. REV. 487 (2012) (arguing that the USPTO should play a central role in patent policy).

⁷ Burk & Lemley, *supra* note 1, at 1630 (“We argue that the courts must embrace their role in making the unitary patent system work for widely divergent industries.”).

⁸ *Id.* at 1696 (“In the case of patents, the PTO is an actor to consider, with what may be an expanding role in shaping the application of the statute.”).

⁹ *Id.* at 1633 (“Scholars have variously argued that the Federal Circuit should defer to the PTO or conversely that the PTO should defer to the Federal Circuit.”).

¹⁰ See Masur, *supra* note 6.

¹¹ *Id.* at 304-11.

¹² Ted Sichelman & Sean O’Connor, *Patents as Promoters of Competition: The Guild Origins of Patent Law in the Venetian Republic*, 49 SAN DIEGO L. REV. 1267, 1271 (2012).

noteworthy.¹³ In fact, the appetite for new knowledge at that time likely have prompted the Venetian government to grant privileges to those artisans and inventors—foreigners, in particular—who were willing to bring their expertise to Venice.¹⁴ Ultimately, an elaborate system of protection for inventions was created, and the first patent act in the world was enacted in 1474 (the “1474 Act”).¹⁵

After the introduction of the 1474 Act, as explained by Luigi Sordelli in 1974, the Venetian Republic had two systems of patent protection: statutory and customary.¹⁶ For the purpose of studying the tailoring of patent protection, the Venetian customary system is significant, because it represented the system that dispensed grants based on the unique characteristics of the invention. In other words, this was the system used to tailor patent protection through the conferral of terms and penalties that were not determined *a priori*, as under the statutory system, but were instead, decided by the Venetian Senate (the “Senate”) for each invention at the time of issuance, respectively.¹⁷

How did the Senate determine which term and penalty to grant in each case? In this article, I use original documents from the Venice State Archive to show that the Venetian Republic provided different terms and penalties based on the unique characteristics of the invention, *including* the industry to which the invention belonged. I reached this conclusion by analyzing all the customary patents issued by the Senate between 1560 and 1580. In particular, the investigation revealed that during the relevant time period, inventions in the Water and Energy industry received, on average, more protection than inventions in other industries. As will be explained in this article, possible explanations for the higher level of protection granted to inventions in these two industries relate to Venice’s location and the specific historical circumstances in which such grants were made.

This article describes an important historical example of tailored patent protection provided by the *issuing authority*, the Venetian Senate, to different inventions. It raises the question of what can be learned from the Venetian experience to provide better incentives to inventors in different fields, as well as to increase patent quality. Finally, it inquires whether we should redesign the role of the USPTO. As mentioned, in recent years

¹³ *Id.*

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ Luigi Sordelli, *Interesse Sociale e Progresso Tecnico Nella “Parte” Veneziana del 19 Marzo 1474 Sulle Privative Agli Inventori*, 23 RIVISTA DI DIRITTO INDUSTRIALE 358, 358-410 (1974) (It.) [hereinafter Sordelli, *Interesse Sociale*].

¹⁷ *Id.*

numerous scholars have criticized the current role of the USPTO, arguing that Congress should provide general rule-making authority in patent law to this administrative agency similar to the authority provided to other administrative agencies in their respective fields.¹⁸ However, other scholars have opposed granting more power to the USPTO both because of its past record of inefficiencies and the possibility of agency capture.¹⁹ While the issue of past USPTO inefficiencies could be quickly resolved with the allocation of more funding to this entity, the problem of agency capture is more complex.²⁰ Thus, the need to study the way in which the Venetian Senate efficiently provided tailored patent protection becomes imperative. In fact, it seems unlikely that the Venetian Senate operated completely immune to external influences. *Notwithstanding this possible limitation*, the Senate managed to create a successful system of protection that lasted more than three centuries and enabled Venice to become the dominant European city of that time. Furthermore, the same patent system was later adopted as a model throughout Europe and reached the United States in the eighteenth century. Thus, the history of Venetian patent protection seems to indicate that it is possible to effectively address the agency capture problem that might permeate the activity of the issuing authority. At a minimum, as Sarah Tran suggested, it appears that it could be used to benefit the system, rather than harm it.²¹ This benefit could be achieved by using the interaction with lobbyists to acquire additional important information about the characteristics and requirements of the various industries.²²

Part I of the article provides the necessary background information for this research. Specifically, it discusses the history of the Venetian Republic and briefly explains how patent protection was provided in Venice between the fifteenth and the eighteenth centuries. Part II describes the investigation conducted at the State Archive in Venice and its results, paying particular attention to the industry-specific analysis and the way in which the terms and penalties of the patent were granted by the Senate to different inventions. Part III highlights the implications of this study for modern

¹⁸ See *supra* note 6 and accompanying text.

¹⁹ See, e.g., BURK & LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT, *supra* note 6, at 106-07; Rochelle Dreyfuss, *Pathological Patenting: The PTO as Cause or Cure*, 104 MICH. L. REV. 1559, 1575-78 (2006); Clarisa Long, *The PTO and the Market for Influence in Patent Law*, 157 U. PA. L. REV. 1965, 1984 (2009); Michael J. Meurer, *Patent Examination Priorities*, 51 WM. & MARY L. REV. 675, 686 (2009); Arti K. Rai, *Growing Pains in the Administrative State: The Patent Office's Troubled Quest for Managerial Control*, 157 U. PA. L. REV. 2051, 2054 (2009); Ryan Vacca, *Acting Like an Administrative Agency: The Federal Circuit En Banc*, 76 MO. L. REV. 733, 754-55 (2011).

²⁰ See Masur, *supra* note 6, at 301-02, 312-15 (describing the complexity of agency capture critiques of the PTO).

²¹ Tran, *supra* note 6, at 529-32.

²² *Id.*

patent systems in terms of both the possibility of using the Venetian experience as a guide to provide tailored patent protection today, as well as the need to reconsider the USPTO role in this context. Finally, the conclusion presents some suggestions for the work that could be undertaken in future studies with respect to tailoring patent protection and improving patent quality.

I. PATENT LAW BETWEEN THE 15TH AND 18TH CENTURIES IN THE VENETIAN REPUBLIC

The Venetian Senate began issuing *ad hoc* patents, *privilegi* (translated into English, *privileges*), to protect technological inventions in 1416.²³ Subsequently, on March 19, 1474, the Venetian Republic enacted what is widely recognized to be the first patent act in the world with a large majority (116 for, ten against, and three abstentions).²⁴ The 1474 Act

²³ See Sordelli, *Interesse Sociale*, *supra* note 16, at 363 (“*L’aver impiegato la forma del privilegio, del resto usuale in quell tempo a Venezia anche per alter materie (ad esempio per concessioni di cittadinanza), stava a significare l’impiego di un modo formale già conosciuto e che rispondesse ad esigenze di dettare disposizioni caso per caso, come nella specie ricorreva in tema di invenzioni, per dare ai richiedenti facoltà particolari.*” [“Using the form of the privilege, which, after all, was typical also for other subject matters at that time in Venice (for example for granting citizenship), meant to adopt a known, formal way to respond to the need for regulating case-by-case, like in the case of inventions, and give petitioners special powers.”]); *infra* Part I.B The Origin of Patent Protection. See also Sordelli, *Interesse Sociale*, *supra* note 16, at 371 (“*Queste notazioni servono a spiegare una situazione concreta esistente nei secoli dal XIII al XV ed al XVI a Venezia . . . in quel period fosse usuale servirsi dello strumento del privilegio . . . per far sorgere in capo ai richiedenti dei diritti esclusivi con poteri di escludere terzi per l’attuazione di macchine, meccanismi, artifici che costituiscono cioè trovati aventi . . . le caratteristiche di invenzioni.*” [“These remarks are necessary to explain a concrete situation which was present in Venice between the 13th and 15th century and the 16th century . . . when it was common to use the privilege tool to grant petitioners exclusive rights with the power to exclude third parties to make machines, mechanisms, artifices which constitute discoveries . . . having the characteristics of inventions.”]).

²⁴ See, e.g., ROBERTO BERVEGLIERI, *INVENTORI STRANIERI A VENEZIA, 1474-1788: IMPORTAZIONE DI TECNOLOGIA E CIRCOLAZIONE DI TECNICI ARTIGIANI INVENTORI*. REPERTORIO (1995) (It.); ROBERT P. MERGES & JOHN F. DUFFY, *PATENT LAW POLICY: CASE AND MATERIALS* 3 (6th ed. 2013); Luca Molà, *Il Mercato delle Innovazioni nell’Italia del Rinascimento*, in *LE TECHNICIEN DANS LA CITÉ EN EUROPE OCCIDENTALE 1250-1650* (Mathieux Arnoux & Pierre Monnet eds., 2004) (Fr.); CRAIG A. NARD, *THE LAW OF PATENTS* 11 (3d ed. 2014); John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1, 23 (2007); Shubha Ghosh, *Exclusivity—The Roadblock to Democracy?* 50 ST. LOUIS U. L.J. 799, 805 (2006); Pamela O. Long, *Invention, Authorship, “Intellectual Property” and the Origin of Patents: Notes Towards a Conceptual History*, 32 TECH. & CULTURE 846, 878 (1991); Giulio Mandich, *Le Privative Industriali Veneziane (1450-1550)*, 34 RIVISTA DI DIRITTO COMMERCIALE 511 (1936) (It.), translated in Giulio Mandich, *Venetian Patents (1450-1550)*, 30 J. PAT. OFF. SOC’Y 166 (1948); Giulio Mandich, *Primi Riconoscimenti Veneziana di un Diritto ai Privativa agli Inventori*, 7 RIVISTA DI DIRITTO COMMERCIALE 101 (1958) (It.), translated in Giulio Mandich, *Venetian Origins of Inventors’ Rights*, 42 J. PAT. OFF. SOC’Y 378 (1960); Christopher May, *The Venetian Moment: New Technologies, Legal Innovation and the Institutional Origins of Intellectual Property*, 20 PROMETHEUS 159, 160 (2002); Sordelli, *Interesse Sociale*, *supra* note 16.

conferred the exclusive authority to issue patents in Venice upon an administrative body called the *Provveditori di Comun*.²⁵ Nevertheless, the Venetian Senate continued to grant patents to inventors until the end of the Republic in 1797.²⁶ Scholars have generally explained this inconsistency in two ways. The majority argued that after 1474, patents were granted in Venice based on the 1474 Act, or in other words, based on the newly established statutory patent system. Specifically, the majority of scholars contended that the 1474 Act formalized and superseded the previous, customary system of senatorial grants.²⁷ However, they also claimed that the statute was loosely applied.²⁸ Consequently, although the 1474 Act granted the power to issue patents to the *Provveditori di Comun*, in practice, the Senate continued to serve as the entity that granted patent protection based on the criteria codified in the 1474 Act. Moreover, the discovery of a few patents issued in full compliance with the 1474 Act, notably granted by the *Provveditori di Comun*, with a ten years term and a 100 ducats penalty, represented exceptions to what was instead the normal application of the statute.²⁹ Alternatively, one other scholar claimed that the

²⁵ See *infra* note 69.

²⁶ Sordelli, *Interesse Sociale*, *supra* note 16, at 376.

²⁷ See, e.g., Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 517; Mandich, *Primi Riconoscimenti Veneziana di un Diritto ai Privativa agli Inventori*, *supra* note 24, at 134, 143.

²⁸ See, e.g., R. Berveglieri & C. Poni, *Three Centuries of Venetian Patents 1474-1796*, ACTA HISTORIAE RERUM NATURALIUM NEC NON TECHNICARUM 17, 381 (1982); BRUCE W. BUGBEE, GENESIS OF AMERICAN PATENT AND COPYRIGHT LAW (1967); LUCA MOLÀ, THE SILK INDUSTRY OF RENAISSANCE VENICE 188 (2000); John F. Duffy, *Harmony and Diversity in Global Patent Law*, 17 BERKELEY TECH. L.J. 685 (2002); Maximilian Frumkin, *Early History of Patents for Invention*, 26 TRANSACTIONS NEWCOMEN SOC'Y 47 (1947); M. Frumkin, *The Origin of Patents*, 27 J. PAT. OFF. SOC'Y 143 (1945); Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24; Frank D. Prager, *A History of Intellectual Property from 1545 to 1787*, 26 J. PAT. OFF. SOC'Y 711 (1944); Craig A. Nard & Andrew P. Morriss, *Constitutionalizing Patents: From Venice to Philadelphia*, 2 REV. L. & ECON 223 (2006); Frank D. Prager, *Examination of the Inventions from the Middle Ages to 1836*, 46 J. PAT. OFF. SOC'Y 268 (1964); Frank D. Prager, *Standards of Patentable Inventions from 1474 to 1952*, 20 U. CHI. L. REV. (1952).

²⁹ In his investigation at the Venice State Archive, Mandich discovered five statutory patents, issued in full compliance with the statute, which he considered to be atypical application of the 1474 Act. He discusses the five privileges at page 136 and, in particular, in footnote 74 of *Primi Riconoscimenti*. Mandich, *Primi Riconoscimenti Veneziana di un Diritto ai Privativa agli Inventori*, *supra* note 24, at 136 n.74. They are: Faustino Bergnato, ASV, *Provveditori di Comun, Scritture*, busta 6, registro 1, carta 3 recto and verso (issued on Mar. 14, 1592); Paris di Nolli and Marc'Aurelio Gaburro, ASV, *Provveditori di Comun, Scritture*, busta 6, registro 1, carta 5 recto (issued on July 10, 1592); Piero Caracello, ASV, *Provveditori di Comun, Scritture*, busta 6, registro 1, carta 90 recto (issued on Dec. 16, 1593); Piero Bordin, ASV, *Provveditori di Comun, Scritture*, busta 6, registro 1, carta 109 recto (issued on Apr. 18, 1594); Zuanne Tramontano, ASV, *Provveditori di Comun, Scritture*, busta 6, registro 1, carta 185 verso (issued on July 10, 1595). See *id.* Moreover, in his previous work, *Le Privative Industriali Veneziane (1450-1550)*, Mandich seems to acknowledge the existence of **statutory** patents by saying that “based on the 1474 Act, patents should have been issued by the *Provveditori di*

1474 Act was a first abortive attempt to create a statutory patent system.³⁰ He argued that when the 1474 Act was implemented, interested subjects forgot about its existence and simply continued to adhere to the previous practice of *privileges* issued by the Senate.³¹

Nevertheless, in 1974, an Italian law professor, Luigi Sordelli, from the University of Siena questioned the validity of these explanations and suggested that following the enactment of the 1474 Act in Venice, it was possible to obtain patent protection in **two** ways: through the statutory system newly created by the 1474 Act, and through the much older customary system characterized by direct, *ad hoc* patents issued by the Senate.³² In other words, in Sordelli's opinion, the 1474 Act did not replace or formalize the previous practice of senatorial grants.³³ On the contrary, he convincingly argued that "at that time, even after they enacted the 'statute,' the Senate (the most important legislative body of the Republic), would not deem its power to grant single privileges or special ones with higher or different terms than those indicated in the law to be limited [in any way]."³⁴ Moreover, Sordelli added that insufficient investigation at the Venice State Archives rather than to the failure to implement the statute resulted in only a few extant patents issued by the *Provveditori di Comun* in full

Comun, but the *Scritture*, that are kept at the Venice State Archive and **collect few grants issued by the *Provveditori* in conformity to the aforementioned statute**, are dated only from 1562." (translated from Italian) (emphasis added). Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 523 n.4. In this way, Mandich appears to argue that, because the relative documents are not extant anymore (over time the Venice Achieves have been subject to nine or ten fires—the most devastating one in 1577—and the *Scritture* dating before 1562 have been lost), it is impossible to determine if there has been **any substantial, literal** application (not just the issuance of "few grants") of the 1474 Act immediately following its enactment. *See id.* at 523. For information about the fires that destroyed part of the *Scritture*, see ANDREA DA MOSTO, L'ARCHIVIO DI STATO DI VENEZIA, TOMO V (1937) (It.), http://www.archiviodistatovenezia.it/siasve/DaMosto_1.pdf [https://perma.cc/5L2H-AMB7].

³⁰ REMO FRANCESCHELLI, TRATTATO DI DIRITTO INDUSTRIALE (1960) (It.);

Remo Franceschelli, *La Prima Legge Generale in Materia di Invenzioni Industriali (la "Parte" Veneziana 19 Marzo 1474)*, 4 RIVISTA DI DIRITTO INDUSTRIALE 371, 371-73 (1955) (It.).

³¹ *Id.*

³² Sordelli, *Interesse Sociale*, *supra* note 16, at 380 ("Therefore, this allows . . . to see the coexistence of industrial privileges granted by the Senate and privileges granted by the *Provveditori di Comun* because of the power given to them by a law . . . issued by the Senate.") (translated from Italian).

³³ *Id.* at 378.

³⁴ *Id.* at 379 ("[N]el periodo in esame, il Senato (il maggior organo legislativo della Repubblica) potesse non sentirsi limitato nella sua sovranità anche dopo l'emanazione della "parte," nel concedere privilegi singoli o speciali in termini maggiori o diversi dalla legge"). Moreover, Sordelli noted that "in the XVI century and, generally, around that time in Venice . . . it was known the super power of the Senate and its tendency to centralize all the functions used to regulate the life of the State in political and economic matters . . ." (quoting ENRICO BESTA, IL SENATO VENEZIANO (ORIGINI, COSTITUZIONE, ATTRIBUZIONI E RITI) (1899)) (internal quotation marks omitted). *Id.*

compliance with the specifications of the Act.³⁵ In these respects, it is notable that in 2000 Luca Molà, an associate professor and Director of the Centre for the History of Innovation and Creativity at the University of Warwick, managed to identify fifteen more statutory patents at the Venice State Archive.³⁶ More significantly, in recent years, 85 additional patents issued by the *Provveditori di Comun* have been discovered. These additional patents are fully examined in a separate paper that I co-authored with Ted Sichelman and Toni Veneri, in which we provide conclusive evidence that Sordelli's hypothesis was correct and shed important new light on the true origin of patent law.³⁷

The existence of two parallel systems of patent protection for inventions manifests great relevance for the research described in this paper, because tailoring patent protection in Venice functioned exclusively through Senatorial privileges. Indeed, the conditions for the patents issued under the 1474 Act, in particular, in regard to their terms and penalties for infringement, were established *ad priori* and were the same for all the inventions. As explained below, the situation in the context of patents issued under the customary system was different—the Senate had unconditional power to decide the number of years of exclusivity, as well as the consequences for violating the patent in each case. In this way, the Senate could customize the protection granted and promote certain inventions over others. Therefore, this article focuses on the Venetian *customary system*. After a brief historical overview and description of the statutory patent system, Part I explains how inventors could obtain Senatorial privileges and the relevance of these grants for the protection of inventions in different industries.

A. Brief Historical Background of the Venetian Republic

The history of Venice begins around the year 697 with the organization of the lagoon as an autonomous military outpost and the election of its first *dux*, the *Doge*, by the local population.³⁸

³⁵ See Franceschelli, *La Prima Legge Generale in Materia di Invenzioni Industriali (la "Parte" Veneziana 19 Marzo 1474)*, *supra* note 30, at 377. Franceschelli noted that a lot of the records collecting documents relevant for the determination of the activity of the *Provveditori di Comun* during the period immediately after the enactment of the 1474 Act are not extant anymore. Consequently, it is impossible to determine if the patent statute was applied soon after its adoption or with some delay. See also Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24.

³⁶ Luca Molà identified fifteen more patents issued directly by the *Provveditori di Comun* and making explicit reference to the 1474 Act. See MOLÀ, *supra* note 28.

³⁷ Ted Sichelman, Stefania Fusco & Toni Veneri, *Retracing the Origins of the Patent System* (unpublished manuscript) (on file with author).

³⁸ See FREDERIC C. LANE, *STORIA DI VENEZIA* 8 (1978) (It.) (the term *Doge* derives from the Latin word *dux* translated as "military leader." The *Doge* of Venezia was the chief magistrate and leader of

Notwithstanding the independent designation of a leader, at that time Venice was under the direct control of the Byzantine Empire.³⁹ The close relationship between the lagoon and the Emperor of Constantinople was signified by the fact that the *Doge* received orders from Ravenna, the center of the Byzantine power in Italy, for at least the next two centuries.⁴⁰

The Byzantine Empire's influence progressively weakened over time, and by the beginning of the 9th century, Venice had acquired *de facto* independence, while nominally remaining Byzantine.⁴¹ In the meantime, Venice had refused to subject itself to the authority of Charlemagne, who became Emperor in 800 and unified most of Western Europe under the Carolingian Empire.⁴² By the year 1000, Venice was completely independent and was determined to become what historians have called "the freest of all the many Italian free-cities of that time."⁴³

After the year 1000, Venice rapidly evolved from a community of fishermen, boatmen and small merchants into a maritime nation with substantial supremacy on the Adriatic coasts.⁴⁴ During the 12th century, Venice became extremely wealthy through its control of trade between Europe and the Levant, and even expanded its dominion beyond the Adriatic Sea.⁴⁵ Because of Venetian success in international trade and the ensuing easy access that its merchants had within a growing number of new markets, there was a significant increase in the international demand for Venetian products, in addition to the sizable domestic demand.⁴⁶ Consequently, during the 14th and 15th centuries, the need to expand the

the Republic); *see also* GINO BINOBENVENUTI, *LE REPUBBLICHE MARINARE: AMALFI, PISA, GENOVA E VENEZIA* (1989) (It.); CHARLES DIEHL, *LA REPUBBLICA DI VENEZIA* (2007) (It.); I SAMUELE ROMANIN, *STORIA DOCUMENTATA DI VENEZIA* (1860) (It.).

³⁹ LANE, *supra* note 38, at 8.

⁴⁰ The great influence of the Byzantine Empire over the Venetian Republic is clearly marked by the lagoon's political institutions and art; *Id.*

⁴¹ *Id.*

⁴² In 810 Charlemagne sent his son, Pepin, to conquer Venice and the Byzantine Emperor intervened on behalf of Venice with his army to reaffirm his authority over the lagoon. With the *Pax Nicephori*, Charlemagne promised the Byzantine emperor, Nikephoros I, to renounce reducing the lagoon of Venice and Dalmatia under his power. DONALD M NICOL, *BYZANTIUM AND VENICE: A STUDY IN DIPLOMATIC AND CULTURAL RELATIONS* 23 (1988); *see also* ROBERTO CESSI, 1-2 *PACTA VENETA*, in 4-5 *ARCHIVIO VENETO* (1928-1929) (It.). While it was also formally stipulated that the Venetian territory, called "*dogato*," belonged to the Byzantine Empire, Venice remained under the leadership of the *Doge* whose actions did not reflect the Emperor's orders anymore; LANE, *supra* note 38, at 8.

⁴³ Venice also avoided being subjected to the authority of the various German tribes that descended onto the Italian peninsula after the collapse of the Roman Empire. LANE, *supra* note 38, at 7.

⁴⁴ *Id.*

⁴⁵ JOHN JULIUS NORWICH, *A HISTORY OF VENICE* (1982).

⁴⁶ LANE, *supra* note 38, at 184.

production of local goods to satisfy foreign markets was of primary importance, for what at that point had become the Republic of Venice, or the *Serenissima Repubblica*.⁴⁷ It is in this context that the Venetian government began issuing “ad hoc” patents, called *privilegi*,⁴⁸ which were primarily granted by the Senate through private Acts.⁴⁹

The purpose of these *privilegi*, at least initially, was to lure foreign artisans and induce them to bring their knowledge and techniques to Venice.⁵⁰ The idea was to promote innovation and boost the local production of goods by introducing new technologies and increasing competition. In fact, as Ted Sichelman and Sean O’Connor have previously pointed out, these initial “patents were not negative rights to exclude, as today, but positive privileges or licenses to practice.”⁵¹ In other words, these were “pro-competitive patents” designed to break the monopoly of the local trade associations of specialist artisans and merchants, the guilds, by conferring non-members the possibility of selling products and practicing methods of production, which were otherwise forbidden to them.⁵² The next subsection fully explains the reasons for the creation of the first system of patent protection in the world.⁵³

B. *The Origin of Patent Protection*

Since the beginning of the 12th century, the activity of artisans and merchants had been highly regulated in Venice.⁵⁴ Specifically, in 1173, the Venetian government passed legislation that granted the guilds exclusive rights to practice “mechanical trades,” such as glassmaking, shipbuilding and silk making.⁵⁵ Moreover, foreign nationals were generally excluded from becoming guild members. In a time of extraordinary economic growth

⁴⁷ On April 15, 1423, Francesco Foscari became *Doge* and acquired the title of Prince, *Serenissimo Principe*. Contextually, the *Serenissima Signoria*, a supreme government body comprising the *Doge*, six advisers to the *Doge* called the *Minor Consiglio* and three leaders of the *Quarantia* (the supreme judicial tribunal), was created by the *Maggior Consiglio* (a political organ with the power to create laws). The *Commune* of Venice ceased to exist and became the *Serenissima Repubblica*. FREDERICK C. LANE, *VENICE: A MARITIME REPUBLIC* 112 (1973).

⁴⁸ See *supra* note 32 and accompanying text.

⁴⁹ Sichelman & O’Connor, *supra* note 12, at 1273-78.

⁵⁰ *Id.* at 1269.

⁵¹ *Id.* (“Unlike today’s patent systems—which solely encompass negative rights to exclude against the backdrop of a generally free market—the Venetian patent system provide a dual right, part of which allowed the patent holder to compete in an otherwise regulated system dominated by the guilds.”).

⁵² *Id.*

⁵³ See *supra* note 24 and accompanying text.

⁵⁴ Sichelman & O’Connor, *supra* note 12, at 1273-78.

⁵⁵ RICHARD J. GOY, *VENETIAN VERNACULAR ARCHITECTURE: TRADITIONAL HOUSING IN THE VENETIAN LAGOON* 93-94 (1989).

and expansion in international trade, such as that in 14th century Venice, these regulations must have appeared to be significant limitations on the full exploitation of the many opportunities that the Venetian policy of independence and colonialism provided.⁵⁶ However, conflicts emerged at that time between Venetian merchants, who had the capital and skills to pursue those opportunities and artisans, who wanted to protect their markets and traditional ways of production.⁵⁷

Ultimately, the Venetian government opted to open the city's doors to innovation and competition.⁵⁸ Therefore, commencing in the early 13th Century, the Grand Council of Venice, the *Maggior Consiglio*, began granting licenses to build various kinds of machines, such as innovative mills and water pumps, to individuals who were not members of the related guilds.⁵⁹ The beneficiaries of these licenses were often foreigners with skills and technologies unknown in Venice.⁶⁰ However, it soon became obvious that these licenses failed to give adequate protection to inventors and skilled artisans.⁶¹ That is, they did not provide the possibility of precluding others—guild-members, in particular—from copying the new trades, methods, and machines that began appearing in Venetian territory.⁶² Consequently, inventors likely have complained and petitioned for something more than the mere privilege of competing with the guilds. They likely have requested the much more significant *right to exclude* others from practicing their inventions.⁶³ The first patent incorporating exclusionary rights that we know of was granted by the *Maggior Consiglio* in 1416 to Ser Francisus Petri, perhaps unsurprisingly a foreigner, for a device to full wool (that is, a device to turn wool into felt).⁶⁴

During the following three centuries until the end of the Republic in 1796, the Venetian government issued thousands of patents to both foreigners and nationals for a wide variety of inventions, including watermills, canal-dredging equipment, food-processing machines, soap formulations and dyeing methods.⁶⁵ By the 16th century, Venice had

⁵⁶ See Sichelman & O'Connor, *supra* note 12, at 1268-69.

⁵⁷ LANE, *supra* note 38, at 184.

⁵⁸ Sichelman & O'Connor, *supra* note 12, at 1274, 1278.

⁵⁹ *Id.* at 1274.

⁶⁰ *Id.*

⁶¹ *Id.*

⁶² *Id.*

⁶³ ASV, *Maggior Consiglio, Deliberazioni*, registro 22, carta 7 verso (image file number 15v) (issued on Feb. 20, 1415) (the term of this patent was 50 years); see also Mandich, *Primi Riconoscimenti Veneziana di un Diritto ai Privativa agli Inventori*, *supra* note 24.

⁶⁴ *Id.*

⁶⁵ See *infra* Part II; see also Molà, *supra* note 24.

undergone a complete transformation, having become the center of technological development in Europe,⁶⁶ and having changed from a nation of sailors into a nation of mainly artisans and engineers.⁶⁷ The full description of the Venetian Republic's system of patent protection is the subject of the next subsection.

C. *The Venetian Patent Systems: Customary Patents and Statutory Patents*

In 1974, Luigi Sordelli explained that between the 15th and 18th centuries two systems of patent protection were operating concurrently in Venice: one based on customary law, and the other based on the 1474 Patent Act.⁶⁸ This part of the article first briefly describes the statutory system, and then focuses on the customary system to provide information relevant to understanding the mechanisms that the Venetian government used to promote certain industries over others.

1. *The Statutory System*

The Venetian statutory patent system was based on a patent act enacted by the Senate in 1474. Under the 1474 Act, an inventor who wanted to obtain a patent had to submit an application, called *supplica*, to the office of the *Provveditori di Comun*.⁶⁹ At that point, the *Provveditori di Comun* reviewed the application and issued a response often stating that "they had seen the invention," and sometimes, that they had made a determination about its social utility and novelty.⁷⁰ Ultimately, if the result of the review was positive, a *privilegio* was granted to the inventor. As explained below, the review operated by the *Provveditori di Comun* for statutory patents was much more limited than the one made for customary patents, in which multiple agencies that specialized in different subject matters were usually involved in the examination process.⁷¹ Consequently, whereas reviewing the applications for senatorial patents could take several

⁶⁶ *Id.*

⁶⁷ LANE, *supra* note 38.

⁶⁸ *See supra* Part I.

⁶⁹ Sordelli noted that a copy of the 1474 Act was included in the "*Capitolare Maggiore*," a collection of laws and administrative acts from 1272 to 1600 used to define the competences of the *Provveditori di Commun*. *See* Sordelli, *Interesse Sociale*, *supra* note 16, at 376 and 392. *See also* Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 520. The *Provveditori di Comun* was an executive department instituted in 1256. It was responsible for numerous subject matters including: trade, the arts or *arti* (wool working, silk making, gold working etc.), shipbuilding, glassmaking, streets, small channels, bridges, schools, immigration, and the association of doctors and surgeons. *See* ORGANI AMMINISTRATIVI (It.), http://www.icar.beniculturali.it/biblio/pdf/damosto_html/05_html.html [<https://perma.cc/FD68-VU4N>].

⁷⁰ Sordelli, *Interesse Sociale*, *supra* note 16, at 394-96.

⁷¹ *See infra* note 72. *See also supra* notes 32-34 and accompanying text.

months, the one for patents granted by the *Provveditori di Commun* was cursory, and resulted in the issuance of a privilege soon after the submission of the *supplica*.⁷²

A typical example of a *privilegio* issued by the *Provveditori di Comun* is reported below:

We, Advise Manin, Fantin Diego and Zuanne Danodo, for the Illustrious and Eminent Ducal Domain of Venice *Provveditori di Comun*, having seen the *supplica* produced before us this very day by Aleessandro Tornimben and Sir. Girolamo Prevaglio for which they have requested the grant of a privilege for ten consecutive years, that no one aside from them or other [person having authority from them], in this city or other lands or places in this Illustrious Domain, will be allowed to make or have [other people] make in any way the cakes . . . with seven kinds of dough and . . . all kinds of meat . . . and fish and with the method and dosages found by the applicants . . . as it is possible to read in their *supplica* . . . [S]ince We consider it to be a good thing to favor new invention through [the exercise] of **our authority and because of the March 19, 1474 Act of the Worshipful Senate**, we grant freedom and privilege to the above mentioned Sir, Alessandro et Girolamo, that for **ten consecutive years** no one aside from those [people having their permission] will be able to make for the purpose of selling in these cities, lands and places of this Illustrious Domain, the new inventions of cakes and other [things] [made] in the way [described] above . . . under the penalty of **100 ducats** and of losing the things that will be found [at the time the infringement is discovered], and of other penalties included in the Act to which all the infringers are . . . subject; being however [understood] that the invention is new and not being found by others . . . [and that] no other privilege has been granted by others, being understood that this privilege cannot have a negative impact on those who want to [make the cakes] at home or the host for the advantage of their taverns, and, in the same way, being understood that the pastry makers will not be limited to doing what they are permitted to do by their [guild].⁷³

⁷² See *infra* Part I.C.2. See also Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 519 (arguing that, based on the words of the 1474 Act, the effect of the submission of the application was the immediate issuance of the patent).

⁷³ See ASV, *Provveditori di Comun*, busta 17, registro 33, carte 62 verso and 63 recto (issued on Sept. 19, 1592) at 17 (“Noi Alvise Manin, Fantin Diedo et Zuanne Dandolo per l’Illustrissimo Ducal Dominio di Venetia Provveditori de Comun veduta la supplicatione davanti di noi prodotta sotto il presente giorno per ser Alessandro Tornimben et missier Gierolamo Prevaglio per la quale ci ricercano che gli dobbiamo concederli privilegio per anni dieci continui altri che loro o cui da loro haverà causa così in questa città come in altre terre et luochi di questo Illustrissimo Dominio non possi far né far fare quovis modo la nova inventione di pastizzi fatti de cinque sorti di paste lavorati con ogni sorte de carnami et uzzelami sì di grasso come di magro con pesce et senza fatti in diverse sorti foggie et maniere et modi de dosi per loro supplicanti ritrovate et medesimamente sfogliade torte et giudoni et offete (?) come nella loro supplicatione si legge alla qual si habbi relatione onde considerata Noi esser

As this example illustrates, statutory patents made direct reference to the 1474 Act and were issued in full application of the statute.⁷⁴ Importantly, they were granted for a term of ten years and provided a penalty of 100 ducats in cases of infringement.⁷⁵ These two elements fundamentally differentiate statutory patents from customary patents, which did not have a fixed term or penalty.⁷⁶ Thus, a Venetian statutory patent was the result of a straightforward process detailed in the Patent Act and characterized by a limited review of the application conducted by the issuing authority, the *Provveditori di Comun*.

On the other hand, depending on the characteristics of the invention, the customary patents could provide more and stronger rights, and were the result of a much more extensive examination of the application than the patents issued under the 1474 Act. In other words, as discussed in detail in the next subsection, customary patents were the tools to obtain tailored, and often, stronger patent protection for inventions in the Venetian Republic.

2. *The Customary System*

Between the 15th and 18th centuries, patent protection could also be obtained in the Venetian Republic through customary law.⁷⁷ In this case, applicants had the option of submitting an application, or *supplica*, which was addressed to the *Doge* or, sometimes, the *Doge* and the *Signoria*.⁷⁸ The *supplica* was then transmitted to the *Minor Consiglio*, which in turn, assigned one or more of its departments to the substantive examination of the invention based on its subject matter.⁷⁹ The executive departments that were frequently involved in the review of patent applications were⁸⁰:

cosa giusta a favorir nove inventioni per autorità del magistrato nostro et virtù della parte dell'Eccellentissimo Senato, 1474 19 marzo concedemo libertà et privilegio alli suddetti ser Alessandro et Gierolamo che per anni X continuuj alcuno sij chi esser si vogli non possi far né far fare per vender in questa città né altre città terre et luochi di questo Illustrissimo Dominio le nove inventioni di far pastizzi et altro, nel modo come di sopra si come hanno supplicato sotto pena de ducati cento et perdita delle robbe che seranno ritrovate et altre pene contenute nella detta parte, alla qual sottozasi tutti li transgressori inremissibilmente essendo però inventione nova non più d'altri ariccordata né ad altri statoli concesso privilegio, intendendosi che il presente privelegio non possi far pregiudicio a quelli che volessero fare per casa loro alli pasti banchetti né etiam alli osti per commodo delle loro hostarie, et così s'intendi alli scalletteri non gli sij pregiudicato di far quel tanto che ad essa arte gli è concesso. Datum die xix Septembris 1592.) (emphasis added).

⁷⁴ Sordelli, *Interesse Sociale*, supra note 16, at 376 and 392.

⁷⁵ See Sichelman & O'Connor, supra note 12 and accompanying text.

⁷⁶ See infra Part II.2.

⁷⁷ See Sordelli, *Interesse Sociale*, supra note 16.

⁷⁸ Mandich, *Le Privative Industriali Veneziane (1450-1550)*, supra note 24, at 520, 523. The *Serenissima Signoria* was the supreme government body of the Venetian Republic and comprised the *Doge*, the *Minor Consiglio* and three leaders of the *Quarantia*. See LANE, supra note 38.

⁷⁹ Mandich, *Le Privative Industriali Veneziane (1450-1550)*, supra note 24, at 523 (noting that the reason for the involvement of different magistrates could be to guarantee the inventor's rights by

- *Provveditori di Comun*, for all kinds of inventions;⁸¹
- *Savi ed Essecuatori alle Acque*, for inventions related to water;
- *Sopraprovveditori e Provveditori alle Biave*, for inventions related to agriculture, food-processing machines and ovens;
- *Cinque Savii alla Mercantia*, for inventions related to trade;
- *Provveditori Sopra la Seta*, for inventions related to silk working;
- *Provveditori alla Sanità*, for health-related invention.

In the case of Sebastano di Silvestri, who in 1560 submitted a *supplica* for a “new method to provide energy to certain draining water machines,”⁸² the *Minor Consiglio* assigned its prosecution to the *Provveditori di Comun* and the *Savi ed Essecuatori alle Acque*. Typically, the notation of the assignment, comprising a preset formula, was added by the secretary of the *Minor Consiglio* under the text of the original application. In Silvestri’s case it states:

The *Savi ed Essecuatori alle Acque* and the *Proveditor di Comun* will answer this *supplica* and, having seen the [invention], will declare and sign their opinion under oath and according to the laws.⁸³

In the *supplica*, the inventor would generally provide her name, her origin, a description of the invention, and an assertion that the invention was new, ingenious and useful.⁸⁴ Further, a statement referring to the significant cost and the amount of work necessary to produce the invention was often present.⁸⁵ The inventor would also expressly request granting the

protecting her from the arbitrary judgement of a single deciding body); see also *infra* Part II. The *Minor Consiglio* was a constitutional body of the Republic and comprised six advisors to the *Doge*, who administered his affairs. See LANE, *supra* note 38.

⁸⁰ See generally, Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 523; Molà, *supra* note 24.

⁸¹ For most applications, regardless of subject matter, the examination was performed by *Provveditori di Comun* often together with one or two other executive departments of the *Minor Consiglio*. See Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 523.

⁸² Sebastano di Silvestri, ASV, Senato, *Deliberazioni, Terra*, registro 43, carta 20v (image file number 81) (issued on Nov. 2, 1560).

⁸³ *Id.* (“*Respondeant huic supplicatione Domini Sapientes et Executores super Acquis, necnon Domini Proveditores Communis, et visis videndis dicant eorum opinionem cum iuramento et subscriptione manuum suarum iuxta leges.*”).

⁸⁴ Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 521 (“[T]he applications were from citizens of Venice, subjects of the Domain, foreigners [coming] from the peninsula, artisans, merchants, nobles and, in 1508, for the first time, also from a Jew. [A considerable number of petitioners] were companies . . . It is also [necessary] to remember that a lot of petitioners remained anonymous until they received the grant.”) (translated from Italian).

⁸⁵ *Id.* at 522.

privilegio—its attendant exclusive rights with geographic coverage and a term of protection.⁸⁶ Finally, in the majority of the cases, she would ask for a penalty in case of infringement of the patent.⁸⁷ Sebastano di Silvestri's application again represents a useful example. It states:

I, Sebastian di Silvestri Domino, son of the excellent Sr. Marin, having found an easy, fast, very effective and inexpensive method of providing energy to [certain draining water machines] . . . humbly petition Your Grace to grant a privilege to me that nobody in this Illustrious Domain would be able to use similar methods without a license or an authorization from me or my heirs or other person having authority from me, for a **term of 50 years**. Under **penalty of 25 ducats and of losing the instrument or machine** that [the infringer] had built.⁸⁸

Once the examination was complete, the various executive departments involved in the review process recorded their recommendation to grant or reject the *privilege* in their official records and sent it to the *Minor Consiglio*.⁸⁹ In some cases, they also expressed an opinion regarding the requested term. Thus, in Silvestri's case, the *Savi ed Essecutori alle Acque* wrote:

[W]e humbly answer that our opinion is that [Your Grace] should grant the privilege, with the condition, however, that [the invention] will not create an obstacle to the flow of the water . . . and that the requested term of 50 years appears too high, that 25 years should be enough.⁹⁰

At that point, assuming a positive result of the substantive examination, the application moved forward and was presented by individual councilors of the *Minor Consiglio* to the Senate for vote.⁹¹ If

⁸⁶ See also *infra* Part II.

⁸⁷ See also *infra* Part II.

⁸⁸ Silvestri, *supra* note 82 (“*Impero` havendo io Sebastian di Silvestri Domino figliol dell'eccellente missier Marin, ritrovato un modo di dar un moto facile veloce e di gran forza et poca spesa, a [edifici da scolar acqua] . . . supplico riverentemente Vostra Serenita` che mi voglia concedere grazia, che nuino sotto questo Illustrissimo Dominio adoperar simil sorte di moto senza licentia et voluntà mia et de mei heredi o cui heverà causa da me per spacio de anni 50. Sotto la pena di ducati 25 et di perder lo instrumento over edificio che evesse fatto . . .*”).

⁸⁹ See Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 524-25.

⁹⁰ Silvestri, *supra* note 82 (“*[R]iveramente rispondemo nostro parer esser che per Vostra Sublimità li sia concessa la grazia, con condizione però che non se impedisca il corso delle acque . . . ne pare che il tempo che'l richiede de 50 anni sia troppo, ch eli possa bastar havendo de anni 25 . . .*”) (demonstrating negotiations resulting in limited term of protection).

⁹¹ Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 524-25, (noting that “the patent granted by the Senate—called “*privilegio*” or “*gratia*”—is, generally, [issued] in conformity, [perhaps] with some modification, with the *supplica* Indeed one of the formulas often used for the grant says: ‘we grant what the aforementioned petitioner has requested’ (*quod*

approved, a brief summary of the grant was recorded in the official register of the Senate, called *registri*.⁹² In Silvestri's case, the Senate, notwithstanding the fact that the very influential *Provveditori di Comun*, also assigned to the case, had approved the requested 50 years, ultimately decided to follow the recommendation of the *Savi ed Essecutori alle Acque* and granted a *privilegio* with a 25-year term. The grant states:

Under the authority of this Council it is granted to Domino Sebastaino di Silvestri that for **25 years** no one aside from him or other person having authority from him, in this city or other city or place in our Domain, can use the new, easy, fast, inexpensive and very effective method that he has found to provide energy to various machines invented by engineers to drain and absorb water **under the penalty included in his *supplica***,⁹³

As the Silvestri case illustrates, contrary to the Venetian statutory patents, the Venetian customary patents did not have a fixed term and penalty. Based on the original documents examined at the Venice State Archive for this research, customary patents could be granted for 10, 20, 25, 30, 40, 50 or 60 years.⁹⁴ They could also be granted "for life," or in perpetuity.⁹⁵ Similarly, there was significant variation in the assigned penalties, which could range from two ducats per infringing item to a flat 1,000 ducat fine.⁹⁶ The Senate possessed the ultimate authority to decide both the term and the penalty in each case.⁹⁷ Specifically, the Senate had the power to decide whether to grant the term requested by the inventor in her *supplica* or to reject it and grant a different one, typically, a shorter term.⁹⁸

The Senate's ability to decide the term is a key element in my research because it illustrates the fact that the Venetian government had the power to control the level of incentives provided to different industries. The same argument could be made in the case of the assignment of the penalty, but,

suprascripto supplicani concedatur sicuti petit'), in this way causing the content of the *supplica* to be incorporated in the patent").

⁹² *Id.*

⁹³ Silvestri, *supra* note 82 ("Che per autorità di questo Consiglio sia concesso a Domino Sebastiano di Silvestri che per 25 anni alcun altro che esso, ochi avera` causa da lui non possa in questa città, nè in alcun'altra città o luogo del Dominio nostro senza permission sua usar il modo ritrovato novamente da lui di dar un moto facile, veloce, di poca spesa, et di gran forza alli edificij, che sono stà ritrovati da diversi ingegneri per scollar, et scigar acque, et si come nella sua supplicatione sotto le pene contenute in essa . . .") (emphasis added).

⁹⁴ See *infra* Part II.

⁹⁵ See *infra* Part II.

⁹⁶ See *infra* Part II.

⁹⁷ See *infra* Part II; see also Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24, at 525.

⁹⁸ See *infra* Part II.

as explained in the next section, this aspect of the customary system seems to have served a different function. Specifically, it appears to have been related to both the costs of policing possible infringements and the execution of what could be considered to be an injunction to destroy the infringing copy or copies of the invention, rather than the need to induce inventors to produce new knowledge. Consequently, the Senate's determination of the terms and penalties of the customary patents will be the subject of a full analysis in the next section.

II. TAILORED PATENT PROTECTION IN THE VENETIAN REPUBLIC

The Venetian Senate issued a few thousand customary patents between the 15th and the 18th centuries.⁹⁹ As discussed in the previous section, customary patents did not have a fixed term of protection and penalty.¹⁰⁰ The term was generally the subject of a request by the applicant in her *supplica*. However, in more than 60% of the cases, the Senate rejected the requested term and granted a different one.¹⁰¹ Similarly, the penalty was decided by the Senate with or without deference to what the applicant had asked in her application. For example, on March 22, 1567, Giacomo Bellasio and his brothers requested a patent for a new mill that made “all the [loom’s] spindles to spin equally, so that without a lot of effort and inconvenience the silk result[ed] evenly woven and stronger . . . and more beautiful than when other mills [were used].”¹⁰² The applicants requested a term of 20 years and a penalty of 500 ducats, but the Senate granted only 15 years and 300 ducats.¹⁰³ How did the Senate decide on the term and penalty for this and other inventions protected through the customary system? This part of the article focuses on this question and demonstrates that the Venetian government used its power to decide the patent’s terms as a tool to incentivize certain industries more than others.

A. *The Investigation at the State Archives in Venice*

In order to understand how the Venetian Senate determined the term and penalty of customary patents, I conducted a thorough analysis of the original documents available at the Venice State Archive. Specifically, I

⁹⁹ Mandich, *Le Privative Industriali Veneziane (1450-1550)*, *supra* note 24.

¹⁰⁰ See *supra* Part I.C.2.

¹⁰¹ See *infra* Part II.B.

¹⁰² ASV, *Provveditori di Comun, Scritture*, busta 5, registro 1 (“[T]utti essi fusi girano egualmente, in modo che senza tanta fatica, et fastidio le sederiescano ugualmente filade, e forte . . . et piu’ belle che alli altri molini *non fanno* . . .”).

¹⁰³ ASV, *Senato, Deliberazioni, Terra*, registro 46, carta 121 recto (image file number 290).

decided to identify and study all of the customary patents issued by the Senate between 1560 and 1580.

The decision to focus on this period was driven, in part, by the fact that the records of the various authorities involved in the prosecution of the customary patents are often incomplete and do not entirely encompass the approximately 350 years of the system's operation.¹⁰⁴ For example, the extant Senate's *registri* are available for almost the full period of the Venetian patent system's existence. However, the extant *scrittura* of the *Provveditori di Comun* that were not lost or destroyed, only extend about twenty years: 1562-1566; 1567-1570; 1570-1577; 1591-1596.¹⁰⁵ Consequently, not all of the periods can be analyzed in detail.

On the other hand, the years between 1560 and 1580 appear to be particularly appropriate for the purpose of providing a full understanding of the customary patent system. In fact, by the end of the 16th century, this system had reached its maturity.¹⁰⁶ At the same time, the economy of the *Serenissima* had completed its transformation and had turned into a production economy.¹⁰⁷ In addition, Venice had established itself as one of the super powers of that time.¹⁰⁸ Therefore, by the end of the 16th century, the Venetian customary system operated in a strong economic and political environment that had the benefit of almost 150 years of experience, and had remained unaffected by the uncertainties and complications that characterized the Republic's subsequent period of decline. Ultimately, it could be said, that by concentrating on the 20 years between 1560 and 1580, it is possible to observe the system at the height of its sophistication, operating in a context of relative stability.¹⁰⁹

The identification of the patents issued by the Senate during the selected period required the meticulous and lengthy investigation of the relevant authorities' records. In particular, the analysis of the Senate's *registri*, in which all of the decisions issued by this authority were recorded, revealed the patents granted between 1560 and 1580. The list of

¹⁰⁴ Copies of these records' indexes for the periods covered by each extant volume are on file with the author.

¹⁰⁵ *Id.* The main reason for missing records is fires, in particular the 1577 fire that devastated the Doge's palace. See 1 CALENDAR OF STATE PAPERS AND MANUSCRIPTS RELATING TO ENGLISH AFFAIRS xxiv-xxv (ed. Rawdon Lubbock Brown, 1864).

¹⁰⁶ Consider that by the end of the 16th century, patents were considered to be a commodity like any other, which could be transferred, inherited and used for a dowry. Companies were formed to acquire patents and trade on them as opposed to using them to develop related products. See Molà, *supra* note 24.

¹⁰⁷ See *supra* Part I.B.

¹⁰⁸ LANE, *supra* note 38.

¹⁰⁹ See Molà, *supra* note 24.

the identified patents with the relative issuance dates was then used to select the Senate's files, the *filze*, in which the documentation of the prosecution of the patents—a copy of the patent application with the response of the *Minor Consiglio*, a copy of the executive departments' opinions involved in the review process, and the final grant by the Senate—was recorded. The *Provveditori di Comun*'s records, the *scritture* and *atti*, in which copies of the patent applications and the result of this department's investigations were filed, helped to fill possible gaps in the *filze*'s documentation. Finally, the review of the *Collegio*'s registry, the *Risposte di Dentro*,¹¹⁰ in which the original patent applications were kept, allowed completing the collection of the necessary data for this investigation. In the end, a total of twelve Senate's *registri*,¹¹¹ twenty-nine Senate's *filze*,¹¹² four *Provveditori di Comun*'s registries¹¹³—one *scritture* and three *atti*, and three *Collegio*'s *Risposte di Dentro*¹¹⁴ were scrupulously reviewed and analyzed. The investigation ultimately produced a list of 155 customary patents granted by the Senate during the relevant period with a variety of terms of protection and penalties. The details of the identified patents are the subject of a full discussion in the next subsection.

¹¹⁰ The *Collegio* had two registries: the *Risposte di Dentro*, “Answers from the Inside,” for applications coming from and/or concerning Venice; and the *Risposte di Fuori*, “Answers from the Outside,” for applications coming from and/or concerning the rest of the Republic's domain. Patent applications filed with the *Minor Consiglio* i.e. *suppliche* for a customary patent were kept in the *Risposte di Dentro*.

¹¹¹ ASV, *Senato, Deliberazioni, Terra*, registri: 42 (Mar. 6, 1559-Aug., 29 1560); 43 (Sept. 7, 1560-Feb. 28, 1561 m.v.); 44 (Mar. 7, 1562-Feb. 25, 1563 m.v.); 45 (Mar. 2, 1564-Feb. 23, 1565 m.v.); 46 (Mar. 1, 1566-Feb. 28, 1567 m.v.); 47 (Mar. 4, 1568-Feb. 20, 1569 m.v.); 48 (Mar. 2, 1570-Feb. 25, 1571 m.v.); 49 (Mar. 1, 1572-Feb. 24, 1573 m.v.); 50 (Mar. 6, 1574-Aug. 29, 1575 m.v.); 51 (Sept. 3, 1575-Aug. 30, 1577); 52 (Sept. 5, 1577-Feb. 20, 1579 m.v.); 53 (Mar. 1, 1580-Feb. 24, 1581 m.v.).

¹¹² ASV, *Senato, Deliberazioni, Terra*, filze: 31 (Mar. 1560-Aug. 1560); 32 (Sept. 1560-Feb. 1560 m.v.); 33 (Mar. 1561-June 1561); 34 (July 1561-Oct. 1561); 35 (Nov. 1561-Feb. 1561 m.v.); 38 (Mar. 1563-Aug. 1563); 39 (Sept. 1563-Feb. 1563 m.v.); 40 (Mar. 1564-Aug. 1564); 41 (Sept. 1564-Nov. 1564); 48 (Nov. 20, 1566-Feb. 1566 m.v.); 49 (Mar. 1567-Aug. 1567); 52 (Sept. 1568-Feb. 1568 m.v.); 54 (Sept. 1569-Feb. 1569 m.v.); 57 (March 1571-Aug. 1571); 59 (Mar. 1572-Aug. 1572); 60 (Sept. 1572-Feb. 1572 m.v.); 63 (Mar. 1574-Aug. 1574); 67 (July 1575-Oct. 1575); 68 (Nov. 1575-Feb. 1575 m.v.); 71 (Mar. 1577-Aug. 1577); 73 (Mar. 1578-May 1578); 74 (June 1578-Aug. 1578); 75 (Sept. 1578-Nov. 1578); 76 (Dec. 1578-Feb. 1578 m.v.); 77 (Mar. 1579-June 1579); 78 (July 1579-Oct. 1579); 79 (Nov. 1579-Feb. 1579 m.v.); 80 (Mar. 1580-Aug. 1580); 81 (Sept. 1580-Feb. 1580 m.v.).

¹¹³ ASV, *Provveditori di Comun, Scritture*, busta 5: registro 7 (Oct. 1562-Nov. 1566; registro 8: Mar. 1567-Dec. 1570; registro 9: Nov. 1570-Oct. 1577); ASV, *Provveditori di Comun, Atti*, busta 13 (registro 31: June 1558-Jan. 1559 m.v.); busta 14 (registro 32: Apr. 1560-Oct. 1561; registro 33: Mar. 1565-May 1567); busta 15 (registro 34: July 1571-Aug. 1574).

¹¹⁴ ASV, *Collegio, Risposte di Dentro*, buste: 2 (1566-1567 m.v.); 3 (1568-1569 m.v.); 4 (1570-1571 m.v.).

B. *The Senate's Tools—Terms and Penalties*

The Venetian Senate had significant power to control the level of incentives provided to inventors. In fact, as previously mentioned,¹¹⁵ the Senate had the authority, at the time of the grant, to decide both the term of protection as well as the penalty in case of infringement for each invention.¹¹⁶ Specifically, this investigation revealed that during the twenty years between 1560 and 1580, the Senate issued a total of 155 customary patents and decided to grant terms equal to ten, fifteen, twenty, twenty-five, thirty, forty, fifty and sixty years. Moreover, in four cases, the Senate granted a term for “life” or “life plus the life of the heirs.” Finally, one patent was issued without a term.¹¹⁷

Below, Chart 1, Distribution of Terms, illustrates the term distribution in detail. Specifically, it reveals that during the relevant period, the most frequently granted terms by the Senate were twenty, twenty-five and thirty years, which corresponded to 31%, 33% and 20% of the patents, respectively. Both ten and fifteen year terms each represented 4% of the patents. The remaining 6% of the patents had terms equal to forty, fifty and sixty years. Finally, the average number of years of protection was 25.42 years.¹¹⁸

¹¹⁵ See *supra* Part I.C.2.

¹¹⁶ See *supra* Part I.C.2.

¹¹⁷ ASV, *Senato, Deliberazioni, Terra*, registro 45 (issued on Feb. 3, 1565). Presumably, the patent in this case had a perpetual term. However, for the purpose of the statistical analysis on the patent terms discussed below, this patent was excluded from the dataset. To be sure, I ran the described calculation, assigning terms of ten, sixty and eighty years to Piccolomini's patent and the statistical results highlighted in the paper did not change. See Appendix.

¹¹⁸ To calculate the average number of years protection and conduct the statistical analysis described below, the following number of years have been assigned to patents that did not have a numerical term: one patent with a term for “life” received sixty years; three patents with the term of “life plus the life of the heirs” received eighty years. I determined the number of years to assign to these patents considering that the highest numerical term granted by the Senate between 1560 and 1580 was sixty years and that, presumably, the Senate with the term “life” wanted to grant a period of exclusivity at least equal to that. Then, I assumed that “life plus the life of the heirs” term must have meant at least addition twenty years over the “life” term. Alternatively, I considered the life expectancy of inventors in the sixteenth century. Numerous studies discuss the average life expectancy in Europe during the Renaissance. They produce different results ranging from thirty-five years to seventy-five years on average depending on factors such as sex, wealth, social status, specific geographic area, and children mortality (whether the average life expectancy was measured at birth, at age five, at age fifteen or later). For this research, I assumed that in the 1500s the average life expectancy of inventors to be between sixty and seventy years—considering that almost all the inventors were males and that in this case the life expectancy must be measured at fifteen years or later. However, since an inventor could receive a patent at almost any age, it becomes very difficult to estimate a “life” or a “life plus the life of the heirs” term. Thus, I concluded that the previous analysis was preferable. For studies on life expectancy at different points in history, see e.g., J P Griffin, *Changing Life Expectancy Throughout History*, 101 J. ROYAL SOC'Y MED 577 (2008); Robert Finlay, *The Venetian Republic as a Gerontocracy: Age and Politics in the Renaissance*, 8 J. MEDIEVAL & RENAISSANCE STUD. 157 (1978); Gilbert Creighton, *When Did a*

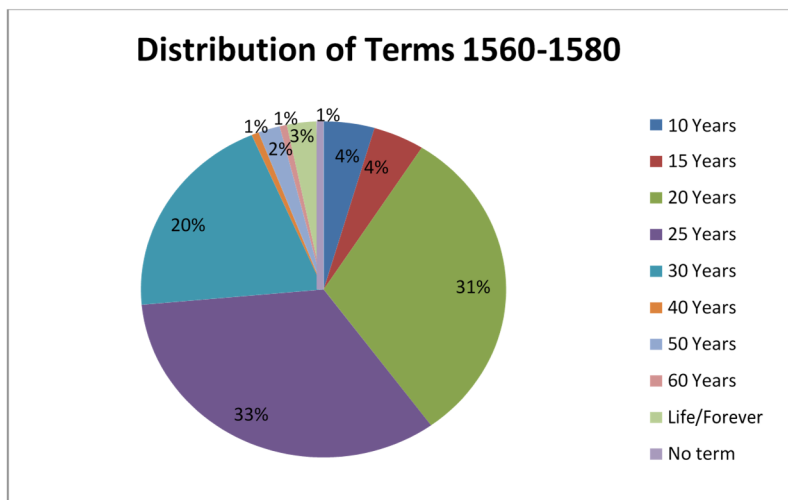


CHART 1: DISTRIBUTION OF TERMS

It is noteworthy that of the 155 identified patents, fifty-two had a term equal to the one requested by the applicant in his *supplica*; one had a longer term than the one requested; and eighty-nine had shorter terms. No information about the requested term was found for three patents, and in ten cases, the applicant did not request a term of protection. Thus, it is possible to say with confidence that the Senate granted a term different than that requested by the inventor in 58% of the cases.

Consequently, the situation was clearly more complex in the context of the assignment of the penalty. The analysis of the 155 identified patents revealed that the Senate adopted a wide range of penalty levels. In 96% of the cases, the penalty was a flat fee, but in six cases, the Senate assigned a penalty based on the number of unauthorized copies of the invention found at the time that the infringement was detected.¹¹⁹ Table 1 below reports the list of penalties assigned to these latter six patents and the relevant inventions.

Man in the Renaissance Grow Old?, 14 *STUD. RENAISSANCE* 7 (1967); S. Ryan Johansson, *Medics, Monarchs and Mortality, 1600-1800: Origins of the Knowledge-Driven Health Transition in Europe* (University of Oxford, Discussion Papers in Econ. & Soc. Hist., Paper No. 85, Oct. 2010), <https://www.nuff.ox.ac.uk/economics/history/Paper85/johansson85.pdf> [<https://perma.cc/VZH6-JZ3C>].

¹¹⁹ For the purpose of the statistical analysis on the patent penalties described below, these patents have been excluded from the dataset.

TABLE 1. PATENTS WITH “PER ITEM” PENALTIES

Invention	Penalty
Jar	2 ducats per jar
Method to sow wheat	5 ducats per field
Method to work the fields	10 ducats per field
Mirror	25 ducats per mirror
Tools to grind (mill)	50 ducats per mill
Machine to grind (mill)	1,000 ducats per mill

The distribution of the “flat fee” penalties is reported in Chart 2, Distribution of Penalties, which reveals that the three penalties the Senate used most frequently were 300 ducats, 500 ducats, and 200 ducats, assigned in 28%, 22%, and 19% of cases, respectively. Together, these three penalty levels comprise 69% of the identified cases. The next most frequent penalty was 100 ducats assigned in 12% of the cases; whereas, the Senate assigned 1,000 ducats in three patents—the highest penalty reported. Six patents were issued without penalty.¹²⁰ Finally, in a few cases, the Senate also used ten ducats, twenty-five ducats, fifty ducats, 150 ducats, 200 ducats and 600 ducats.

¹²⁰ These patents were excluded from the dataset used for the statistical analysis of the patent penalties.

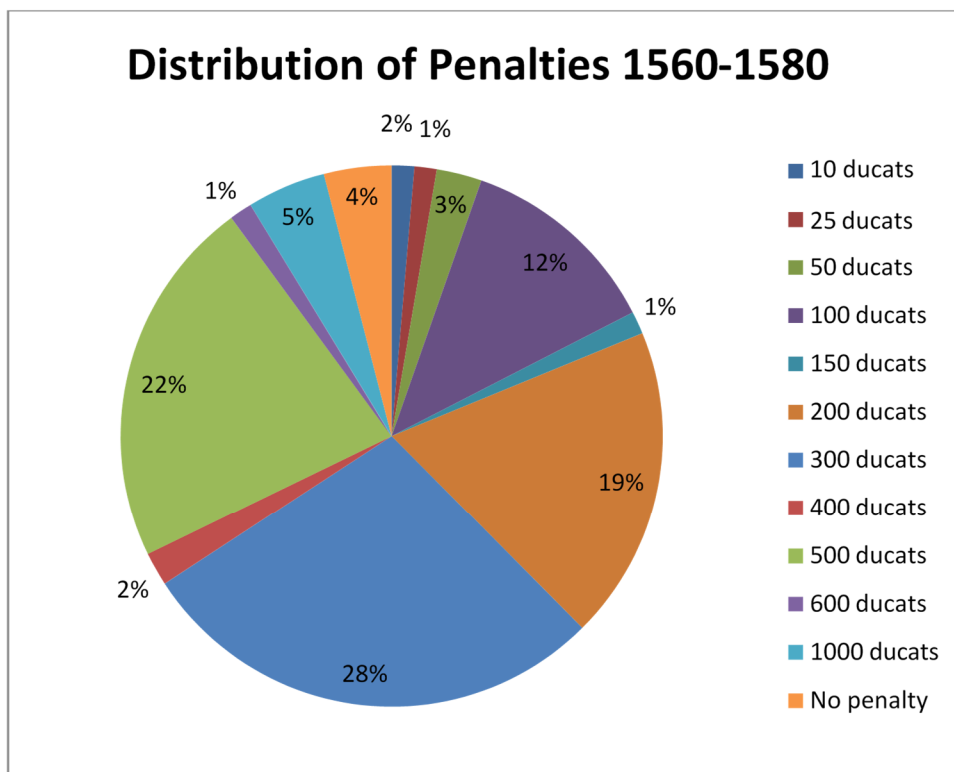


CHART 2: DISTRIBUTION OF PENALTIES

It is also interesting to consider the level of deference that the Senate paid to the applicant's request in the context of the penalties. In this regard, an important finding is that the applicants appeared to have a significantly lower interest in the assignment of the penalty than they did with the term. In fact, in fifty out of 155 cases, the applicant did not even request a specific penalty. On the other hand, the applicant failed to request a specific term in only fourteen cases. As will be fully discussed in the next subsection, a possible explanation for this result is that the function of the penalty was primarily to cover the costs of policing infringements and enforcing the patent.¹²¹ Moreover, the penalty collected in the case of infringement had to be divided in equal amounts among three, sometimes four different subjects, including the officer who carried out the destruction of the unauthorized copy or copies of the invention, as well as the person reporting the infringement.¹²² Consequently, compared to the term, the

¹²¹ See *infra* Part II.C.

¹²² See *infra* notes 123-130 and accompanying text.

penalty must have appeared to be a much more indirect benefit for the inventor who, in one-third of the cases, completely neglected to ask for it.¹²³ In six cases, no information was found regarding the requested penalty. Of the remaining ninety-nine patents, 37% had a penalty other than the one requested by the applicant. Specifically, the Senate increased the penalty in 11% of the cases and reduced it in 26% of the cases. The remaining issue at this point is to determine what the Senate wanted to achieve by exercising its power to grant the term and penalty in patent law, which will be discussed in detail in the next subsection.

C. Industry-based Patent Protection

In this part of the article, I explain that the Senate used the granting of the term and the penalty to achieve somewhat different goals. The term was clearly used to promote certain industries over others, whereas the penalty was primarily designed to cover the costs engendered by the infringement of the patent. I reached this conclusion by dividing the 155 identified patents by the relevant industries of their inventions. The relevant industries are: Agriculture, Construction, Energy, Food, Chemistry, Textile and Water.¹²⁴ Because twenty-two of the identified patents could not be assigned to any of the aforementioned industries, I created an additional category called “Other.” The patents included in the “Other” category belong to the following industries: Entertainment, Musical Instruments, Home Supply, and other Manufacturing.¹²⁵

¹²³ See *infra* Part II.C.

¹²⁴ The Agriculture industry includes all the identified patents for inventions that pertained to agriculture, such as a new method to make the fields fertile or a new machine to irrigate the fields. The Construction industry includes all the identified patents for inventions that pertained to building, such as a new machine to transport dirt and sand or a new instrument to heat limestone. The Energy industry includes all the identified patents for inventions that pertained to the production of energy, such as a new and more efficient mill or a new machine to grind (mill) without water. The Food industry includes all the identified patents for inventions that pertained to food or food production, such as a new machine to sift flour or a new machine to grind meat. The Chemistry industry includes all the identified patents for inventions that pertained to chemicals (paintings, pharmaceuticals, pesticides, etc.), such as a new pesticide for worms or a new facial oil. The Textile industry includes all the identified patents for inventions related to textile production, such as a new method to print fabric with gold and silver and a new frame to make silk. The Water industry includes all the identified patents for inventions pertaining to management of water, the building of channels or the recovery of swamps, such as new machines or methods to dig channels or a new pump to extract water from the soil.

¹²⁵ For each of these latter industries, the number of assigned patents ranges from one to three. Examples of the relevant inventions include: bedding for animals (other Manufacturing); a machine in which people can see ninety-eight moving arts (Entertainment); and a harpsichord (Musical Instruments).

The main challenge I encountered in classifying the patents was that in two cases, the grant was for multiple inventions, which could have been assigned to different industries. Therefore, to avoid double counting, I classified these two cases based on the industry of the invention in each patent that had the highest economic value. The following, Chart 3, Distribution of Patents by Industry, illustrates the distribution of the identified patents by industry. It reveals that the two industries with the highest number of patents were Water and Energy, 27% and 25%, respectively; followed by Textile, 12%; the industries included in “Other,” 11% total; and Construction, 10%. The industries with the smallest number of patents were Food, 6%; Agriculture, 5%; and Chemistry, also 4%.

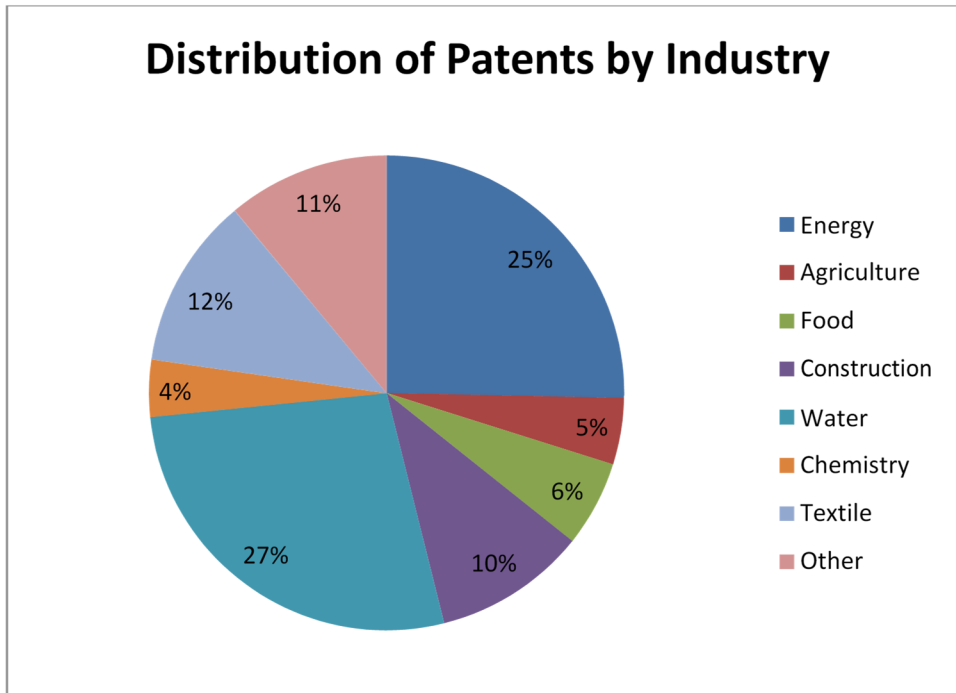


CHART 3: DISTRIBUTION OF PATENTS BY INDUSTRY

The next step encompassed calculating the average number of years of protection granted to inventions in different industries. Table 2 below reveals that inventions in the Water and Energy industry received, on average, five to seven additional years of protection compared to inventions in other industries.

TABLE 2. AVERAGE NUMBER OF YEARS OF PROTECTION BY INDUSTRY

Industry	Years
Water	28.57
Energy	28.08
Food	23.89
Agriculture	23.57
Chemistry	22.50
Construction	21.88
Textile	21.67
Other	21.47

The fact that inventions in the Water or Energy industries were favored compared to other inventions is also evident when interpreting the data in the Tables 3 and 4. Table 3 displays inventions that received the *longest* terms in the twenty years considered. They are all inventions in the Water and Energy industries.

TABLE 3. INVENTIONS WITH THE LONGEST TERMS 1560-1580

Invention	Industry	Term
Machine to lift water	Water	40 years
Methods to build wells	Water	50 years + citiz.
Inventions to dig channels	Water	50 years
Dry mills	Energy	50 years
Machine to grind (mill)	Energy	60 years
Machine to lift water	Water	Life
Perpetual motion of water	Energy	Life + heirs
Machine to dig channels	Water	Life + heirs
Machine to grind (mill) without water	Energy	Life + heirs

In contrast, Table 4 lists the inventions that received the *shortest* terms during the twenty years considered. In this case, only two inventions belong to the Energy industry, and there are no inventions from the Water industry.

TABLE 4. INVENTIONS WITH THE SHORTEST TERMS 1560-1580

Invention	Industry	Years
Bedding (for animals)	Other	10
Powder for worms	Chemistry	10
Grinder	Food	10
Method to print fabric with gold and silver	Textile	10
Machine in which people can see 98 moving arts	Other	10
Windmills	Energy	10
Windows	Construction	10
Machine to lift heavy weights	Construction	15
Machine to grind rocks	Construction	15
Mills for silk	Energy	15

To determine if the Venetian Senate also used its power to assign a penalty in order to promote certain industries over others, I calculated the average penalty by industry. The results are summarized in Table 5. Contrary to the term averages, the penalty averages present no statistically significant industry-based differences. In fact, if we compare the term industry averages with each other, it is possible to identify two distinct groups: the Energy-Water group that received longer terms on the one hand, and all the other industries on the other. Specifically, when either the Energy or Water industry is compared with one of the other industries, the difference of the term averages proves to be statistically significant with a 90% level of confidence.¹²⁶ However, this result cannot be observed when the other industries are compared. Similarly, this result cannot be observed when the same statistical analysis is conducted with the penalty averages, indicating that there is no relationship between the assignment of a specific penalty and the industry of the invention.

¹²⁶ For a full explanation of statistical analysis conducted here, see Appendix.

TABLE 5. AVERAGE PENALTY BY INDUSTRY

Industry	Ducats
Food	403.13
Water	361.83
Other	343.57
Construction	340.63
Energy	308.33
Chemistry	300.00
Agriculture	270.00
Textile	247.22

Finally, with respect to the grant of the term, I compared the inventions with the highest assigned penalty to those with the lowest penalty, but also in this case, no industry-based differences could be identified. However, reading the identified patents helped to glean a possible explanation for these penalty results. In fact, as mentioned briefly above, the assigned penalty generally had to be divided in equal measure among three, or sometimes four, different subjects. These subjects usually were: the *Pietà* (a convent, orphanage, and music school in Venice); the Arsenal, the accuser whose identity in many cases had to remain secret; the applicant; and the magistrate in charge of executing the injunction to destroy or confiscate the infringing copy of the invention.¹²⁷ Illustrating this point, in the case of *Auger della Borda* and *Valentin Correr tedeschi*¹²⁸ the Senate decided that:

[N]obody, aside from them, or those having a license or permission from them, for 25 years, can use in any way . . . the new invention . . . under penalty of losing the machines and of having to pay **1,000 ducats to be divided in four shares, one for the *Pietà*, one for the Arsenal, one for the accuser, [whose identity] must be kept secret, and one for the applicants** or those who will have authority from them.¹²⁹

¹²⁷ In some cases, the grant included an injunction to either destroy or confiscate the infringing copy of the invention.

¹²⁸ *Senato, Deliberazioni, Terra*, registro 43, carte 29 verso and 30 recto (files 99-100) (issued on Dec. 11, 1560).

¹²⁹ *Id.* (“[C]he niuno altro, che essi, ovvero chi haverà licentia, et libertà da loro possi per anni 25 usar quavis modo . . . il novo ingegno . . . sotto pena di perder gli edificij, et di pagar ducati 1,000 da esser divisi in quattro parti una alla *Pietà*, una all’Arsenal, una all’accusator, il quale sia tenuto segreto, et l’altra loro supplicant o chi haverà causa da essi.”) (emphasis added).

The case of *Don Joao de Spinosa*¹³⁰ provides another useful example. Here, the Senate provided that:

[F]or 25 years, nobody aside from [the applicant] or those having authority or license from him can . . . use in any way [the invention] . . . under penalty of losing the machine or machines, made by the infringer, that [at that point] will belong to the applicant or those having authority from him and of having to pay 400 ducats **of which [100 ducats] will go to the accuser, [whose identity] will remain secret, 100 [ducats] to the magistrate executing the [the injunction], 100 [ducats] . . . to the Arsenal and 100 [ducats] to the applicant.**¹³¹

Finally, the case of *Gerolamo Bembo*¹³² represents an example of when the penalty had to be divided among three subjects. Specifically, the Senate's grant said that:

[N]obody aside from the [applicant], or his heirs, or those having authority from him . . . for the period of 30 years can make . . . the machine and invention . . . under penalty of losing the machines, models and factories built against this order, that will be immediately destroyed, and of paying **500 ducats one third belonging to the accuser, one third to the magistrate . . . executing [this order and] one third to our Arsenal**¹³³

It is notable that in *Bembo's* case, the Senate did not even assign a portion of the penalty to the applicant. However, this must be considered to have been a very unusual situation. Certainly, the function of the penalty was also to compensate the patent holder, but this was not the primary objective. Indeed, in the context of the penalty, the Senate had to ensure that the amount granted, presumably based on the characteristics of the specific invention,¹³⁴ was sufficient not only to satisfy the inventors themselves, but also to satisfy all the subjects involved in the infringement,

¹³⁰ ASV, *Senato, Deliberazioni, Terra*, registro 43, carte 125 verso (files 291) (issued on Nov 25, 1561).

¹³¹ *Id.* (“[C]he per anni 25 alcun'altro che esso, o chi haverà causa, ovvero licentia da lui possa . . . usar quovimodo l'ingegno . . . sotto pena . . . di perdere . . . l'edificio, ovvero edificij, che avessero fatti, gli quali siano d'esso supplicante o de chi haverà causa da lui et di pagar ducati 400 de quali siano dell'accusator, il quale sarà tenuto segreto, 100 del magistrate che farà l'esecuzione, cento applicati alla casa dell'Arsenal, et 100 di esso supplicante, o de chi haverà causa da lui.”)(emphasis added).

¹³² ASV, *Senato, Deliberazioni, Terra*, registro 52, carte 179 recto (issued on June 6, 1579).

¹³³ *Id.* (“[C]he altri che lui, o suoi heredi, o chi haverà causa da lui, non possa per lo spazio d'anni 30 prossimi fabricar . . . l'edificio et invention . . . sotto pena di perder li edificij, modelli, et fabbriche fatte contra il presente ordine, qualai siano subito rovinare, et di ducati 500 un terzo de quali sia dell'accusator, un terzo di quell magistrato. . . che farà l'esecuzione, et l'atro terzo alla casa nostra dell'Arsenale.”)(emphasis added).

¹³⁴ In this case, I am speculating regarding the possibility that the penalty would change if the invention were, for example, difficult to destroy because of its size, was very valuable, or created a heightened risk for those reporting the infringement.

as well as guaranteeing a share for the Arsenal and charity. In other words, this analysis illustrates that the Senate used its power to assign the penalty to achieve substantially different goals than in the case of the grant of the term, which was clearly industry driven. The next subsection briefly analyzes possible reasons for the Senate to favor the Water and Energy industries over others.

D. Possible explanations for favoring specific industries

The Venetian Senate used its customary patent system to provide higher incentives for inventions in the Water and Energy industries. As explained in the previous subsection, these industries received, on average, five to six additional years of protection.¹³⁵ Why did the *Serenissima* have such a strong interest in the Water and Energy industries compared to other industries, such as the Textile industry, which were also of great importance to its economy?¹³⁶ There are three possible reasons for this result. The first and the most obvious relates to Venice's location. Venice is built on a lagoon; therefore, any invention that pertained to draining water, digging channels, pumping water, and reclaiming swamps, must have been of vital importance for the life of Venetian citizens in the 16th Century.

The second possible reason relates to the specific historical period during the 16th century, in which these inventors sought patents at a time concurrent with two significant events in Europe. First, the demographic pressure became substantial; thereby, leading to the discovery of new ways to produce more energy *per capita*, such as new machines (mills in particular) that could produce energy at a lower cost, became essential.¹³⁷ Second, deforestation had caused the price of wood to skyrocket.¹³⁸ Thus, finding alternative combustibles or more efficient machines, such as new stoves or the use of olive pomace rather than wood, were very important.

A final possible reason was the risk of failure associated with these inventions, particularly, mills.¹³⁹ Contemporaneous accounts report that the

¹³⁵ See *supra* Part II.C.

¹³⁶ Consider the fact that the range of patented inventions in the last half of the 15th century was very wide and included, for example, recipes, chemical formulae for dyeing, furnaces, water pumps, mills, fabrics, glass, ceramic, food, etc. See Molà, *supra* note 24.

¹³⁷ For example, the goal of the patented water mills was often to produce more energy with the same amount of water by increasing the rotation speed of the wheel. In Venice, numerous experiments were conducted to develop a mill that could use tidal power. See Luca Molà, *Energia e Brevetti per Invenzioni nell'Italia del Rinascimento*, in *ECONOMIA ENERGIA*, SECC. XIII-XVIII, 981-91 (Florence, Le Monnier, 2003).

¹³⁸ *Id.*

¹³⁹ *Id.*

success rate of the patented mills was quite low.¹⁴⁰ Specifically, they point to the cost of operating the new mills, which often turned out to be higher than the expected savings as well as the existence of certain structural limitations, which could not have been foreseen at the time the patent application was examined.¹⁴¹ Moreover, by the end of the 16th century, the basic mill technology was well known, and many of these new inventions were the result of significant experimentation attempting to improve that technology.¹⁴² Ultimately, it could have been the case that workable improvements for such a well-developed technology were harder to develop. In conclusion, the higher risk of failure, combined with the unique challenges of the time and location, engendered the need to promote the Water and Energy industry over other industries. The remaining issue, which will be discussed in the next section, is whether we can use what we have learned about the tailoring activity in the patent law of the Venetian Republic to inform the way in which we promote innovation and patent quality today.

III. IMPLICATIONS FOR CONTEMPORARY PATENT PROTECTION

The Venetian Republic's patent system seems to have produced a number of positive results. For example, historians have reported that because of its patent law, Venice transformed itself into a nation of artisans and engineers and became the center of technological development in 16th Century Europe.¹⁴³ Moreover, they noted that contemporaneous governments adopted the Venetian patent system as a model for their own countries; thus, they contributed to the creation of an international market for inventions, in which companies were formed to acquire patents in different states.¹⁴⁴ These patents were used to either develop related products or to profit from their transfer to other subjects.¹⁴⁵ In turn, this process allowed for the dissemination of new technologies throughout Europe.¹⁴⁶ Therefore, given these outcomes, what can be learned from the Venetian experience that could be used to inform our decisions in patent law today?

¹⁴⁰ *Id.*

¹⁴¹ *Id.*

¹⁴² *Id.*

¹⁴³ Molà, *supra* note 24; LANE, *supra* note 38.

¹⁴⁴ In fact, at that time, patents came to be considered commodities like any other. *See* Molà, *supra* note 24.

¹⁴⁵ *Id.*

¹⁴⁶ *Id.*

As highlighted in the Introduction, in 2003, Dan Burk and Mark Lemley explained that “there is no reason to assume that a unitary patent system [like the current one] optimally encourages innovation in the wide range of diverse industries,”¹⁴⁷ because there are significant structural differences in how industries innovate.¹⁴⁸ Consequently, patent protection should be tailored to reflect such differences.¹⁴⁹ Specifically, Burk and Lemley suggested that *courts* should use the flexible standards present in patent law to protect the needs of the various industries.¹⁵⁰ However, they also argue that other solutions might be available and, specifically, suggested that *administrative agencies*, such as the USPTO, could achieve the same result.¹⁵¹

This paper describes a historical example in which the tailoring activity in patent law was conducted by the issuing authority—the Venetian Senate—thereby providing an opportunity to re-examine the relevance of the issuing authority’s role within the U.S. patent system and to consider whether this role could be redesigned to provide optimal levels of incentives to different industries. The relevant literature with respect to the current role of the USPTO underlines a striking difference between this agency and other administrative agencies, such as the EPA, the SEC, or the OSHA.¹⁵² In fact, contrary to these other entities, the USPTO does not have general regulatory authority and enjoys very limited ability to influence policies in patent law.¹⁵³ This is especially surprising considering the significant technical aspect that characterizes patent law and the need to use highly specialized information to answer many questions in this area.¹⁵⁴ The result is that patent law is virtually the only technical field of law in which the knowledge accumulated by its administrative agency through years of experience is not used to improve the effectiveness of the system. In

¹⁴⁷ Burk & Lemley, *supra* note 1.

¹⁴⁸ *Id.*

¹⁴⁹ *Id.* at 1577.

¹⁵⁰ *Id.* at 1578-79 (Supreme Court precedent provides courts the freedom needed to adapt to different innovations in differing industries).

¹⁵¹ *Id.* at 1696.

¹⁵² See Masur, *supra* note 6, at 302-04.

¹⁵³ *Id.* at 303.

¹⁵⁴ Masur criticized courts’ past decisions in patent law. *Id.* at 278-79 (“In areas of regulation ranging from securities, to pharmaceutical drugs, to transportation, to the environment, policymakers have turned [] to expert administrative agencies, perhaps because they understood the institutional deficiencies of courts. This general trend toward agency policymaking in technical fields comes with good reason. Absent input from an agency or the legislature, the federal courts have repeatedly proved inadequate to the task of setting sound patent policy. Yet the institutional design for patent law remains an outlier. Patent law is a highly technically complex regulatory field controlled entirely by the courts. Similarly, the PTO is one of the only federal administrative agencies to lack any semblance of substantive rulemaking authority.”).

particular, the USPTO information is not used to make the patent system more responsive to the specific characteristics and needs of the industries, and the subjects operating within them, namely the inventors.

This is even more surprising if we consider the fact that the Venetian patent system after which—to various degrees—virtually all the major modern patent systems in the world have been modeled, operated in a completely different way. In that context, the knowledge acquired by the issuing authority through the reviewing process was the fundamental basis for *both* the decision to grant the patent, assuming that the examination showed that specific requirements were present, *and* the tailoring activity.¹⁵⁵ Thus, the gathering of all the relevant information about the invention was scrupulously pursued by the Senate’s executive departments that were assigned to review the patent applications.¹⁵⁶ Importantly, to accomplish this task, the reviewing departments often requested the assistance of interested subjects such as the guilds—the industries of that time, or the other executive departments relevant for the subject covered by the invention.¹⁵⁷ That is, it was not uncommon for the examiners to discuss the nature of the invention, its novelty, and whether the invention would cause any harm to the community or to the reputation of the Venetian products with the guilds or other interested entities. For example, in the case of Zorzi Pasqualigo, the invention was a new silk dye, and the *Provveditori di Commun* were assigned to its examination. In their opinion, the *Provveditori* reported that, “*in order to produce a sound answer*” on the whether the invention was novel and would have benefited the Republic, they asked both the silk merchants and the dyers to see and evaluate the invention.¹⁵⁸ Another example is the case of Zuan Maria Terzo, where the invention was a new tool used in silk production—“a tool to wrap and channel silk [threads].”¹⁵⁹ The assigned reviewing department was the *Cinque Savi alla Mercantia*, the Venetian department in charge of Commerce.¹⁶⁰ However, since the invention involved the silk industry, the

¹⁵⁵ See *supra* Part I.C.

¹⁵⁶ *Id.*

¹⁵⁷ *Id.*

¹⁵⁸ Zorzi Pasqualigo, ASV, *Provveditori di Comun, Scritture*, busta 5, registro 2 (issued on Apr. 1, 1569) (“[V]olendo fare la debita risposta habbiamo prima fatto intervenire li soprintendenti delli mercanti della seda, quali vedute le mostre delli colori apresentate per detto supplicante han detto essere vagi, et belli et che quando . . . Ne’ contesti di ciò habbiamo anco voluto udire li tentori sopra questa materia . . .”).

¹⁵⁹ Zuan Maria Terzo, *Cinque Savi alla Mercantia, Prima Serie, Risposte*, 139 (It.) (“[T]rattandosi dell’arte della seda tanto importante a questa Città habbiamo fatto venir all’officio nostro li Provveditori di essa arte, et li habbiamo fatto vedere la presente supplicatione affine che ne informassero de alcun contrario che potesse apportar ad essa arte questa nova invenzione . . .”).

¹⁶⁰ *Id.*; see *supra* Part I.C.

Cinque Savi requested the opinion of the *Proveditori alla Seta*, the representatives of the silk administrative department, about whether the invention would create any harm to the Venetian silk industry.

The benefit of these interchanges was clearly the fact that the issuing authority had a full understanding of the prior art *and* of the mechanisms of the various industries and their needs. As we have seen, the information gathered by the reviewing departments was incorporated into their opinions and passed on by the *Minor Consiglio* to the Senate, which had the exclusive authority to decide about the grant and tailoring of protection in the specific case.¹⁶¹ Ultimately, it is reasonable to presume that this examination of the inventions performed in close connection with all subjects that had the highest understanding of the relative technical field, including the guilds, not only facilitated the tailoring of patent protection, but possibly resulted in the higher quality of the issued patents. As mentioned, increasing patent quality and tailoring patent protection have been central issues in significant research and debates in recent years. Thus, naturally the question becomes whether it would be possible for the modern patent office to achieve the same results that the Venetian Senate produced working together with all the other subjects involved in the review of patents at that time. What might be associated with such activity?

To answer these questions, it is necessary to consider the two strongest arguments found in the relevant literature against awarding rule-making authority to the USPTO. They refer to: 1) the USPTO past performance, and 2) the USPTO capture.¹⁶²

The first objection alludes to the fact that, if we consider the way in which the USPTO has been carrying out its current task of reviewing patent applications, we must conclude that this entity should not be entrusted with rule-making authority like other administrative agencies because many have considered its performance to be suboptimal. However, scholars have quickly dismissed this issue by explaining that the USPTO performance, like the performance of any other entity, is dependent on its funding and that the USPTO “operates under conditions of limited resources.”¹⁶³

¹⁶¹ See *supra* Part I.C.

¹⁶² In addition to the *PTO experience* and the *PTO capture*, Masur identifies four other possible explanations for Congress failing to delegate rule-making authority to the PTO. Ultimately, he concludes that *path dependence*—Congress’ adherence to prior practice due to historical accident, is the most likely explanation. The other explanations are: *rent-seeking*—Congress’s desire to continue collecting rents from interest groups; *property rights*—Congress’s belief that the patent systems shouldn’t be governed by rules created by an administrative agency, because patents are property rights; *statutory vagueness*—Congress’s fear that the PTO will take undue liberties given the lack of specificity of the Patent Act. See Masur, *supra* note 6, at 296-04.

¹⁶³ *Id.* at 300.

Consequently, improving the USPTO performance would probably be sufficient to allocate more money to it.¹⁶⁴ A full analysis of this point is beyond the scope of this paper, because very little can be learned from the Venetian experience in terms of the resources employed by the issuing authority to conduct its activity. As described above, the reviewing of the patent applications in Venice was very thorough and involved multiple subjects; thus, it must have required substantial resources.¹⁶⁵ However, in the absence of detailed information in the original documents about the cost associated with providing patent protection at that time, no other conclusion can be made on this issue. Having said that, it appears straightforward that allocating more funding to an agency, such as the USPTO, would be beneficial because, at the minimum, it would allow this entity to hire better, more qualified employees, which is very likely to translate into improved performance.

The second objection to the USPTO acquiring general regulatory authority and being the entity that provides tailored patent protection is more complex and refers to the possibility that this agency will be captured by private interests.¹⁶⁶ However, as has been emphasized, this argument does not explain why other administrative agencies have been awarded more regulatory power. In fact, nothing seems to differentiate the USPTO in terms of agency capture that could justify the discrepancy in the rule-making authority granted by Congress to other entities.¹⁶⁷

From a different perspective, scholars have also explained that courts are generally considered to be less subject to the capture problem.¹⁶⁸ Thus, the Federal Circuit is considered a much better alternative to the USPTO to create policies in patent law.¹⁶⁹ However, other scholars have contradicted this argument. They explained that external influences extend to courts as well, and “that the Federal Circuit itself may have been captured by private interests.”¹⁷⁰

In the context of the Venetian example, the problem of agency capture would have resulted in the guilds being able to exercise too much power over the Senate on decisions relating to patent law. However, as we have seen, the Venetian case reveals that rather than being a problem, the close

¹⁶⁴ See *infra* notes 167-70 and accompanying text.

¹⁶⁵ See *supra* Part I.C.

¹⁶⁶ See, e.g., BURK & LEMLEY, *supra* note 6, at 106-07; Long, *supra* note 19, at 1969; Meurer, *supra* note 19, at 686.

¹⁶⁷ Masur, *supra* note 6, at 313 (“... the PTO fares no worse than the typical administrative agency.”).

¹⁶⁸ *Id.* at 301-02.

¹⁶⁹ Tran, *supra* note 6, at 491.

¹⁷⁰ Masur, *supra* note 6, at 313.

relationship between the issuing authority and the industries was a positive factor.¹⁷¹ In other words, as previously suggested by Sarah Tran, the Venetian case seems to indicate that industry lobbying could become an element that helps the system rather than harms it.¹⁷² That is, if structured correctly, the interaction with the interest groups fosters an otherwise unlikely use of important information. In Venice, this was made possible by the presence of a system in which the information gathered by the examiners was certain to reach the decision maker—the Senate. At that time, there was no disconnect between those who had the information, the examining departments, and those who needed to use that information to make important decisions in patent law—the Senate.¹⁷³ Nevertheless, “no disconnect” did *not* mean the absence of control or *review* of that information. As described above, very often the examination of the invention was assigned to *multiple* executive departments working with different guilds.¹⁷⁴

Moreover, the *Proveditori di Commun*, an agency of general competence, was almost always involved in the reviewing process together with other specialized departments. As a result, multiple inputs contributed to form the full picture on which the Senate conducted its work. Furthermore, while it is true that the subjects acquiring the information, the reviewing departments, and the subject ultimately making the decisions, the Senate, operated “under the same roof,” some *distance* was built among the various subjects involved in examining the patent applications. As described above, the information gathered by the administrative departments was incorporated into their opinions.¹⁷⁵ The *Minor Consiglio* collected these opinions and presented the application to the Senate.¹⁷⁶ Thus, a few “steps” separated the guilds and the Senate. Ultimately, even if it appears unlikely that the Senate operated completely independently of interest groups, it would have been very difficult for a single guild to exercise much power over the Senate’s decision-making in patent law. At the same time, it is through this system that the Venetian Republic achieved its goal of granting tailored patent protection and high-quality patents for more than 300 years.

¹⁷¹ See *supra* Part I.C.

¹⁷² Tran, *supra* note 6, at 526-27.

¹⁷³ Masur, *supra* note 6, at 315, 325.

¹⁷⁴ See *supra* Part I.C.

¹⁷⁵ *Id.*

¹⁷⁶ *Id.*

In conclusion, the lessons provided by the Venetian experience, combined with the fact that any external influence by interest groups might extend to entities other than administrative agencies, seem to indicate that *some* degree of agency capture in relation to the activity of the issuing authority might be acceptable. In other words, some degree of industry capture might be considered tolerable if it represents the price that we have to pay for a better-informed patent system that provides the correct incentives to inventors in different industries and produces higher quality patents than those currently issued.

CONCLUSIONS

In 2003, Burk and Lemley demonstrated that patent protection should be tailored to the characteristics of different industries. Prior to this research, other scholars argued in favor of tailored patent protection. However, only after Burk and Lemley's article did significant debate emerge on the tailoring of patent protection, and related to that, increasing patent quality. The most significant source of disagreement in this context revolves around the entity that should be entrusted with the authority to provide tailored patent protection—the Federal Circuit or the USPTO. This paper reveals that historically, the tailoring of patent protection had been provided by the Venetian Republic for over 300 years. In that case, the issuing authority—the Senate—granted tailored protection in each case.

Using original documents from the Venice State Archive, this paper reveals that between the 15th and 18th centuries, the Venetian Republic provided patent protection based on the characteristics of the invention as well as its industry. In particular, toward the end of the 16th century, it granted a higher level of protection to inventions in the Water and Energy industry compared to inventions in other industries.

The Venetian Republic achieved the goal of promoting specific industries over others through its customary patent system, which allowed the Senate to grant different terms and penalties to different inventions. Specifically, between 1560 and 1580, the Senate granted, on average, five to seven additional years of protection to inventions in the Water and Energy industry compared to others. On the other hand, the grant of the penalties was used to cover the costs of possible infringements.

Therefore, what can we learn from the Venetian experience that could inform the modern debate on patent law? As mentioned, the tailoring and reviewing activities in Venice were conducted by the issuing authority. Consequently, this study represents an opportunity to re-evaluate the relevance of the issuing authority's role within our patent system. It provides a rationale for considering the specific changes that should be

made to increase the USPTO's regulatory authority and begin investigating if our patent office's role could be redesigned to optimize the level of incentives provided to different industries.

In the literature, the two most significant objections to an increased role of the USPTO within the patent system and, in particular, to vest this entity with general regulatory authority that could be used to provide tailored patent protection, are past performance and the risk of agency capture. As emphasized by other scholars, this paper argues that the USPTO's past performance could be significantly improved with better funding.¹⁷⁷ Moreover, it presents the Venetian case to show that, historically, the agency capture problem has been managed and that the close interaction with the industries has been used to benefit the system rather than to harm it. In Venice, the Senate and its executive departments used the interaction with the guilds to improve the way in which tailored protection was provided; they used the guilds' knowledge to their advantage. Ultimately, it is reasonable to believe that this better-informed system not only provided better incentives to the inventors, but also resulted in very high-quality patents.

In conclusion, additional research is necessary to fully determine how the Venetian example can be used to improve the current system. However, this paper presents a very strong case favoring a more significant role of the USPTO within the patent system in view of the relevant experience and specialized knowledge that was well understood in the Venetian Republic to facilitate the Republic's efficient and effective administration of patent rights. Moreover, in other areas, Congress has chosen to entrust administrative agencies with substantial rule-making authority. It is now time for the same result to be achieved in patent law as well.

APPENDIX

The conclusion discussed in Part II.C is the result of a statistical hypothesis test carried out according to the following steps:

Null and alternative hypotheses. For each pair of industries (namely, population 1 and population 2), a null (H_0) and alternative (H_1) hypotheses were stated as follows: The null hypothesis, which is a contradiction of the result to be proved, was that the two industries had the same mean. The alternative hypothesis was that the two industries had different means.

Test statistic. The test statistic for the difference of two population means is:

¹⁷⁷ Masur, *supra* note 6, at 300.

$$t = \frac{(x_1 - x_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

where:

x_1 : sample mean of population 1

x_2 : sample mean of population 2

μ_1 : mean of population 1

μ_2 : mean of population 2

σ_1 : sample standard deviation of population 1 σ_2 : sample standard deviation of population 2 n_1 : sample size of population 1

n_2 : sample size of population 2

The test statistic, t , is assumed to have a *student's t* probability distribution function with a number of degrees of freedom, df , given by:

$$df = \frac{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

Significance level. The significance level was chosen at 90% ($\alpha = 0.1$) in order to define the probability threshold (p-value).

Results. The null hypothesis was rejected in favor of the alternative hypothesis according to the following tables.

Main case

In the *main case* the patent granted to Fedele Piccolomini was excluded from the dataset.

Terms:

	Average	Standard deviation	Count	Percentage
Agriculture	23.57	5.56	7	4.54%
Construction	21.88	5.12	16	10.39%
Chemistry	22.50	7.58	6	3.90%
Energy	28.08	13.16	39	25.32%
Food	23.89	6.01	9	5.84%
Other	21.47	7.02	17	11.04%
Textiles	21.67	4.20	18	11.69%
Water	28.57	13.54	42	27.27%

Table 1. Averages and standard deviations.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		0.69	-1.51	-1.51	-0.11	0.78	0.82	-1.70
Construction	-0.69		-0.19	-2.51	-0.85	0.19	0.13	-2.76
Chemistry	-0.29	0.19		-1.49	-0.38	0.29	0.26	-1.63
Energy	1.51	2.51	1.49		1.44	2.44	2.75	-0.17
Food	0.11	0.85	0.38	-1.44		0.92	0.99	-1.63
Other	-0.78	-0.19	-0.29	-2.44	-0.92		-0.10	-2.65
Textiles	-0.82	-0.13	-0.26	-2.75	-0.99	0.10		-3.02
Water	1.70	2.76	1.63	0.17	1.63	2.65	3.02	

Table 2. Test statistic values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		1.35	1.36	-1.32	-1.34	1.34	1.37	-1.32
Construction	-1.35		-1.39	-1.30	-1.34	1.31	1.31	-1.30
Chemistry	-1.36	1.39		-1.35	-1.36	1.37	1.41	-1.36
Energy	1.32	1.30	1.35		1.31	1.30	1.30	-1.29
Food	1.34	1.34	1.36	-1.31		1.32	1.35	-1.31
Other	-1.34	-1.31	-1.37	-1.30	-1.32		-1.31	-1.30
Textiles	-1.37	-1.31	-1.41	-1.30	-1.35	-1.31		-1.30
Water	1.32	1.30	1.36	1.29	1.31	1.30	1.30	

Table 3. *p*-values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		0	0	1	0	0	0	1
Construction	0		0	1	0	0	0	1
Chemistry	0	0		1	0	0	0	1
Energy	1	1	1		1	1	1	0
Food	0	0	0	1		0	0	1
Other	0	0	0	1	0		0	1
Textiles	0	0	0	1	0	0		1
Water	1	1	1	0	1	1	1	

Table 4. Test results: 1 means to reject the null hypothesis; 0 fails to reject the null hypothesis.

Penalties:

	Average	Standard deviation	Count	Percentage
Agriculture	270.00	164.32	7	4.54%
Construction	340.63	285.90	16	10.39%
Chemistry	300.00	234.52	6	3.90%
Energy	308.33	138.10	39	25.32%
Food	403.13	316.35	9	5.84%
Other	343.57	239.80	17	11.04%
Textiles	247.22	121.84	18	11.69%
Water	361.83	236.54	42	27.27%

Table 5. Averages and standard deviations.

	Food	Water	Other	Construction	Energy	Chemistry	Agriculture	Textile
Food		-0.75	-0.26	-0.58	-1.09	-0.86	0.33	-1.28
Water	0.75		0.34	0.43	-0.49	-0.03	1.21	-0.26
Other	0.26	-0.34		-0.08	-0.72	-0.39	0.53	-0.60
Construction	0.58	-0.43	0.08		-0.88	-0.57	1.69	-1.26
Energy	1.09	0.49	0.72	0.88		0.49	1.43	0.37
Chemistry	0.86	0.03	0.39	0.57	-0.49		1.49	-0.27
Agriculture	-0.33	-1.21	-0.53	-1.69	-1.43	-1.49		-2.49
Textile	1.28	0.26	0.60	1.26	-0.37	0.27	2.49	

Table 6. Test statistic values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		-1.32	-1.37	-1.38	-1.34	-1.33	1.37	-1.35
Construction	1.32		1.35	1.33	-1.33	-1.31	1.32	-1.32
Chemistry	1.37	-1.35		-1.42	-1.34	-1.37	1.41	-1.40
Energy	1.38	-1.33	1.42		-1.37	-1.32	1.30	-1.29
Food	1.34	1.33	1.34	1.37		1.34	1.37	1.36
Other	1.33	1.31	1.37	1.32	1.34		1.32	-1.31
Textiles	-1.37	-1.32	-1.41	-1.30	-1.37	-1.32		-1.30
Water	1.35	1.32	1.40	1.29	1.36	1.31	1.30	

Table 7. *p*-values.

	Food	Water	Other	Construction	Energy	Chemistry	Agriculture	Textile
Food	0	0	0	0	0	0	0	0
Water	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	1	0
Energy	0	0	0	0	0	0	1	0
Chemistry	0	0	0	0	0	0	1	0
Agriculture	0	0	0	1	1	1	0	1
Textile	0	0	0	0	1	0	1	0

Table 8. Test results: 1 means to reject the null hypothesis; 0 fails to reject the null hypothesis.

Piccolomini ten year case

In the *Piccolomini ten year case* the patent granted to Fedele Piccolomini was assigned a term of ten years.

Terms:

	Average	Standard deviation	Count	Percentage
Agriculture	23.57	5.56	7	4.52%
Construction	21.88	5.12	16	10.32%
Chemistry	22.50	7.58	6	3.87%
Energy	28.08	13.16	39	25.16%
Food	23.89	6.01	9	5.81%
Other	21.47	7.02	17	10.97%
Textiles	21.67	4.20	18	11.61%
Water	28.14	13.67	43	27.74%

Table 9. Averages and standard deviations.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		0.69	-1.51	-1.51	-0.11	0.78	0.82	-1.54
Construction	-0.69		-0.19	-2.51	-0.85	0.19	0.13	-2.56
Chemistry	-0.29	0.19		-1.49	-0.38	0.29	0.26	-1.51
Energy	1.51	2.51	1.49		1.44	2.44	2.75	-0.02
Food	0.11	0.85	0.38	-1.44		0.92	0.99	-1.47
Other	-0.78	-0.19	-0.29	-2.44	-0.92		-0.10	-2.48
Textiles	-0.82	-0.13	-0.26	-2.75	-0.99	0.10		-2.80
Water	1.54	2.56	1.51	0.02	1.47	2.48	2.80	

Table 10. Test statistic values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
	Water	Energy	Food	Agriculture	Chemistry	Construction	Textile	Other
Agriculture		1.35	1.36	-1.32	-1.34	1.34	1.37	-1.32
Construction	-1.35		-1.39	-1.30	-1.34	1.31	1.31	-1.30
Chemistry	-1.36	1.39		-1.35	-1.36	1.37	1.41	-1.35
Energy	1.32	1.30	1.35		1.31	1.30	1.30	-1.29
Food	1.34	1.34	1.36	-1.31		1.32	1.35	-1.31
Other	-1.34	-1.31	-1.37	-1.30	-1.32		-1.31	-1.30
Textiles	-1.37	-1.31	-1.41	-1.30	-1.35	-1.31		-1.30
Water	1.32	1.30	1.35	1.29	1.31	1.30	1.30	

Table 11. *p*-values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		0	0	1	0	0	0	1
Construction	0		0	1	0	0	0	1
Chemistry	0	0		1	0	0	0	1
Energy	1	1	1		1	1	1	0
Food	0	0	0	1		0	0	1
Other	0	0	0	1	0		0	1
Textiles	0	0	0	1	0	0		1
Water	1	1	1	0	1	1	1	

Table 12. Test results: 1 means to reject the null hypothesis; 0 fails to reject the null hypothesis.

Piccolomini sixty year case

In the *Piccolomini sixty year case* the patent granted to Fedele Piccolomini was assigned a term of sixty years.

Terms:

	Average	Standard deviation	Count	Percentage
Agriculture	23.57	5.56	7	4.52%
Construction	21.88	5.12	16	10.32%
Chemistry	22.50	7.58	6	3.87%
Energy	28.08	13.16	39	25.16%
Food	23.89	6.01	9	5.81%
Other	21.47	7.02	17	10.97%
Textiles	21.67	4.20	18	11.61%
Water	29.30	14.21	43	27.74%

Table 13. Averages and standard deviations.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		0.69	-1.51	-1.51	-0.11	0.78	0.82	-1.90
Construction	-0.69		-0.19	-2.51	-0.85	0.19	0.13	-2.95
Chemistry	-0.29	0.19		-1.49	-0.38	0.29	0.26	-1.80
Energy	1.51	2.51	1.49		1.44	2.44	2.75	-0.41
Food	0.11	0.85	0.38	-1.44		0.92	0.99	-1.83
Other	-0.78	-0.19	-0.29	-2.44	-0.92		-0.10	-2.84
Textiles	-0.82	-0.13	-0.26	-2.75	-0.99	0.10		-3.21
Water	1.90	2.95	1.80	0.41	1.83	2.84	3.21	

Table 14. Test statistic values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
	Water	Energy	Food	Agriculture	Chemistry	Construction	Textile	Other
Agriculture		1.35	1.36	-1.32	-1.34	1.34	1.37	-1.32
Construction	-1.35		-1.39	-1.30	-1.34	1.31	1.31	-1.30
Chemistry	-1.36	1.39		-1.35	-1.36	1.37	1.41	-1.35
Energy	1.32	1.30	1.35		1.31	1.30	1.30	-1.29
Food	1.34	1.34	1.36	-1.31		1.32	1.35	-1.31
Other	-1.34	-1.31	-1.37	-1.30	-1.32		-1.31	-1.30
Textiles	-1.37	-1.31	-1.41	-1.30	-1.35	-1.31		-1.30
Water	1.32	1.30	1.35	1.29	1.31	1.30	1.30	

Table 15. p -values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		0	0	1	0	0	0	1
Construction	0		0	1	0	0	0	1
Chemistry	0	0		1	0	0	0	1
Energy	1	1	1		1	1	1	0
Food	0	0	0	1		0	0	1
Other	0	0	0	1	0		0	1
Textiles	0	0	0	1	0	0		1
Water	1	1	1	0	0	0	0	

Table 16. Test results: 1 means to reject the null hypothesis; 0 fails to reject the null hypothesis.

Piccolomini eighty year case

In the *Piccolomini eighty year case* the patent granted to Fedele Piccolomini was assigned a term of eighty years.

Terms:

	Average	Standard deviation	Count	Percentage
Agriculture	23.57	5.56	7	4.52%
Construction	21.88	5.12	16	10.32%
Chemistry	22.50	7.58	6	3.87%
Energy	28.08	13.16	39	25.16%
Food	23.89	6.01	9	5.81%
Other	21.47	7.02	17	10.97%
Textiles	21.67	4.20	18	11.61%
Water	29.76	15.50	43	27.74%

Table 17. Averages and standard deviations.

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	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		0.69	-1.51	-1.51	-0.11	0.78	0.82	-1.96
Construction	-0.69		-0.19	-2.51	-0.85	0.19	0.13	-2.93
Chemistry	-0.29	0.19		-1.49	-0.38	0.29	0.26	-1.87
Energy	1.51	2.51	1.49		1.44	2.44	2.75	-0.53
Food	0.11	0.85	0.38	-1.44		0.92	0.99	-1.90
Other	-0.78	-0.19	-0.29	-2.44	-0.92		-0.10	-2.85
Textiles	-0.82	-0.13	-0.26	-2.75	-0.99	0.10		-3.16
Water	1.96	2.93	1.87	0.53	1.90	2.85	3.16	

Table 18. Test statistic values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Water	Energy	Food	Agriculture	Chemistry	Construction	Textile	Other	
Agriculture		1.35	1.36	-1.32	-1.34	1.34	1.37	-1.31
Construction	-1.35		-1.39	-1.30	-1.34	1.31	1.31	-1.30
Chemistry	-1.36	1.39		-1.35	-1.36	1.37	1.41	-1.34
Energy	1.32	1.30	1.35		1.31	1.30	1.30	-1.29
Food	1.34	1.34	1.36	-1.31		1.32	1.35	-1.31
Other	-1.34	-1.31	-1.37	-1.30	-1.32		-1.31	-1.30
Textiles	-1.37	-1.31	-1.41	-1.30	-1.35	-1.31		-1.30
Water	1.31	1.30	1.34	1.29	1.31	1.30	1.30	

Table 19. *p*-values.

	Agriculture	Construction	Chemistry	Energy	Food	Other	Textile	Water
Agriculture		0	0	1	0	0	0	1
Construction	0		0	1	0	0	0	1
Chemistry	0	0		1	0	0	0	1
Energy	1	1	1		1	1	1	0
Food	0	0	0	1		0	0	1
Other	0	0	0	1	0		0	1
Textiles	0	0	0	1	0	0		1
Water	1	1	1	0	0	0	0	

Table 20. Test results: 1 means to reject the null hypothesis; 0 fails to reject the null hypothesis.