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PATENTLY PECULIAR: PATENTS AND INNOVATION IN THE UNITED KINGDOM OF THE NETHERLANDS

Homer Wagenaar (Belgian Competition Authority)
Christopher L. Colvin (Queen's University Belfast)

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QUEEN'S UNIVERSITY CENTRE FOR ECONOMIC HISTORY
Queen's Business School
Queen's University Belfast
185 Stranmillis Road
Belfast BT9 5EE

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Patently Peculiar: Patents and Innovation in the United Kingdom of the Netherlands*

Homer Wagenaar† Christopher L. Colvin‡

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Abstract

We examine the accessibility and functioning of the patent system in the United Kingdom of the Netherlands, a state that existed between 1815 and 1830. The country's patent law combined an examination process with significant government discretion over a patent's duration and cost. Using our hand-collected database of all patent applications—granted, withdrawn, and rejected—we analyse the determinants of success, and the conditions imposed on applicants by the system's administrators. We find that discretion optimised patent terms rather than causing bias. The system was accessible despite high fees. Our analysis suggests that social class, skills, and market orientation drove the demand for patents. Our research contributes to understanding the history of European patent institutions by adding high-quality patent data for the second economy in the world to experience an Industrial Revolution.

Keywords: patents, innovation, industrialisation, discretion, Low Countries.

JEL Classification: L51, N44, N74, O31, O34.

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† Belgian Competition Authority, Brussels.
‡ Department of Economics, Queen's University Belfast, and Centre for Economics, Policy and History. Corresponding author. Email: chris.colvin@qub.ac.uk.

1. Introduction

We conduct a quantitative analysis of a new hand-collected dataset of all patent applications submitted to the government of the United Kingdom of the Netherlands (hereafter, UKNL). Covering present-day Belgium and the Netherlands, this polity was created in 1815, at the conclusion of the Napoleonic wars, as a buffer state against future French aggression (Kennedy 2016). In 1817, the new UKNL government introduced a single patent system for the entire state, to be administered centrally from Brussels and The Hague, its alternating seats of government.[1] The UKNL's existence as a unified state ended in 1830 with the Belgian Revolution and the *de facto* secession of the Southern Netherlands. The UKNL's patent system was then inherited, unchanged, by its two successor states. But while Belgium went on to enforce and enhance this patent system, the same patent laws gradually fell into disuse in the Netherlands, where the system was eventually abolished in 1869 (Wagenaar 2025). In this paper, we investigate the genesis and impact of Belgian and Dutch patent law by examining its use in a period when the Southern Netherlands had begun its path towards becoming the world's second industrial nation (Mokyr 1974; Phillips and Buyst 2020).

The UKNL's new patent system was rather peculiar in that it combined the intellectual property traditions of several neighbouring states, and gave civil servants significant discretion over its administration (Wagenaar 2025). It borrowed various features of the French patent system of 1791, including the distinction between inventions made by domiciled applicants and inventions imported from abroad. It gave applicants the option to apply for patent protection for five, ten, or fifteen years, for which they had to pay very high up-front fees. The law required successful applicants to put their patented inventions into production within two years of the patent's grant. The patent system's administrators also borrowed and expanded upon several informal practices from the French system, including a substantive patent examination step and a practice of reducing patent fees for inventors claiming limited financial means.[2]

Unlike in France, the UKNL's patent system gave government officials the power to reject patent applications. In so doing, the UKNL state introduced a distinctly "Dutch dimension" into the practice of the law in the form of discretion for officials on a case-by-case basis over the conditions for granting patents. More specifically, it distinguished itself from the French system by: (1) actively rejecting patents for lack of novelty or utility; (2) altering the patent length requested by the applicant in light of their novelty claims; and (3) imposing

[1] The King of the UKNL was also the Grand Duke of Luxembourg, and so the UKNL and Luxembourg were in a personal union. They were administered as a single jurisdiction for the purpose of the patent system.
[2] See Baudry (2015, 226–29; 2019) for a description of these informal practices in the French patent system, and Nuvolari et al. (2023) for a quantitative history of the French system.

conditions to supplement those mentioned in the law, such as open license clauses. Furthermore, the UKNL state prevented public access to patent specifications until their expiry, giving patent protection some of the benefits usually only derived from trade secrecy.[3]

Elsewhere, Wagenaar (2025) describes the history of the UKNL's intellectual property regime by process tracing patent applications through the patent system using the same archival sources exploited here. Wagenaar asks how the UKNL's patent institutions developed informal rules of procedure for features like patent examination. He then tracks the day-to-day operation of the patent system over time to see how patent law and practice changed in each successor state following Belgium's *de facto* independence. Wagenaar's contribution is to have focused on actual policy implementation, beyond the legal stipulations, revealing officials who used wide discretion to adapt patent rights to specific circumstances in individual cases. He describes an institution that differs significantly from today's one-size-fits-all approach to the design of intellectual property rights (cf. Scotchmer 2006).

Our current paper, as the first data-driven description and analysis of the UKNL's patent system, builds on Wagenaar's institutional history. The only other investigation of this system to rely on actual patent data is Doorman (1947). And while Doorman's work is foundational and central to part of the database we compile for our own study, his analysis is limited to a few tables of patent count data. The most influential work to use Doorman's patent data is Mokyr (1976), who tracks the numbers of patents by technological sector emanating from parts of the country that would later become Belgium and the Netherlands. Studies by De Favereau (2011) and Péters (2014) on the post-independence Belgian patent system do not analyse anything before 1830. The Dutch abolition of its patent system and its subsequent period without patents (1869–1912) have garnered the most interest from historians.[4] But the rare discussions there of the UKNL's 1817 patent law are always presented through the lens of the later Dutch abolition debates (see Wagenaar 2025). We, therefore, fill a clear gap in the literature.

Mokyr's (1976) work is thus the most direct predecessor of our present analysis. Using Doorman's patent counts, Mokyr (1976) argues that the Southern Netherlands (i.e., present-day Belgium) industrialised early alongside Great Britain in the First Industrial Revolution, but the Northern Netherlands (i.e., present-day the Netherlands) did not.[5] While both parts of the

[3] These various features made UKNL patent law and practice closer to the contemporary patent systems of several German states (cf. Donges and Selgert 2019a, 2019b; Lehmann-Hasemeyer and Streb 2020).

[4] See Doorman (1947), Machlup and Penrose (1950), Schiff (1971), den Hertog (1976), Gerzon (1986), Stokvis (1993), Moser (2005), de Ridder (2015), and van Gompel (2019). These works are useful for understanding the contemporary debates on patents in the Netherlands, and the economics of the "patentless period", but do not describe the uses of the patent system in the early nineteenth century.

[5] Building on Mokyr, Griffiths (1979) argued that the Netherlands suffered an "industrial retardation", industrialising only very late in the nineteenth century. Griffiths's late dating has since been brought back

kingdom shared the same patent institutions, they nevertheless had very different experiences of innovation and technical change. Thus, describing the patent system in use clarifies the pattern of industrialisation across the Low Countries, but also suggests that having a patent system was not a sufficient condition for an Industrial Revolution to take place. We add to Mokyr's analysis with a much more in-depth study of the drivers of patenting during this period.

We base our cliometric treatment of the UKNL's patent system around a central question: how accessible was this polity's patent system to inventors? Then, we examine how it compares with other contemporaneous European patent systems, drawing on insights from recent cliometric research. To answer these questions, we construct a new database comprising the population of applications filed during the existence of the UKNL as a unified state. Our data constitute: (1) applications eventually granted; but also (2) those withdrawn by applicants; and (3) those rejected by the system's administrators. They are pieced together from the handwritten archival records of the various government ministries responsible for the system's administration. The data themselves are an important contribution, also because historical research on nineteenth-century European patent systems thus far makes use only of *granted* patents. Excluding unsuccessful applications from other historical patent datasets may obfuscate the effects of patent systems on selecting success.

Besides information on the technology being patented, we record any available characteristics of the applicants, including their occupation and place of residence. We code these using the HISCO-HISCLASS scheme, following van Leeuwen et al. (2002) and van Leeuwen and Maas (2011). We also classify patents into technological classes using the machine learning algorithm of Billington and Hanna (2021). Our unique data thus permit us to explore the correlates of a patent application's success, as well as the conditions under which a patent is granted. We investigate whether UKNL-domiciled applicants and those residing abroad were treated the same. We also examine whether applicants from northern provinces (i.e., what would become the Netherlands) and those from southern provinces (i.e., what would become Belgium) were treated equitably.

We find that the wide discretion of the law to customise the conditions for each patent did not appear to have led to unfair, arbitrary or inconsistent treatment. Rather, discretion was apparently used to economically optimise the patent length and costs, balancing the needs of applicants and society. We find that, despite high patent fees, the system was accessible to the

somewhat (see discussion in van Zanden and van Riel 2021). And the timing and geography of Belgium's early industrialisation have also been nuanced (Philips and Buyst 2020). However, there remains agreement that the North and South had different industrialisation experiences.

UKNL's non-elite; that similar proportions of social classes patented in each region; and that both skills and market orientation drove the demand for patent protection. Our findings somewhat rehabilitate the UKNL's patent system, which previous scholarship has typically disparaged as being rather peculiar and predestined to fail (e.g., Schiff 1971). Our work suggests instead that the system was emerging as an "open access order institution", which was developing clear and well-understood rules and practices (following the terminology of North et al. 2009). Moreover, we demonstrate that the consistent implementation of discretion over patent terms meant it was functioning as an "inclusive economic institution" open to all, irrespective of ability to pay (following the terminology of Acemoglu and Robinson 2012).[6] Contrary to Kydland and Prescott's (1977) famous view that policy discretion over the patent system leads to time-inconsistent policymaking, the UKNL's experience suggests instead that administrative discretion, when applied consistently and in a non-arbitrary fashion, can be welfare-enhancing.

Our paper builds on a plethora of recent cliometric studies of patent systems during the First and Second Industrial Revolutions: Bottomley (2014b) and Billington (2021) for England, Scotland, and Ireland, 1700–1852; Sáiz (2014) for Spain, 1820–1930; Donges and Selgert (2019b) for Baden, 1844–1877; Nuvolari and Vasta (2019) for pre-unification Italy, 1855–1872; Lehmann-Hasemeyer and Streb (2020) for Württemberg, 1844–1868; Donges and Selgert (2021) for Prussia, 1845–1877; Nuvolari et al. (2023) for France, 1791–1844; and, most recently, Berger and Prawitz (2024) for Sweden, 1840–1914. These European studies, in turn, build on earlier work conducted by Sokoloff, Khan and Lamoreaux on the patent system of the United States (Sokoloff 1988; Sokoloff and Khan 1990, 1993; Lamoreaux and Sokoloff 1996, 2001). Not only do we contribute to this literature by describing a new country case study, but our comparison of findings across these studies is also a valuable contribution to economic historians seeking to understand the state-of-the-art in this field. Despite its peculiar design, we find that the outcomes of the UKNL's patent system were more-or-less comparable to studies of patents in France, Germany and Great Britain.

Beyond our more explicit contributions, this paper also offers new insight into the emergence and rapid collapse of the UKNL as a unified state in the early nineteenth century. In their epilogue to an edited volume commemorating 200 years since the founding of the UKNL, Judo and Van de Perre (2015) identify the design and functioning of the polity's legal system

[6] This contrasts with van den Berg (2012), who characterises William I's efforts to integrate other parts of the legal systems of the two previously separate jurisdictions as amounting to an oppressive top-down imposition by Northern Netherlanders on the people of the Southern Netherlands.

as a continuing lacuna in our historical knowledge.[7] Our analysis of the UKNL's patent system offers a perspective on its emerging day-to-day legal practices, as distinct from its formal "black-letter law", specifically in the realm of innovation policy. However, we argue that a more significant contribution is our work's potential to improve our understanding of the UKNL's economic structure and performance. This period in the economic history of the Low Countries remains quite neglected by scholars of both Belgium and the Netherlands, who tend to conclude their narratives with the Batavian Revolution of 1795 or to begin with the Belgian Revolution of 1830, or who only examine the part of the UKNL that happens to fall within their country's modern borders (cf. Witte 2016).[8]

Our work proceeds as follows. Section 2 develops a set of hypotheses about the statistical regularities of the UKNL's patent system based on our reading of the most recent literature on other contemporaneous European patent institutions, in addition to our knowledge of the UKNL's system based on Wagenaar (2025). Section 3 then describes the dataset we collected and explains the empirical strategy we employed for analysis. Section 4 presents results of our univariate statistical analysis, while Section 5 does the same via discrete choice models by which we can differentiate on a multivariate basis along these same dimensions. Section 6 discusses our results in light of our initial hypotheses and compares our findings with the cliometric works introduced in Section 2. Finally, Section 7 concludes.

2. Hypothesis Development

We are the first to conduct a data-driven study of the workings of the UKNL's patent system. As such, we are unable to start with informed expectations about how this institution functions in practice. Instead, we derive our working hypotheses from a review of recent studies on patent systems operating elsewhere in roughly the same historical period. We identify four categories of testable hypotheses that are common across these studies (see Table 1). The first two sets of hypotheses are on the functioning of patent institutions themselves: (1) the relationship between patent rights and the transfer of technology (H1-2); and (2) the accessibility of patents and the discrimination employed by patent institutions (H3-5). The second two concern the interaction between patent institutions and the causes of the First Industrial Revolution, dividing between:

[7] Van den Berg's (2012) study of the attempt to replace the Code Napoléon is a rare exception.
[8] There are notable exceptions to this: Horlings (2006) looks at the economic causes and consequences of Belgian independence, highlighting the role of the large fiscal transfers that went from the South to the North; Buyst (2013) argues that economic integration between the Northern and Southern Netherlands proved too difficult to achieve; and Philips and Buyst (2020) start their economic analysis of the entire Low Countries region in 1820, and then compare both successor polities on a longitudinal and comparative basis following the UKNL's partition.

(3) demand factors (H6-8); and (4) supply factors (H9-11). We review the literature on each set of hypotheses in turn, and use our discussion to inform our expectations regarding the UKNL.

[INSERT TABLE 1 HERE]

2.1 Patents and Technology Transfers

Patent institutions influence technology transfer by granting monopoly rights to innovators entering new markets. Countries have historically adjusted patent laws to optimise technology importation and invention, either favouring or restricting foreign applicants. Follower nations are documented to use patents to catch up by discriminating against inventors from leading economies or adopting weak intellectual property rights (Lerner 2002). Common mechanisms used across history include: (1) working clauses requiring patents to be used within a few years; (2) open licence clauses limiting monopolies; and (3) patents of importation, allowing anyone to patent foreign technology new to the country.

A separate patent right for importation was common throughout Europe in our period of inquiry. In England, patents for introducing foreign technology predated those for new inventions (Bottomley 2014b).[9] In the early modern period, when foreign patents were difficult to track, states prioritised what was new to their polity, not distinguishing invention from importation (Doorman 1940). The US broke from this tradition in 1790, restricting patents to the "first and true inventor" (Khan 2005). France's 1791 law explicitly distinguished invention patents from importations (Pretel 2018), a model later adopted by Spain (Sáiz 2014), some Italian states (Armengaud 1840; Tolhausen 1857; Nuvolari and Vasta 2019), parts of Germany (Donges and Selgert 2019a), and, in 1817, the UKNL (Wagenaar 2025).

Patents of invention and patents of importation differ fundamentally in economic risk and purpose (H1). Patents of invention typically cover risky unproven innovations, while patents of importation reduced risk and uncertainty by giving temporary monopoly rights to those selecting established technologies from abroad. Importation costs vary between economies according to technological and resource gaps, but are likely to be lower than those for invention. Importers are typically users or entrepreneurs who identify market opportunities rather than creators of new technology, and are likely more economically than technically connected to innovations.

While the French patent system included patents of importation as a distinct intellectual property right, the most recent cliometric study of this system by Nuvolari et al. (2023) does

[9] The "first and true inventors" of the British system included importers. Applicants were required to specify whether they had invented or imported the invention (Bottomley 2014b).

not investigate the differences between patents of importation and patents of invention for their users. Instead, their statistical analysis of technology transfer treats the two patent rights interchangeably. Sáiz (2014) is the only author we are aware of who quantitatively compares patents of importation and invention for the nineteenth century, for the case of Spain. There, Spanish citizens and foreigners were apparently treated equally: both could enjoy either a patent of invention as the true inventor, or a patent of importation if not. Both had to work their patent within a set number of years, but patents of importation were more constrained in length and more costly.[10]

The impact of patent institutions on technology transfer (H2) is difficult to assess, since patented and unpatented inventions must be compared and counterfactual scenarios considered. Studies address this by: (1) comparing jurisdictions with varying patent activity, as in Nuvolari and Vasta (2019) for pre-unification Italy and Donges and Selgert (2019b) for Baden; or (2) analysing patents taken in multiple jurisdictions, as seen in Bottomley (2014b) and Billington (2021) for the UK, Nuvolari et al. (2023) for France and Sáiz (2014) for Spain. These approaches help clarify the role of patent systems in facilitating technological diffusion.

The UKNL patent system, like the French model, granted patents of importation to both original foreign inventors and third-party applicants, providing monopolies equivalent to patents of invention, albeit limited to the term of any existing foreign patent.[11] Archival evidence suggests that the UKNL system differentiated between these patents, reducing their terms because importation required less effort (Wagenaar 2025). Importers, like domestic inventors, had to work their patents within two years, but this requirement was adjusted when considered necessary to be more burdensome for them. The system also rejected patents for easily disseminated technologies and introduced open license clauses, compelling importers to share technology for a "fair" fee.[12] These features likely fostered technological transfer, shaped patents of importation into distinct property rights, and helped overcome legal barriers to skilled labour migration and machinery exports.[13]

[10] Indeed, Sáiz (2014) finds that patents of importation were more likely to be taken: (1) by individuals with more production-related occupations; (2) for less complex light industry inventions; (3) for inventions that were successfully worked; and (4) by those domiciled in Spain rather than abroad.

[11] This policy of making the patent length reflect the effort of the applicant and the likelihood for them to make a decent but not exaggerated profit—and therefore to constrain patent length more often towards importers—was formulated in a report to the King in June 1817 (Report to the King on patent request Berthelin, in NL-HaNA, 2.04.01, 4039, Dossier Berthelin, 23-6-1817, 1218).

[12] Open license clauses, rejection of "easy" importations, working clauses, and reduction of patent length that developed in the UKNL remained common practices in post-independence Belgium (Varlet 1838, 28–32).

[13] The United Kingdom of Great Britain and Ireland had labour restrictions against skilled workers' migrating (until 1824) and machinery exports (until 1843)—but these laws were not enforceable (Jeremy 1977).

2.2 Accessibility and Discrimination

The debate on patent accessibility in economic history dates to Sokoloff and Khan's (1990) work on the "democratisation of invention" in the US. They found that early nineteenth-century patenting was also conducted by low-status individuals—rural, non-specialised, and often artisans rather than professionals. They linked this trend to expanding market opportunities and argued that innovation in the First Industrial Revolution relied on widely available basic skills and knowledge, suggesting few supply constraint on inventive activity. It made patenting accessible to a broad segment of the population (H3).

Khan (2005) compares American patent institutions with those in Britain and France. The latter she finds elitist, due to high patent fees, weak legal security, and slow publication of specifications, which she argues hindered competition. In contrast, the US system's security encouraged a market for technology, facilitating the monetisation of patents.[14] Khan contends that this broad accessibility enabled innovation to flourish beyond capital-intensive sectors, handicapping Britain and France as long-term competitors.

Khan's assessment of US patent institutions, however, remains controversial. Streb (2022) questions her stark comparison with Britain and France, which industrialised successfully despite differing patent systems. Bottomley (2019b) argues that pre-1836 US patents lacked novelty checks and that Britain's system, though costly, was fair and effective. Baudry (2019) finds that France *did* have an informal examination process that improved patent quality, while Galvez-Behar (2019) argues the French system, despite high fees, was democratic. Nuvolari et al. (2023) and Billington (2021) find that artisans patented widely in France and Britain. Meanwhile, Nuvolari and Vasta (2015; 2017; 2019) argue that pre-unification Italy had accessible fees and was therefore also open to non-elites.[15] We expect the UKNL's patent rights to function in a similar way to these other European patent institutions.

The debate on nineteenth-century patent system accessibility focuses primarily on class (H3), with less attention to gender and race—with the notable exception of Khan (1996; 2000; 2016; 2017; 2024) and Cook (2014). Khan (1996) shows that restrictive US marriage laws limited women's ability to patent independently, a situation mirrored in the UKNL under the Code Napoleon, where married women required spousal permission to patent. This legal barrier explains the near absence of female patentees in our dataset.[16] Cook (2014) found that racial

[14] This is also analysed in Lamoreaux and Sokoloff (2001) and Lamoreaux et al. (2013).
[15] Berger and Prawitz (2025) are dissenters in this genre, in that they argue that Sweden's patent system was not particularly accessible to non-elites.
[16] Meanwhile, Khan (2024) shows that British women inventors specialised in fields that was not eligible for patents.

violence in the US suppressed African American patenting. While race was not significant in the Dutch metropole, discrimination in the UKNL could have existed along regional lines (Northern versus Southern Netherlands), by linguistic identity (Dutch versus French), social class (social elites versus other groups), and religion (Catholic, Protestant and Jewish).

Patent system accessibility is often considered in relation to citizens, but foreign inventors may also face additional significant barriers (H5). Several countries imposed restrictions on foreigners, such as the US between 1793 and 1836, which allowed patents for citizens and domiciled foreigners only (Khan 2005), or Prussia, which required foreign applicants to use local patent agents (Donges and Selgert 2021). Foreigners also faced burdens such as working clauses that required investment in local production facilities, and open license clauses limiting monopoly rights. Fee discrimination was widespread; post-1836 US patent laws charged foreigners more, and British applicants most (Hancock 1850), while Württemberg secretly overcharged foreigners despite treaty obligations (Lehmann-Hasemeyer and Streb 2020). Processing delays also acted as barriers; in the 1920s, Germany delayed American machine-tool patents to benefit domestic firms (Richter and Streb 2011), while from the 1960s, Japan discriminated against foreigners by delaying or denying their applications (Kotabe 1992).

Using descriptive econometrics, we can ascertain the degree to which the UKNL's patent authorities discriminated. In particular, we can investigate discrimination against foreigners and between (language) regions within the UKNL system across three parameters: (1) the patent approval rate; (2) the patent application processing times; and (3) the patent application fees. Beyond this, because the UKNL system allowed the authorities to decide patent length on a case-by-case basis, we can also analyse differences between the patent length requested by the patentee and that officially assigned by the patent examiner. We can use similar metrics, together with evidence on the class composition of patent applicants, to ascertain how "democratic" the UKNL patent system was (H3). Given the institutional history presented in Wagenaar (2025), we posit that the UKNL's system was democratic even though the patent fees were high, because reduced fees were charged to applicants with insufficient means.[17]

Besides testing for discrimination against foreigners (H4), it makes sense to test for internal discrimination between Northern and Southern patent applicants. After all, the Southern and the Northern Netherlands had been distinct polities for centuries and been united only lately. The UKNL government has been described as a semi-constitutional autocracy centred around Willem I. It mostly consisted of Northern Netherlandish personnel and ministers

[17] A five-, ten- or fifteen-year patent cost 150, 300 or 600 Dutch guilders. The wage for an unskilled worker in the Northern Netherlands in 1819/1820 was around one guilder a day (van Zanden and van Riel 2000, 84).

(van Zanten 2004, 178–179; Deneckere 2015; IJsselmuiden 1988).[18] This government is argued to have exploited the Southern Netherlands as a revenue-generating territory to service a huge state debt that was mostly held by Northern elites (van Zanden and van Riel 2021).

We know that the UKNL system indirectly discriminated against foreigners by distinguishing between patents of invention and patents of importation. Yet domestic UKNL importers of technology did not necessarily obtain patents of importation more easily than foreigners. Thus, to investigate whether the patent system applied more informal discrimination between foreign than domestic applicants, the domestic importer of technology should be compared with the foreign importer (H5).[19]

2.3 Demand and Supply Factors

The literature on innovation often uses the patent system to track and analyse invention across time, and consequently, discussions on patenting during the First Industrial Revolution remains a popular topic of enquiry. However, scholars acknowledge that much of the crucial innovations of this period occurred outside the patent system (Greasley and Oxley 2007; MacLeod 2009; Mokyr 2009a; Moser 2013; 2016; MacLeod and Nuvolari 2016).

The central debate concerns whether supply (skills, knowledge) or demand (economic needs) was more influential (Crafts 2011; Dowey 2017). Allen (2009) supports a demand-driven view, arguing technological needs drove innovation, while Mokyr (2009b) emphasises supply factors. Other scholars highlight the roles of skilled labour, institutions (Kelly et al. 2014; Dowey 2017), and cultural influences (McCloskey 2010; Jacob 2014; cf. Ó Gráda 2016). These perspectives are not mutually exclusive—Allen (2009) incorporates Mokyr's macro-(demand) and micro-invention (supply) distinction. Nuvolari et al. (2021) support a demand-driven model but stress engineers' contributions, reinforcing supply-side elements. Crafts (2011) calls for further research into incremental micro-inventions.

Cliometric patent histories mirror these debates. On the supply side, Billington (2021) and Nuvolari et al. (2023) show that skilled individuals, including artisans and scientifically trained inventors, dominated patent use in Britain and France (H6) and were more likely to secure valuable patents (H7). Meanwhile, for Sweden, Berger and Prawitz (2024) find that

[18] However, for the Ministry of the Interior, the department responsible for the UKNL's patent system, 40% of civil servants hailed from the Southern Netherlanders. This was a relatively good proportion, considering that their overall share in the national government was just 10%. The population of the Southern Netherlands was 3 million; the Northern Netherlands counted 2 million (Commissie voor de Statistiek 1826).

[19] We should also test for differences between the compulsory licenses clauses imposed on patents. The first open license clauses appeared in 1825 and 1826, and concerned steam engines technology imported and invented by Gerhard Mauritz Röntgen, who was a pioneer of the first steamships built in the UKNL, and a former UKNL navy officer and industrial spy (Ramaer 1918; Koch 2013, 395–97).

patenting is associated with a highly educated social elite (H6), but also find an association between patenting and higher intergenerational social mobility. Donges and Selgert (2019b; 2021) find similar patterns in Baden and Prussia; they note that foreign patentees in Baden sought protection from local competition (H8), linking technological capacity to patenting.

From a demand perspective, research tests whether patentees responded to economic incentives. Bottomley (2014a), Nuvolari and Vasta (2019), and Donges and Selgert (2019b; 2021) show that inventors in Britain, Italy, Baden, and Prussia applied for patents where markets existed for their innovations (H9). Furthermore, Bottomley (2014a), Billington (2021), Nuvolari and Vasta (2019), and Nuvolari et al. (2021) find that more valuable patents were filed in multiple jurisdictions (H10), highlighting patentees' focus on economic returns.

Patent grant rates generally follow the Industrial Revolution's timeline in each country (H11)—except in Prussia, where the patent office was highly restrictive (Donges and Selgert 2021). The causal link between patents and industrialisation is unclear (Greasley and Oxley 2007; MacLeod and Nuvolari 2016), but technological transformation probably increased the benefits of patenting. This applies especially to industries where secrecy was unfeasible due to exposure to reverse engineering (Moser 2005).

The limitations of patent statistics are well known (Griliches 1990; Streb 2016). Patents represent only certain innovations, since not all inventions are patentable or worth patenting. Trade secrecy is often preferable when secrecy can be maintained (MacLeod 1988). Patenting is more viable in markets with fewer competitors, easier counterfeit detection, and willing buyers (Moser 2005). Moreover, patents differ in scope and value, with only a small fraction proving highly valuable.

Historical research uses five methods to assess patent quality. The first relies on renewal fees and assumes valuable patents are maintained (following Schankerman and Pakes 1986). The second evaluates patent specifications through technology historians (MacLeod et al. 2003). A third method, devised by Nuvolari and Tartari (2011), tracks documentary citations. The fourth, pioneered by Khan and Sokoloff (1993), analyses inventor biographies. Lastly, researchers use alternative innovation proxies (Moser 2016), such as productivity, power, speeds (Allen 1983; Nuvolari 2004; Lampe and Moser 2010; Kelly and Ó Gráda 2019), world fair exhibits (Moser 2005), or prizes (Brunt et al. 2012).

Patents have historically served purposes beyond protecting inventions. MacLeod (1988) highlighted motives like reputation-building, branding, and investor signalling, particularly in first-to-file systems where inventors patented pre-emptively. Péters (2014) and

De Favereau (2011) have found similar trends in post-revolution Belgium, where patents in zinc and agriculture often served as signalling devices.

The UKNL patent system involved a substantive examination phase, but explicitly stated that grants did not guarantee novelty or utility.[20] Patents were mostly rejected for lack of novelty and, less frequently, lack of utility (Wagenaar 2025). Examiners counselled applicants on viability but did not always block patents. The system relied on fees and examination to filter insignificant inventions. Requests for fee-free patents led to greater scrutiny of patentees and invention utility. While patentees were likely not always highly skilled (H6), skilled individuals probably held the most valuable patents (H7), and foreigners' patents competed with domestic industries where economic opportunities were strongest (H8).

Measuring patent value in the Dutch case is challenging. All costs were paid upfront; no renewal fees were due. Patent length is also unreliable, for authorities could limit the duration of economically valuable patents because they judged that sufficient returns on investment could be made across a shorter period. Instead, a composite quality index can be developed using the technology histories of Doorman (1947).

Regarding demand orientation, UKNL patenting was likely to have been both market- and incentive-driven. We know already that the Southern Netherlands patented more than the North (Mokyr 1976), reflecting that region's early industrialisation (H9, H11). We also expect that valuable patents were probably filed in multiple jurisdictions (H10), so hypothesise that imported technology in the UKNL was higher in value. Not all patents were to protect innovations; some were taken for their signalling value rather than legal exclusion rights.[21]

3. Data and Empirical Strategy

We construct a dataset of the full population of all patent applications in the UKNL between 1817 and 1830 in four stages. First, we extract a dataset from Doorman's (1947) list of all granted patents in the Netherlands in the nineteenth century. Doorman's data were completed

[20] The UKNL adopted a clause from the 1791 French legislation, which lacked a preliminary examination and aimed to prevent patents from being used for signalling. The UKNL cited this clause when doubting an invention's utility (see, e.g., the report to the King on resistance by Glaser to the patent request by Heinish, NL-HaNA, entry no. 2.04.01, inv. no 4451, 2-3-1829, no 203A). See Billington et al. (2025) for further discussion on the economics of patent examination through the lens of signalling theory.

[21] In one case, a patent applicant explicitly requested a patent without exclusive rights, seeking only the prestige of using the state insignia and the title 'patented by His Majesty King of the Netherlands' on labels and price lists. His request was denied due to a lack of novelty (Report on request of Franciscus Gijsbertus van den Boogaard, NL-HaNA, 2.04.01, 4383, 22-2-1828, 109A).

and corrected using the registry of all patents granted between 1817 and 1869, obtained from the Nationaal Archief in The Hague.[22]

Second, the ledgers on all communications and dossiers of the Ministry of Education served to reconstruct all applications related to inventions.[23] This allows us to retrace the full procedural steps that any patent application had undergone, for example whether and how often it was returned for correction, and the reconstruction of the length of application procedure for each patent application. The successful patents were cross-referenced with the dataset of granted patents. Crucially, using these records enables us to retrieve those applications that were discontinued or rejected, as well as those inventors who sought to obtain other rewards, such as loans or prizes.

In the third stage, all dossiers retrievable in the relevant archives were searched for important details like the title or nature of the invention, what the applicant had applied for, the applicant's occupation, and the reasons for rejection.[24] In the fourth stage, we divided patentees and patents into categories to aid our analysis. The occupations were encoded into HISCLASS categories following the procedure set out in van Leeuwen and Maas (2011), as used recently by Billington (2021), Nuvolari et al. (2023) and Berger and Prawitz (2024) for English, French and Swedish patentees.[25] The classes were then recombined into groups to avoid relatively arbitrary class distinctions due to the exact choice of terms used by applicants to describe themselves.[26] The patent titles were transformed into technological classes following the twenty technology class categories developed by Billington and Hanna (2021). For maximum accuracy, we adapted their machine learning tool to Dutch, and manually corrected the output.

Finally, we used Doorman's (1947; 1953) technology histories to build a patent quality indicator for granted patents. Doorman's aim was to construct a technological history of the Netherlands, accompanying his list of granted patents with individual technological history comments. He frequently inserted references to individual patents or patentees found in

[22] The UKNL's patent registries, including Doorman's replacement registry, are held by the Nationaal Archief (Dutch National Archives) in The Hague under NL-HaNA: entry no. 2.04.23.01 (Ministerie van Binnenlandse Zaken: Afdeling Nijverheid en voorgangers, 1817-1877), inv. no. 1236-1240 (Registers van verleende octrooien).
[23] For the ledgers, see NL-HaNA, entry no. 2.04.01 (Ministerie van Binnenlandse Zaken, 1813-1848), inv. no. 4049-4051 (Indices 1815–1818); 4190-4196 (Indices op de verbalen 1818–1824); 4925-4936 (Indices op de verbalen 1824–1830). High-quality photographs of the ledgers and dossiers are available digitally at: https://www.nationaalarchief.nl/en/research/archive/2.04.01.
[24] See NL-HaNA, 2.04.01, inv. no. 4039-4942 (Uitvindingen); inv. no. 4055-4175 (verbalen: besluiten, minuten van uitgaande brieven en ingekomen stukken, 1818–1824); inv. no. 4204-4545 (verbalen 1824–1830).
[25] See Appendix A for description of the HISCLASS encoding, some descriptive statistics of the outcome, as well as a comparative analysis with the HISCLASS outcome of the United Kingdom of Britain and Ireland.
[26] We cannot preclude the possibility that inventors are misreporting their own profession. However, it is reasonable to assume that the professional background of inventors is better for those whose patent underwent an examination of the type which involved an industrial advisor drawn from local Chambers of Commerce.

literature or technological historiography of the time, with their prizes at industrial fairs. We used these comments to build a "Doorman Indicator" for valuable patents.[27]

[INSERT TABLE 2 HERE]

Our resulting dataset is very rich. It contains details of all patent applicants, including their name, place and province of residence within the UKNL, country of residence if foreign, and occupation. It also includes information about the invention being applied for, including a quality indicator, patent type, length and fees requested, the patent length, fees and conditions imposed on the applicant, each administrative step linked to the relevant date at the ministry, which external players were involved in the processing and examination of the application, whether the patent application had been rejected and by whom, and whether the patent had been transferred to another owner and to whom. The variables created for this paper are in Table 2.

[INSERT FIGURE 1 HERE]
[INSERT FIGURE 2 HERE]

Figure 1 reports the patent application success ratio across time for our period of study. Figure 2 is a flowchart depicting how the Dutch patent system functioned in this period.[28] It shows how the patent system fitted into the UKNL's wider national innovation system; the files also record requests for subsidies, income support and loans, together with honorary titles and tax benefit requests. Requests often overlapped; several individuals requested both a premium and a patent, or asked for a subsidy but were instead forwarded to the patent authorities. In this paper we focus only on the 1,093 patent requests, thereby excluding other policy interventions from our core analysis.

The second important distinction evident from Figure 2 is whether a patent request is for a patent of invention, improvement or importation. Elsewhere, Wagenaar (2025) explains the legal and institutional features of these different types of patent. In short, 'invention' covered patents for new inventions by domestic inhabitants; 'improvement' signified improvements added to existing patents; and 'importation' indicated the first person to import a technology to UKNL territory, whoever the original inventor was. Given the small number of

[27] We did we not include citations in journals and magazines that Doorman considered to be self-promotion by the patentee. Nor did we include patents that Doorman discussed from personal interest.
[28] Appendix B uses this figure to describe the institutional design of the UKNL patent system in more detail.

patents for improvement in our dataset, and the fact that these were always sought by the original holder of the patent being improved, we exclude them from our main analysis.[29]

[INSERT FIGURE 3 HERE]
[INSERT FIGURE 4 HERE]

Figure 3 maps political borders, population and industrial employment in 1819 across three panels. Figure 4 maps our patent of invention dataset in two panels. A comparison of these maps depicting patent applications and grants does not suggest systematic discrimination across regions by patent officials; a visual inspection suggests that grants appear to number roughly in proportion to applications. Overall, the pattern of patenting corresponds with the pattern of industrial employment, but with some important outliers. The strongest industrial employment in 1819 is found in West-Vlaanderen (WVLA) and Oost-Vlaanderen (OVLA), yet patenting rates there across 1817-1930 are low. These provinces had a widespread rural textile (linen) industry employing a large share of the population with traditional production methods. Only Ghent (the capital of Oost-Vlaanderen) had a flourishing Manchester-style cotton industry thanks to successful early industrial espionage (Buyst 2018). The other outliers are the strong patenting performance of Zuid-Holland (ZHOL) and Zuid-Brabant (ZBRA), neither of which was a strong industrial centre at the time of the 1819 census, though both acted as the UKNL's revolving capital cities. Strong patenting rates in capitals have also been found in other studies (e.g. Nuvolari et. al. 2023), and are likely to be more a reflection of patent applicants and agents preferring to be close to the administrative process than any inherent patenting propensity of the local population.

To explore the 11 hypotheses derived from our reading of the cliometrics literature on European patent systems, we use an empirical strategy that explores whether statistical associations exist between the various indicators of interest in the context of the UKNL patent system. First, we employ univariate statistics that juxtapose directly the means of the various variables of interest across divisions of patent type, granted and ungranted patents, and geography. Then, we compute multivariate statistics to take account of possible interacting effects between variables. We do this by using discrete choice (logistic) models to estimate what indicators seem best to predict patent type, patent grants, the conditions under which the patents were granted, and the value of patents. Besides reporting a pseudo-R^2 statistic to measure the model's fit, we also calculate the area under the curve (AUC) of a receiver

[29] We could not classify some patents because they never went far enough in the application process for a declaration of their patent type. We count them as withdrawn patents.

operating characteristic to evaluate the predictive ability of the models—a diagnostic tool borrowed from the biomedical sciences.[30]

4. Univariate Statistical Analysis

Table 3 reports the univariate statistics for the full sample. Panel A shows that of all the patent applications, only 48 per cent survive the process and are granted. 22 per cent of applications are retracted or discontinued after the state informs applicants that their application does not meet the legal requirements. Most applications are submitted by a single applicant, with only 11 percent submitted by multiple applicants. This suggests that for most inventors or importers, a partnership with a wealthier individual was not required to gain access to the patent system.[31]

[INSERT TABLE 3 HERE]

The data show that only a small number of patents (19 per cent) were requested by someone who had applied before within the same 15-year timeframe. By contrast, many more (42 per cent) American patents from this period (1812-1830) were requested by a patentee who had more than one patent (Sokoloff and Khan 1990).[32] If we follow Sokoloff and Khan's logic (H3), then the relatively low number of career patentees seems to suggest a democratic use of the patent system. 30 per cent of patent applications were assessed by a technical adviser, while just 4 per cent were assessed by Chambers of Commerce and Industry.

Patent requests for inventions are distinguished from importations in the right-hand columns of Table 3 Panel A. At first sight, the intuition that these patent types are different (H1) is supported and should be treated separately in (regression) analyses: on almost all variables, a statistically significant difference is tested through a means test. The two indicators that are similar are the share of applications withdrawn after their first confrontation with the legal standards, and the proportion of applicants with several patent applications.

Interestingly, patents of importation are more likely to be refused than patents of invention, which is consistent with UKNL's policy of tougher investigations into these types of patent described in Wagenaar (2025). Besides having to conform to the usual minimum

[30] The area under the receiver operating characteristic curve (ROC curve) computes a logistic regression model's ability to discriminate between true signals (sensitivity) and false signals (1-specificity). Hosmer et al.'s (2013) rule of thumb: a value between 0.5 and 0.7 means that the model performs poorly, not much better than random; between 0.7 and 0.8 are acceptable; between 0.8 and 0.9 excellent; and between 0.9 and 1 outstanding.

[31] We know this because the Dutch law required all transfers of patent rights to be registered with the state for a small fee, or they would otherwise lose their validity. If an inventor wished to partner with a wealthy sponsor in return for a share of the patent, the sponsor would either have been listed as an inventor, or would become known following a patent transfer. Only 17 patents were transferred in our study window.

[32] Similar figures as for the US held for France in these years (Nuvolari et al. 2023).

standards of novelty and utility, the UKNL chose to grant only patents of importation to the kind of invention that does not spread easily across countries without patent rights. The data also confirm that industrial advisers were consulted more frequently in the examination of patents of importation. For patents of invention, the state was more likely involved as technical adviser, seemingly in line with the expectation that novel inventions required more technical competence to judge their novelty and utility.

As applicants for a patent of importation, a pattern of better-connected individuals emerges. They are more likely to work together with others and more likely to come from higher socioeconomic classes—whether this means a merchant-related position, a highly-trained professional, a manufacturer, an officer or a noble. Meanwhile, applicants of a patent of invention are most likely to be from the artisanal classes who work in the field where they have invented something—the "tinkerers".

In Table 3 Panel B, we split the data according to whether a patent was granted or not. For both patents of importation and invention, a shorter distance to one of the two administrative capitals of the UKNL appears to increase the likelihood of a patent grant. An industrial adviser was consulted with equal probability for granted and not granted patents, whether importation or invention. In contrast, a technical adviser was consulted more frequently in the case of applications that were granted, for patents of either type. This implies that the state was more at ease refusing patents without technical advice. Manufacturers, nobles and large landholders are more likely to be granted patents of invention or importation. For patents of importation, the merchant class is also represented. This confirms the picture drawn above of better-connected individuals being more likely to import foreign technology. Success in obtaining patents in importation applications also seems to depend more on experience. The opposite holds for higher professionals, who are less likely to be granted a patent of importation than applicants from other socioeconomic classes.[33]

Table 3 Panel C summarises the data by geography. On the left side, we split the data according to the UKNL's internal geography. We see that Southern applicants were: (1) more likely to be successful patentees; (2) more likely to gain several patents; (3) more likely to hold patents of importation; and (4) more likely to come from the manufacturing, landholder and nobility classes. By contrast, the Northern applicants are more likely to represent the merchant class. This contrast between manufacturers and commerce is consistent with the idea of a

[33] Applicants whose class we cannot discern are more likely to have had their patent denied. We think this is a mechanical result because successful applicants engage with the patent process for longer, and more records about them remain in the archives; ascertaining their profession is thus more likely.

manufacturing South and a commercial North. No statistical difference is found in the frequency of involvement by technical or industrial advisers between the two parts of the kingdom (H4), suggesting that the patent system was administered uniformly across the UKNL.

We compare the domestic requests for patents of importation with foreign requests for patents of importation on the right side of Table 3 Panel C. This suggests there was no discrimination over the patent grant decision (H5). The division across social classes is similar, except for higher professionals who are much more likely to come from abroad. This is probably a consequence of a more advanced state of professionalisation in France and the UK than in the UKNL.

[INSERT TABLE 4 HERE]

Table 4 reports the univariate statistics for the full sample of granted patents, beside patents of invention and importation separately, with again means testing on the difference between patents of invention and importation. We list various measures where the UKNL state could discriminate: (1) patent fees; (2) the length requested and assigned in years; (3) the reduction in patent lifespan granted to applicants; and (4) whether additional conditions were assigned to granted patents, such as open license clauses or a reduced length of the working clause.

The statistics suggest that the state did discriminate between the two patent types on all fronts (H1). The only exception appears to be the assigned lifespan. However, the length assigned here differs more from the length requested. The state reduced the lifespan for more than half of the granted patents of importation, compared to a third of patents of invention.

For the successful patents, we obtain the familiar pattern of the highest class of manufacturers and nobility more frequently being patentees for imports, with the medium-skilled and lower-skilled workers and artisans more frequently being granted patents for inventions than importations. The higher professionals and merchant classes are relatively evenly split between patents of invention and importation.

The average length requested of ten years is high (H3), considering that a ten-year patent would have cost the entire annual income of an unskilled worker. It probably reflects the wealth of the average patentee, or the expectation that they would be able to get a patent for a reduced fee—or even free—by claiming insufficient financial means. The Doorman Indicator suggests a higher *ex post* value assigned to patents of importation than to patents of invention: about 16 per cent of patents of importation have a higher value, versus 10 per cent of the patents of

invention—an outcome that conforms to the expectation that valuable patents are patented across more polities (H10), as well as being an important means of technology transfer (H2).

Univariate statistics are limited in that they do not make visible the underlying relationships between the indicators. In the following sections, we use regression analyses to further tease out the statistical regularities in a multivariate setting. In the first section we discuss the differences between patents of importation and invention. Then we investigate which patent applications tend to be more successful.

5. Multivariate Statistical Analysis

5.1 Correlates of Invention vs Importation

Table 5 reports a set of logistic regressions where we discern whether there is a systematic distinction to be made between patents of invention and patents of importation. The first four regressions are for the full sample of all applications, while the last four test for granted patents only. An advantage of this approach is that we can look for differences in the success rate, besides differences in those patents that have been successful, in variables that concern granted patents, such as the reduction of patent length.

[INSERT TABLE 5 HERE]

Each group of four regressions follows a regular patten in that they include, and then exclude, country of origin and the social class as control variables. Across all regressions we control for time period of application, and technological class of the invention. We include a time dimension because patent policies developed across our period. We include technology classes as controls because we know from other work that technology fields have a different propensity to patent, and use the patent system differently. The R^2 and AUC statistics indicate that the models' predictive quality improves significantly when geographical and class dimensions are included.

First, the table confirms that the state treats patents of importation and patents of invention differently (H1). Both the patent success rate and by how much the lifespan is reduced are affected negatively for patent of importation. While technical advisers are involved in both patent types, industrial advisers are involved significantly more for patents of importation.

Applications filed by multiple individuals are more likely to be applying for a patent of importation, which is consistent with patents of importation being a more commercial enterprise from the outset (H9). Prior experience of the patent system matters much less. In terms of geography, the table confirms that individuals residing in the South are more likely to obtain

patents of importation than those in the North, even when the social classes variable is included, which likely reflects market opportunities gained during industrialisation (H9, H11). Obviously, foreign patentees were much more likely to obtain patents of importation since legally they were required to do so; only a small minority of such applicants were foreigners settled in the UKNL or partnered by domestic parties. The distance variable appears to be irrelevant for the requested patent type, except when the country of the first applicant is not specified.

The class of factory owners, nobility and large landholders is our reference category. Other higher and wealthier classes behave quite like them in their demand for patents of importation. It is the artisanal class and medium and lower skilled workers who are less likely to ask to import technology rather than invent it themselves.

Overall, our multivariate analysis is consistent with the notion that patents of invention are significantly distinct from patents of importation in terms of their characteristics, the characteristics of their applicants, and their treatment by the state (H1). For this reason, in the remainder of this paper, we investigate each category of patents separately rather than including both application types in the same regression framework.

5.2 Correlates of Successful Patent Grants

Table 6 further demonstrates what factors are systematically associated with patents granted by the UKNL's patent authorities. The first three models show the success rate for patents of invention, while the second three focus on patents of importation. We include only those patents that have "passed" the initial legal test, in the sense that they were not withdrawn after a (better) description or drawing was demanded, or had not been refused for not being patentable. We exclude these withdrawn patents because we then see more clearly the role of the state in making the active choice for rejection.

[INSERT TABLE 6 HERE]

Interestingly, the table suggests that there was no active discrimination in the patent grant decision for patents of invention (H3, H4), nor that the patent system was inaccessible to patent applicants once they could supply sufficiently accurate patent specifications (H5).[34] In

[34] There is qualitative evidence to suggest that the patent administrators aided those applicants who claimed that they did not have the capacity to make a sufficiently accurate technical drawing and description in the right language. For example, 'invitation to the governor of North-Holland to invite the burgomaster of Amsterdam to appoint an expert who can help P. Elders to improve the drawings of his invented hydraulic engine (Information to Elders, NL-HaNA, entry no. 2.04.01, inv. no. 4105, 28-12-1820, 1928).

predicting the success rate of a patent application, it did not matter where the inventor came from, or what class they belonged to. Almost nothing is statistically significant. The R^2 and AUC indicate that the models' fit or accuracy does not improve much when geographical or class indicators are included.

The story is different for patents of importation. There the involvement of a technical adviser made it more likely that the state would grant a patent. Nevertheless, here too the data do not suggest any active discrimination on either internal or external borders (H3, H4). Higher professionals, as well as the unknown class, were significantly less likely to obtain a patent of importation (H5). The direction and strength of the coefficients for the other classes do seem to confirm a pattern of wealth and connections leading to greater success in importation requests, while the medium and lower classes seem to have had more difficulty (H2)—although these results are not significant.

5.3 Correlates of Granted Patent Conditions

We test for the correlates of patent fee and patent length reductions in Table 7. This table reports logistic regressions for patent fee reductions in models 1 and 2, distinguished by patent type, and for reductions of the patent length requested at the patent grant in models 3 and 4. There is a positive correlation between the *ex post* value of the invention and the reduction of fees for patents of invention. The policy of aiming to grant free patents only to more useful inventions appears to have been to some extent successful. There is no strong relationship for the reduction of patent length.

[INSERT TABLE 7 HERE]

The relationship with distance to the closest capital is negatively associated with the decision to reduce fees. If a patentee of a patent of invention was living further away from one of the UKNL's capitals, they were less likely to obtain a reduced patent fee. The possibility of obtaining a free patent was not mentioned in the law; the existence of this practice had to spread by word-of-mouth or by information from the state (H5). Perhaps those applicants living closer to the capitals were more likely to have known about this practice.[35] That we do not find a significant result for patents of importation is unsurprising.

[35] In 1928, civil servants at the ministry complained to the governor of South-Brabant that applicants from Brussels were asking for free patents as a matter of course. The complaint is anecdotal evidence that this practice was not as widespread elsewhere in the country (see letter to the Governor of South-Brabant on the request of Meulemans, NL-HaNA, 2.04.01, 4439, 18-12-1828, no 41F).

We find no significant association between patent fee reductions and the place of origin of the patentee (H3, H4), whether for patents of invention or for patents of importation. That the coefficient for the industrial adviser is significant and negative for patents of importation confirms our expectation that the Chambers of Commerce were mostly involved when the state was suspicious of the invention's novelty or potential monopoly power, and thus less inclined to grant free patents. We find a negative association between applications naming several people and obtaining a reduced patent fee. This is consistent with teams of applicants being composed of partnerships between inventors and investors. They were more likely to hold the required capital to obtain the patent.

Compared to the reference category of factory owners, nobility and large landholders, particularly the medium-skilled workers and related small business holders were most likely to obtain a free patent of invention. This was less likely—but still significant and with a powerful association—for higher professionals and low-skilled workers; those who are likely to have invented the invention themselves *and* without the means to pay for the patent. That merchants and clerks had relatively similar results implies that the state was indeed relatively consistent in only granting patents to the "deserving poor" (H5). However, the relationship is less clear for patents of importation. The decision to allocate reductions in the granted length, reported by models 3 and 4, reveal a much less clear set of correlations. No variable is correlated with patent length reductions in this multivariate setting.

5.4 Correlates of Patent Value

In our last set of logistic regressions, reported in Table 8, we explore the correlates of the Doorman Indicator, our *ex post* indicator of patent value that was constructed using the technological history by Doorman (1947; 1953). Because the number of patents of higher value is rather limited, we do not find many significant associations. However, there does appear to be a link between skill and patent value, in the sense that higher professionals are more likely to have obtained a high value patent than the class of factory owners, nobility and large landholders—thus fitting the hypothesis that skilled patentees submitted more economically valuable inventions for consideration (H7). For patents of importation, the manufacturing class apparently knew better what constituted a valuable invention to import than the merchant class did (H7, H9). The results also suggest that teams of multiple applicants or those with experience in patenting are not necessarily a guarantee of patent quality.

[INSERT TABLE 8 HERE]

[INSERT TABLE 9 HERE]

There appears to be no statistical association between patent value and the place of residence of the applicants. If we investigate the underlying data in Table 9, we find that, indeed in a relative sense, a larger percentage of patents hailing from the Northern Netherlands were of a high value. However, the South was patenting much more—in an absolute sense more than twice as many applications. Even compensating for its larger population, the South was patenting more often than the North, whether for inventions or importations.

6. Discussion

We have analysed the patent system of the UKNL through the lens of a set of eleven hypotheses gathered from the cliometrics literature on the patent systems of Industrial Revolution-era Europe. Table 10 lists these hypotheses, alongside the findings of our own cliometric analysis of a new hand-collected dataset of patent applications and granted patents in the UKNL, a polity that encompassed both an early (Belgium) and a late (the Netherlands) industrialising region. We discuss our findings in turn below.

[INSERT TABLE 10 HERE]

We find that patents of importation and invention were fundamentally different, both in their treatment by government officials, and in the type of users who applied for them (H1). The UKNL state explicitly tried to balance intellectual property rights granted to the individual technology importer with the interests of the wider society, to ensure patents hindered the economy as little as possible. In determining a patent's length, the patent system's administrators considered that inventing new technology took more effort than importing technology, and tried to estimate how far and under what conditions a patent of importation was truly necessary to stimulate technology transfer. Applicants for patents of importation were typically more commercially minded and well-connected, while applicants for patents of invention had more technical skills and competences.

It is more difficult to estimate whether the UKNL's patent system functioned overall as an important means of technology transfer (H2). The number of granted patents of importation was not enormous: about ten per year. Twice as many were demanded by domestic citizens as by foreigners. That industrialising Southern Netherlands was importing more technology seems to be an indication that this intellectual property right served an important purpose there. That patents of importation tended to have a higher value than patents of invention suggests the same.

It is likely that the actual technology transfer from Britain and France was larger than what could be observed from the patent system's use. The Southern Netherlands constituted an attractive labour market for skilled workers from Britain, who could earn much more there by teaching the local workers their techniques (Lefebvre et al. 2011). Our patent data include applications from several English and French nationals living in the UKNL's South.[36]

We find that the UKNL's patent system was accessible to non-elite patentees, with a large share of the patent applicants and granted patents coming from the class of artisans, owners of small enterprises and medium-skilled workers (H3). This socioeconomic class was also granted the most discounted or free patents. We find a low participation of patent applications coming from the lower classes, however. It is likely they were less aware of the patent system, let alone of the possibility of gaining a free patent. Yet the participation by the lower classes in the UKNL was comparable to England's in this period (cf. Billington 2021).

Against our expectations, we find no strong evidence of geographical discrimination (H4-5). The UKNL patent system appears to have processed requests coming from the Northern Netherlands, the Southern Netherlands and from foreigners equitably. This finding holds whether we use the indicator of patent grant rates, or the conditions under which the patents were granted. Of course, patents of importation were not treated like patents of invention; the bar was both higher to prove the utility and the novelty of such inventions, and the conditions imposed were stricter. However, this applied to domestic as well as foreign applicants for patents of importation. Considering that foreign inventors would normally already have been able to obtain a patent in their own country, their position is different from that of an inventor. The only discrimination we detect is that reduced patent fees were rarely granted to foreigners, while even a domestic importer could sometimes obtain a patent for free. This fair treatment would put the UKNL on par with France (cf. Nuvolari et al. 2021) and Baden (cf. Donges and Selgert 2019), and distinctive from Württemberg (cf. Lehmann-Hasemeyer and Streb 2020).

The evidence we present points towards the relevance of both supply and demand logics for the invention of new technology during the First Industrial Revolution. We see that skilled patentees were the most frequent users of the patent system (H6), although not by much. Indeed, the significant share of more mercantile and commercial patentees suggests that a significant portion were attracted to the commercial opportunities offered by the patent system (H9),

[36] In 1835, the national industry exhibition of newly independent Belgium evaluated who had contributed the most to Belgian industry and awarded founders of two major machine-building companies: Huyttens-Kerremans, who owned several patents of importation, and Cockerill, who instead imported and copied machines without using patents. They also rewarded de Bast de Hert for importing and popularising English cotton spinning technology without asking for a patent (Gachard 1836).

hinting at a demand logic. There is clearer evidence that the elite of most skilled patentees, such as engineers, patented the more economically valuable inventions (H7), which is consistent with the findings of Nuvolari et al. (2021) and Nuvolari et al. (2023). We lack the requisite data to test whether foreigners patent more in industries with strong competition (H8). However, the list of patents carrying conditions gives the impression that the patent administrators of the UKNL at least saw this as a serious risk; they are all in technology areas with significant domestic competition.[37]

We find indirect evidence of a more demand-oriented approach to patenting in the characteristics for patents of importation, particularly when compared to patents of invention. They tend to be more commonly requested by commercially oriented, wealthy and well-connected individuals, and more frequently have multiple individuals as named applicants. Our findings are consistent with the idea that patents were obtained in jurisdictions with better marketing opportunities (H9). Reassuringly, valuable patents tend to be patented in more jurisdictions, confirmed by the finding that patents of importation tended to be of higher value generally than patents of invention (H10). Overall, the link between patents and the First Industrial Revolution from Mokyr (1976) is also found in our study: comparatively speaking, more patents were granted in the Southern Netherlands, even compensating for population (see Figure 4). The South had more manufacturers as patentees and was also importing more—evidence of a catching up with the latest technologies in France and England (H11). In an absolute sense, applicants from the Southern Netherlands also patented more than twice as many valuable innovations, even though relatively speaking a Northern patent was more likely to have been valuable *ex post* according to our index.

7. Conclusion

All in all, we find that the wide discretion in the UKNL patent system did not lead to unfair or inconsistent treatment. The patent system was administered in a way that Acemoglu and Robinson (2012) could describe as an inclusive economic institution. It was an examination system that provided its administrators significant discretionary latitude to customise the conditions to each patent—which they used to economically optimise patent length and costs, balancing the needs of applicants and society. The discretion was applied consistently and non-arbitrarily; the patent system was what North et al. (2009) could classify as open access order institution. The UKNL's authorities used this discretion to differentiate between patents of

[37] See discussion Appendix B, especially Table B1.

importation and patents of invention. Patents of importation were treated less favourably, because the UKNL estimated both the investment costs and the necessity for an incentive to be lower for importing existing technology rather than the invention of new technology.

The outcomes of the patent system were largely comparable to those of France, Germany and Great Britain; we found that the UKNL's national innovation system was accessible to those who did not belong to the elite despite its high patent fees, that similar proportions of the social classes patented, and that both skills and market orientation mattered for patent system outcomes. Overall, the patent system was a relatively successful area of legal integration between the Northern and Southern Netherlands. Unlike the South's unequitable treatment with respect to political representation, fiscal policy and religious freedoms (see Kennedy 2016), the UKNL's open and inclusive national innovation system was unlikely to have been a contributing factor to the Belgian Revolution in 1830. And the fact that the patent system failed to thrive in the Northern Netherlands following Belgian independence is not evidence that it could not function equitably, as the same patent law continued to be used on both sides of the border.

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Tables and Figures

Table 1: Comparison of findings across cliometric studies of historical European patent systems

Study reference:	Sáiz (2014)	Nuvolari and Vasta (2019)	Donges and Selgert (2019)	Lehmann-Hasemeyer and Streb (2020)	Billington (2021)	Donges and Selgert (2021)	Nuvolari et al. (2023)	Berger and Prawitz (2024)
Study location:	Spain	Pre-Unification Italy	Baden	Württemberg	England, Scotland & Ireland	Prussia	France	Sweden
Study window:	1820–1930	1855–1872	1844–1877	1844–1868	1700–1841	1845–1877	1791–1844	1840–1914
Patents of Importation and Technology Transfers:								
H1: Patents of importation differed fundamentally	**Yes**	**--**	**--**	**--**	**--**	**--**	No	**--**
H2: Patents are an important means of technology transfer	**Yes**	Yes	**Yes**	Yes	Yes	**--**	**Yes**	**--**
Accessibility and Discrimination:								
H3: Patent system accessible to non-elite patentees	**--**	**Yes**	Yes	Yes	**Yes**	**Yes**	Yes	**No**
H4: Domestic regions are treated differently	**--**	**No**	No	**--**	**--**	**--**	No	**--**
H5: Foreigners are treated differently	**--**	**No**	No	**Yes**	**--**	Yes	**No**	**--**
Supply Factors:								
H6: Skilled patentees are most frequent users of the patent system	**--**	**--**	Yes	**--**	**Yes**	Yes	**Yes**	**Yes**
H7: Skilled patentees patent more economically valuable inventions	**--**	**--**	**--**	**--**	**Yes**	**--**	**Yes**	**Yes**
H8: Foreigners patent more in industries with strong competition	**--**	**--**	**Yes**	Yes	**--**	**--**	**--**	**--**
Demand Factors:								
H9: Patentees obtain patents in jurisdictions with market opportunities	**--**	**Yes**	**Yes**	Yes	Yes	**Yes**	**--**	**--**
H10: Valuable patents are patented in more jurisdictions	**--**	**Yes**	**--**	Yes	**Yes**	**--**	**Yes**	**Yes**
H11: Timing and geography of patenting mirrors industrial revolution	**--**	**Yes**	Yes	Yes	Yes	No	Yes	**--**

Notes: In bold we note the conclusions drawn from quantitative analysis. Non-bold are based on literature or qualitative reasoning by the authors. Two lines (--) indicate hypotheses that are not discussed or tested in that publication.

Table 2: Definitions of variables used in statistical analysis

Variable	Unit	Definition
Dependent variables:		
Patent of invention	Discrete	Applicant asks for a patent of invention (1 = patent of invention request).
Patent of importation	Discrete	Applicant asks for a patent for importing a foreign invention (1 = patent of importation request).
Patent grant	Discrete	Patent has been granted (1=granted).
Legal test failure	Discrete	Patent application is discontinued after a rejection that cites the law (1 = discontinued). Common reasons: (1) no clear description or drawing; (2) not in the right language; (3) no patent length or start date supplied for the foreign patent imported; (4) invention not patentable subject matter.
Lifespan requested	Years	Lifespan requested by the patent applicant in years.
Difference in lifespan	Years	Difference in years between the lifespan requested by the patent applicant and the lifespan assigned by the patent office at patent grant.
Lifespan reduced	Discrete	Lifespan assigned at patent grant was smaller than the lifespan requested by the patent applicant (1 = smaller).
Difference in patent fees	Guilders	Difference between patent fees assigned and patent fees normally expected by law (positive = cheaper).
Patent fees reduced	Discrete	Patent fees have been reduced by more than 49 guilders from what is normally expected in law.
Patent special conditions	Discrete	Patent has been granted under special conditions, such as a license clause or a shorter working clause than normal (1 = conditions assigned).
Doorman Indicator	Discrete	Whether the invention has been published other than by initiative of the inventor, received a prize, or made a difference in technological history, as found by Doorman (1 = valuable patent).
Explanatory variables:		
Distance to capital	kms (00s)	Distance that the applicant has to travel to the closest capital (Brussels or The Hague) calculated using Google Maps. The United Kingdom of the Netherlands changed its capital every year. For each patent the closest capital is taken.
Multiple applicants	Discrete	Patent has multiple applicants (1 = more than one).
Experienced applicant	Discrete	One of the patent applicants has previously applied to patent a different invention (1 = has previously applied).
Industrial adviser	Discrete	Government has sought industry advice (1 = sought advice). Most often Chambers of Commerce and Industry, sometimes important manufacturers, such as John Cockerill or J. J. Huyttens Kerremans.
Technical adviser	Discrete	Government has sought technical advice (1 = sought advice). Most often one of the technical advisers of the ministry, sometimes the Royal Academy of Science of Brussels, the Royal Institute of Science of Amsterdam, or other scientific societies or scientists.
Country of first applicant	Categorical	Country of residence of the first applicant. Values are the Northern Netherlands (present-day the Netherlands), Southern Netherlands (present-day Belgium, Dutch Limburg and Luxemburg), or foreigners (most are from France, German states or the UK).
HISCLASS	Categorical	Variable based on the HISCLASS assigned to the first applicant of the patent. HISCLASS is normally divided into 12 classes. We collapse these into five class groups, in addition to an unknown category. See Appendix A.
Technology	Categorical	Technology class, assigned to the title of the invention of the patent request. Also includes an unknown category.
Time	Categorical	Time bins of three-year windows, grouping patents together by year of first contact. The first bin is a six-year window spanning 1816 to 1821.

Table 3: Univariate statistics for the full sample

Panel A. Full sample, patent applications of invention, and patent applications of importation

Variable	Full sample			Invention			Importation			Means test	
	N	*mean*	*sd*	*N*	*mean*	*sd*	*N*	*mean*	*sd*	*t-value*	
Patent grant	1,060	0.480	0.500	615	0.558	0.497	423	0.400	0.490	5.211	***
Legal test failure	1,060	0.220	0.414	615	0.205	0.404	423	0.229	0.421	-0.993	
Distance to capital	1,047	0.903	1.402	612	0.495	0.599	415	1.526	1.948	-10.425	***
Multiple applicants	1,060	0.112	0.316	615	0.099	0.299	423	0.137	0.344	-1.877	*
Experienced applicant	1,060	0.194	0.396	615	0.208	0.406	423	0.177	0.382	1.288	
Industrial adviser	1,060	0.038	0.191	615	0.018	0.133	423	0.069	0.253	-3.792	***
Technical adviser	1,060	0.300	0.458	615	0.328	0.470	423	0.270	0.444	2.064	**
HISCLASS:											
Factory owners, nobility, large landholders	1,060	0.184	0.388	615	0.140	0.347	423	0.253	0.435	-4.511	***
Higher professionals	1,060	0.076	0.266	615	0.060	0.238	423	0.102	0.303	-2.274	**
Merchants, clerks, lower professionals	1,060	0.129	0.336	615	0.122	0.327	423	0.139	0.347	-0.861	
Medium-skilled workers, business holders	1,060	0.210	0.408	615	0.280	0.449	423	0.118	0.323	6.929	***
Low-skilled workers	1,060	0.059	0.237	615	0.083	0.276	423	0.026	0.159	4.174	***
Class unknown	1,060	0.341	0.474	615	0.315	0.465	423	0.362	0.481	-1.624	

Notes: See Table 2 for variable definitions. Applications for patents of improvement are excluded; t-statistics assume unequal variance; significance levels reported as *** p<0.01, ** p<0.05, * p<0.1.

Panel B: Granted versus not granted applications for patents of invention and importation

Variable	Invention							Importation						
	Granted			Not granted			Means test	Granted			Not granted			Means test
	N	*Mean*	*sd*	*N*	*mean*	*sd*	*t-value*	*N*	*mean*	*sd*	*N*	*mean*	*sd*	*t-value*
Distance to capital (100 km)	343	0.433	0.521	269	0.574	0.679	2.820 ***	169	1.322	1.512	246	1.666	2.190	1.894 *
Multiple applicants	343	0.090	0.287	272	0.110	0.314	0.811	169	0.130	0.337	254	0.142	0.349	0.340
Experienced applicant	343	0.224	0.418	272	0.188	0.391	-1.130	169	0.249	0.433	254	0.130	0.337	-3.004 ***
Industrial adviser	343	0.020	0.142	272	0.015	0.121	-0.539	169	0.053	0.225	254	0.079	0.270	1.052
Technical adviser	343	0.405	0.492	272	0.232	0.423	-4.706 ***	169	0.420	0.495	254	0.169	0.376	-5.600 ***
HISCLASS:														
Factory owners, nobility, landholders	343	0.166	0.373	272	0.107	0.309	-2.165 **	169	0.337	0.474	254	0.197	0.398	-3.176 ***
Higher professionals	343	0.070	0.255	272	0.048	0.214	-1.172	169	0.071	0.258	254	0.122	0.328	1.787 *
Merchants, clerks, lower professionals	343	0.134	0.341	272	0.107	0.309	-1.046	169	0.195	0.398	254	0.102	0.304	-2.578 **
Medium-skilled workers, business holders	343	0.268	0.444	272	0.294	0.456	0.707	169	0.118	0.324	254	0.118	0.323	-0.007
Low-skilled workers	343	0.076	0.265	272	0.092	0.289	0.711	169	0.012	0.108	254	0.035	0.185	1.649 *
Class unknown	343	0.286	0.452	272	0.353	0.479	1.772 *	169	0.266	0.443	254	0.425	0.495	3.444 ***

Notes: See Table 2 for variable definitions. Applications for patents of improvement are excluded; t-statistics assume unequal variance; significance levels reported as *** p<0.01, ** p<0.05, * p<0.1.

Panel C: Northern versus Southern Netherlands applicants; and UKNL versus Foreign applicants

Variable	Northern versus Southern Netherlands							UKNL versus Foreign (patents of importation)						
	Northern NL			Southern NL			Means test	UKNL			Foreign			Means test
	N	*Mean*	*sd*	*N*	*mean*	*sd*	*t-value*	*N*	*mean*	*sd*	*N*	*mean*	*sd*	*t-value*
Patent grant	227	0.436	0.497	686	0.515	0.500	-2.058 **	285	0.407	0.492	138	0.384	0.488	0.452
Legal test failure	227	0.260	0.440	686	0.204	0.403	1.692 **	285	0.225	0.418	138	0.239	0.428	-0.331
Patent of invention	227	0.749	0.435	686	0.636	0.482	3.313 ***							
Patent of importation	227	0.216	0.412	686	0.344	0.475	-3.903 ***							
Distance to capital (100 km)	227	0.602	0.483	678	0.424	0.467	4.864 ***	280	0.467	0.448	135	3.722	2.027	-18.441 ***
Multiple applicants	227	0.132	0.339	686	0.105	0.307	1.071	285	0.151	0.359	138	0.109	0.312	1.239
Experienced applicant	227	0.181	0.386	686	0.220	0.415	-1.313	285	0.218	0.413	138	0.094	0.293	3.528 ***
Industrial adviser	227	0.026	0.161	686	0.038	0.191	-0.887	285	0.074	0.262	138	0.058	0.235	0.622
Technical adviser	227	0.348	0.477	686	0.300	0.459	1.318	285	0.288	0.453	138	0.232	0.424	1.242
HISCLASS:														
Factory owners, nobility, landholders	227	0.159	0.366	686	0.187	0.390	-0.983	285	0.270	0.445	138	0.217	0.414	1.200
Higher professionals	227	0.053	0.224	686	0.061	0.240	-0.478	285	0.056	0.231	138	0.196	0.398	-3.818 ***
Merchants, clerks, lower professionals	227	0.172	0.378	686	0.112	0.316	2.139 **	285	0.137	0.344	138	0.145	0.353	-0.223
Medium-skilled workers, business holders	227	0.216	0.412	686	0.235	0.424	-0.592	285	0.133	0.341	138	0.087	0.283	1.477
Low-skilled workers	227	0.084	0.278	686	0.063	0.243	1.019	285	0.035	0.184	138	0.007	0.085	2.125 **
Class unknown	227	0.317	0.466	686	0.343	0.475	-0.708	285	0.368	0.483	138	0.348	0.478	0.414

Notes: See Table 2 for variable definitions. Applications for patents of improvement are excluded; t-statistics assume unequal variance; significance levels reported as *** p<0.01, ** p<0.05, * p<0.1. Comparison between North and South is for the full sample; between the UKNL and foreign applicants is only for patents of importation.

Table 4: Univariate statistics for granted patents of invention and importation

Variable	Full sample			Invention			Importation			Means test	
	N	*mean*	*st*	*N*	*mean*	*sd*	*N*	*mean*	*sd*	*t-value*	
Difference in patent fees	509	65.296	127.609	343	83.962	139.708	169	26.254	85.657	5.672	***
Patent fees reduced	509	0.277	0.448	343	0.335	0.473	169	0.154	0.362	4.688	***
Lifespan requested	492	10.889	3.908	327	10.606	4.124	168	11.426	3.402	-2.429	**
Lifespan assigned	509	8.878	3.127	343	8.936	3.238	169	8.722	2.895	0.620	
Difference lifespan	492	1.968	2.968	327	1.599	2.771	168	2.711	3.243	-3.754	***
Lifespan reduced	492	0.374	0.484	327	0.284	0.452	168	0.548	0.499	-5.784	***
Patent special conditions	509	0.090	0.287	343	0.029	0.168	169	0.213	0.411	-5.629	***
Doorman Indicator	509	0.120	0.325	343	0.102	0.303	169	0.160	0.367	-1.670	*
Distance to capital	509	0.724	1.051	343	0.433	0.521	169	1.322	1.512	-7.376	***
Multiple patents	509	0.104	0.306	343	0.090	0.287	169	0.130	0.337	-1.377	
Experienced applicant	509	0.232	0.422	343	0.224	0.418	169	0.249	0.433	-0.556	
Industrial adviser	509	0.031	0.175	343	0.020	0.142	169	0.053	0.225	-1.759	*
Technical adviser	509	0.411	0.492	343	0.405	0.492	169	0.420	0.495	-0.352	
HISCLASS:											
Factory owners, nobility, large landholders	509	0.224	0.417	343	0.166	0.373	169	0.337	0.474	-4.210	***
Higher professionals	509	0.069	0.253	343	0.070	0.255	169	0.071	0.258	0.156	
Merchants, clerks, lower professionals	509	0.155	0.362	343	0.134	0.341	169	0.195	0.398	-1.791	*
Medium-skilled workers, business holders	509	0.216	0.412	343	0.268	0.444	169	0.118	0.324	4.692	***
Low-skilled workers	509	0.055	0.228	343	0.076	0.265	169	0.012	0.108	3.831	***
Class unknown	509	0.281	0.450	343	0.286	0.452	169	0.266	0.443	0.345	

Notes: See Table 2 for variable definitions. Applications for patents of improvement are excluded; t-statistics assume unequal variance; significance levels reported as *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5: Logistic regression of patent type (0= invention; 1 = importation)

Variable	Full sample				Granted patents			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Patent grant (dummy)	-0.564***	-0.662***	-0.648***	-0.753***				
	(0.146)	(0.165)	(0.153)	(0.171)				
Difference in lifespan (10log)					0.221***	0.231***	0.224***	0.243***
					(0.049)	(0.052)	(0.051)	(0.056)
Patent fees reduced (dummy)					-0.893***	-0.727**	-0.692**	-0.517
					(0.306)	(0.319)	(0.313)	(0.336)
Doorman Indicator (dummy)					0.643*	0.909**	0.528	0.863**
					(0.364)	(0.365)	(0.391)	(0.397)
Industrial adviser (dummy)	1.240***	1.289***	1.296***	1.380***	0.909	0.891	0.847	0.860
	(0.401)	(0.420)	(0.419)	(0.449)	(0.644)	(0.613)	(0.683)	(0.730)
Technical adviser (dummy)	-0.250	-0.079	-0.264	-0.115	-0.059	0.164	-0.049	0.253
	(0.162)	(0.180)	(0.167)	(0.185)	(0.248)	(0.278)	(0.250)	(0.282)
Distance to capital (10log)	0.181***	0.015	0.162***	-0.006	0.195***	0.065	0.173**	0.013
	(0.043)	(0.049)	(0.044)	(0.050)	(0.067)	(0.072)	(0.073)	(0.080)
Multiple applicants (dummy)	0.339	0.415*	0.413*	0.475*	0.066	0.322	0.166	0.429
	(0.218)	(0.252)	(0.238)	(0.271)	(0.330)	(0.393)	(0.362)	(0.451)
Experienced applicant (dummy)	-0.211	-0.020	-0.316*	-0.110	0.177	0.313	0.059	0.229
	(0.182)	(0.194)	(0.190)	(0.199)	(0.266)	(0.303)	(0.273)	(0.301)
Country of first applicant:								
Northern Netherlands		*reference*		*reference*		*reference*		*reference*
Southern Netherlands		0.729***		0.734***		0.913**		1.013**
		(0.218)		(0.225)		(0.364)		(0.397)
Foreign		4.251***		4.245***		4.130***		4.388***
		(0.420)		(0.435)		(0.708)		(0.721)
HISCLASS:								
Factory owners, nobility, large landholders			*reference*	*reference*			*reference*	*reference*
Higher professionals			-0.185	-0.716**			-0.694	-1.237**
			(0.287)	(0.341)			(0.500)	(0.611)
Merchants, clerks, lower professionals			-0.332	-0.371			-0.212	-0.094
			(0.247)	(0.280)			(0.369)	(0.383)
Medium-skilled workers, business holders			-1.391***	-1.442***			-1.458***	-1.648***
			(0.239)	(0.257)			(0.374)	(0.386)
Low-skilled workers			-1.953***	-1.734***			-2.169**	-1.907**
			(0.375)	(0.402)			(0.868)	(0.863)
Class unknown			-0.454**	-0.613***			-0.640*	-0.961***
			(0.206)	(0.228)			(0.334)	(0.369)
Constant	-0.945**	-2.604***	-0.455	-2.040***	-0.739	-1.543**	-0.512	-1.469*
	(0.413)	(0.637)	(0.448)	(0.626)	(0.726)	(0.764)	(0.798)	(0.865)
Technology fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,024	1,024	1,024	1,024	470	470	470	470
No. of patents of importation	412	412	412	412	163	163	163	163
Pseudo R-squared	0.091	0.234	0.133	0.265	0.160	0.274	0.200	0.318
AUC	0.699	0.790	0.739	0.818	0.764	0.829	0.789	0.853

Notes: See Table 2 for variable definitions. Reported coefficients are log-transformed odds-ratios. Robust standard errors in parentheses; significance levels reported as *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Logistic regression of patent grants that passed the legal test (1=granted)

Variable	Invention			Importation		
	(1)	(2)	(3)	(4)	(5)	(6)
Industrial adviser (dummy)	0.339	0.367	0.367	-1.178**	-1.085**	-1.115**
	(1.001)	(1.016)	(1.018)	(0.497)	(0.548)	(0.531)
Technical adviser (dummy)	0.188	0.148	0.152	1.569***	1.505***	1.534***
	(0.237)	(0.236)	(0.238)	(0.316)	(0.321)	(0.326)
Distance to capital (10log)	-0.132*	-0.150**	-0.153**	-0.199**	-0.175**	-0.251**
	(0.070)	(0.066)	(0.071)	(0.099)	(0.082)	(0.103)
Multiple applicants (dummy)	-0.191	-0.169	-0.175	-0.206	-0.248	-0.234
	(0.379)	(0.380)	(0.385)	(0.295)	(0.335)	(0.330)
Experienced applicant (dummy)	-0.236	-0.331	-0.334	0.587*	0.326	0.421
	(0.271)	(0.276)	(0.276)	(0.350)	(0.379)	(0.379)
Country of first applicant:						
Northern Netherlands	*reference*		*reference*	*reference*		*reference*
Southern Netherlands	-0.041		-0.009	-0.413		-0.550
	(0.269)		(0.268)	(0.430)		(0.445)
Foreign	0.087		0.165	-0.104		-0.083
	(0.841)		(0.916)	(0.441)		(0.453)
HISCLASS:						
Factory owners, nobility, large landholders		*reference*	*reference*		*reference*	*reference*
Higher professionals		-0.309	-0.314		-1.053**	-1.154**
		(0.539)	(0.539)		(0.511)	(0.524)
Merchants, clerks, lower professionals		-0.117	-0.117		0.012	-0.051
		(0.428)	(0.429)		(0.453)	(0.450)
Medium-skilled workers, business holders		-0.484	-0.484		-0.511	-0.579
		(0.364)	(0.366)		(0.498)	(0.491)
Low-skilled workers		-0.880*	-0.879*		-0.488	-0.356
		(0.489)	(0.490)		(0.844)	(0.857)
Class unknown		-0.543	-0.549		-1.016***	-1.087***
		(0.388)	(0.391)		(0.371)	(0.368)
Constant	0.116	0.353	0.337	-0.194	0.108	0.272
	(0.548)	(0.606)	(0.636)	(0.923)	(0.878)	(0.959)
Technology fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	488	488	488	310	310	310
No. of patents granted	338	338	338	169	169	169
Pseudo R-squared	0.087	0.095	0.095	0.171	0.196	0.201
AUC	0.698	0.705	0.705	0.761	0.781	0.782

Notes: See Table 2 for variable definitions. Reported coefficients are log-transformed odds-ratios. Robust standard errors in parentheses; significance levels reported as *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Logistic regression of patent fee and length reductions for granted patents

Variable	Patent fees		Patent length	
	Invention	*Importation*	*Invention*	*Importation*
	(1)	(2)	(3)	(4)
Doorman Indicator (dummy)	0.672	1.463*	-0.598	-0.959
	(0.432)	(0.767)	(0.478)	(0.598)
Industrial adviser (dummy)	-0.088	3.099***	-0.984	0.662
	(0.746)	(1.142)	(1.057)	(0.868)
Technical adviser (dummy)	0.414	-2.122***	-0.454	0.558
	(0.311)	(0.821)	(0.316)	(0.401)
Life span requested (years)	-0.056	-0.156		
	(0.038)	(0.099)		
Distance to capital (10log)	-0.214**	0.203	0.056	0.019
	(0.093)	(0.176)	(0.092)	(0.137)
Multiple applicants (dummy)	-1.846***	-1.879	-0.042	0.936
	(0.577)	(1.240)	(0.440)	(0.663)
Experienced applicant (dummy)	-0.759**	0.237	-0.523	-0.517
	(0.371)	(0.778)	(0.373)	(0.434)
Country of first applicant:				
Northern Netherlands	*reference*	*reference*	*reference*	*reference*
Southern Netherlands	-0.049	0.640	-0.218	0.824
	(0.453)	(0.770)	(0.370)	(0.641)
Foreign	1.870*	-0.849	0.226	0.267
	(1.100)	(0.998)	(1.311)	(0.589)
HISCLASS:				
Factory owners, nobility, large landholders	*reference*	*reference*	*reference*	*reference*
Higher professionals	0.860	-1.365	0.286	0.508
	(0.553)	(0.948)	(0.577)	(0.665)
Merchants, clerks, lower professionals	0.527	0.613	-0.544	0.594
	(0.552)	(0.808)	(0.506)	(0.544)
Medium-skilled workers, business holders	1.696***	-0.042	-0.306	-0.271
	(0.450)	(1.019)	(0.453)	(0.743)
Low-skilled workers	1.558**	0.863	-0.463	-1.159
	(0.621)	(1.691)	(0.604)	(1.329)
Class unknown	0.391	-0.148	0.774*	-0.237
	(0.511)	(0.783)	(0.442)	(0.504)
Constant	-1.325	2.088	-0.781	0.308
	(1.021)	(1.991)	(0.967)	(1.245)
Technology fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	327	142	320	159
Number of reductions of fees/length	113	26	93	92
Pseudo R-squared	0.228	0.289	0.124	0.117
AUC	0.810	0.862	0.732	0.742

Notes: See Table 2 for variable definitions. Dependent variable in (1) and (2) is a dummy variable, where 1 = applicant received a fee reduction; dependent variable in (3) and (4) is a dummy variable, where 1 = applicant assigned a shorter patent duration than requested. Reported coefficients are log-transformed odds-ratios. Robust standard errors in parentheses; significance levels reported as *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Logistic regression of *ex post* patent value

Variable	Invention	Importation
	(1)	(2)
Industrial adviser (dummy)	-0.084	-0.308
	(1.008)	(1.530)
Technical adviser (dummy)	-0.145	0.469
	(0.445)	(0.692)
Life span requested (years)	0.043	-0.185*
	(0.044)	(0.109)
Distance to capital (10log)	0.133	0.079
	(0.142)	(0.185)
Multiple applicants (dummy)	0.310	-2.831***
	(0.504)	(1.024)
Experienced applicant (dummy)	-0.620	-2.308**
	(0.502)	(1.068)
Country of first applicant:		
Northern Netherlands	*reference*	*reference*
Southern Netherlands	-0.759	-0.479
	(0.550)	(0.892)
Foreign	0.048	-1.392
	(1.177)	(1.303)
HISCLASS:		
Factory owners, nobility, large landholders	*reference*	*reference*
Higher professionals	1.568**	-0.389
	(0.753)	(1.002)
Merchants, clerks, lower professionals	-1.136	-2.320*
	(0.795)	(1.352)
Medium-skilled workers, business holders	0.306	-0.620
	(0.672)	(0.894)
Low-skilled workers	-0.342	
	(0.985)	
Class unknown	-0.245	-1.795**
	(0.627)	(0.871)
Constant	-2.111	3.558
	(1.425)	(2.274)
Technology fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	299	155
No. of high value patents	34	27
Pseudo R-squared	0.147	0.395
AUC	0.764	0.899

Notes: See Table 2 for variable definitions. Dependent variable is a dummy variable, where 1 = patent has a Doorman Indicator. Reported coefficients are log-transformed odds-ratios. Robust standard errors in parentheses; significance levels reported as *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Descriptive statistics on *ex post* valuable patents

	Low value	High value
Northern Netherlands		
N	84	17
% North	83%	17%
% UKNL	17%	3%
Southern Netherlands		
N	317	37
% South	90%	10%
% UKNL	62%	7%
Foreigners		
N	47	6
% Foreign	89%	11%
% UKNL	9%	1%

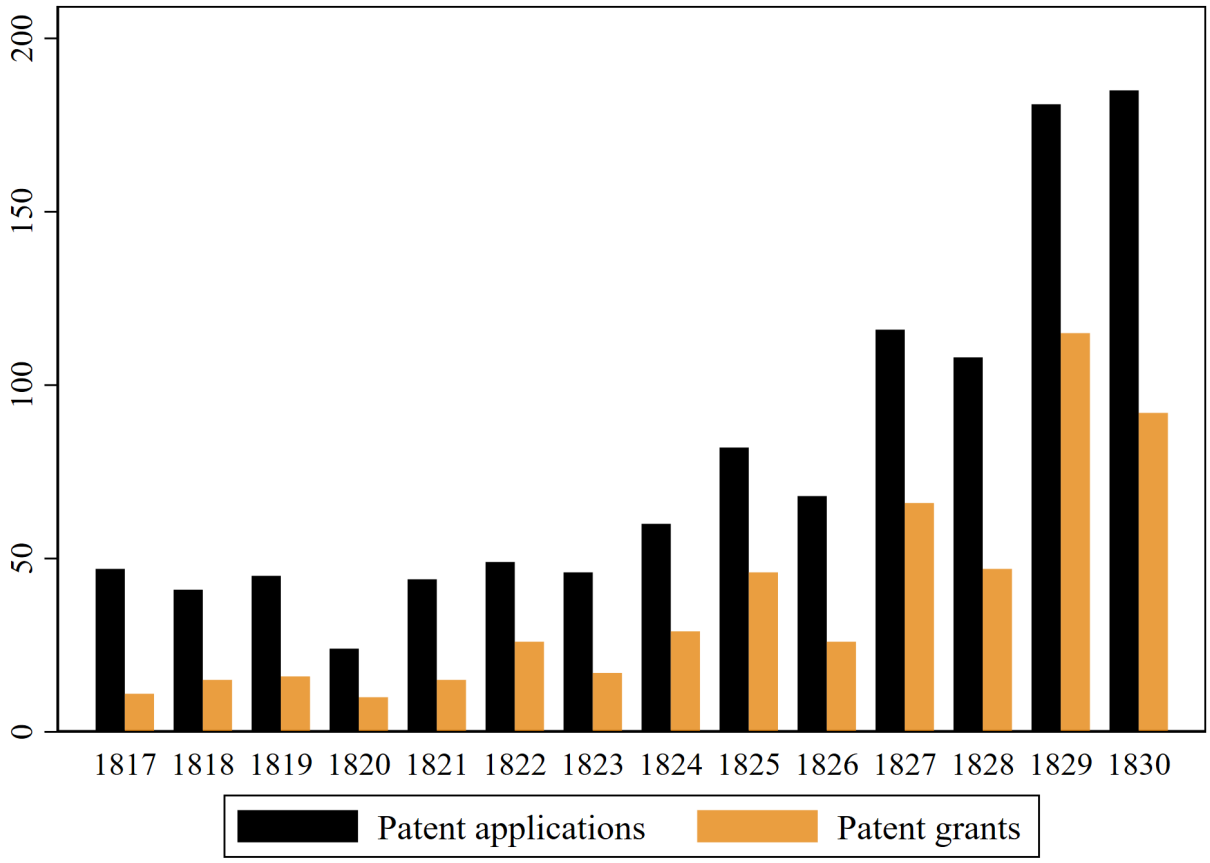
Notes: Includes both patents of invention and importation. High-value patents are defined as those with a Doorman Indicator.

Table 10: Comparison of expectations and findings

Hypothesis		Expectation	Finding
Patents of Importation and Technology Transfers:			
H1	Patents of importation differed fundamentally	Yes	Yes
H2	Patents are an important means of technology transfer	Yes	Uncertain
Accessibility and Discrimination:			
H3	Patent system accessible to non-elite patentees	Yes	Yes
H4	Domestic regions are treated differently	Yes	No
H5	Foreigners are treated differently	Yes	Uncertain
Supply Factors:			
H6	Skilled patentees are most frequent users of the patent system	Uncertain	Yes
H7	Skilled patentees patent more economically valuable inventions	Yes	Yes
H8	Foreigners patent more in industries with strong competition	Yes	Uncertain
Demand Factors:			
H9	Patentees obtain patents in jurisdictions with market opportunities	Yes	Yes
H10	Valuable patents are patented in more jurisdictions	Yes	Yes
H11	Timing and geography of patenting mirrors industrial revolution	Yes	Yes

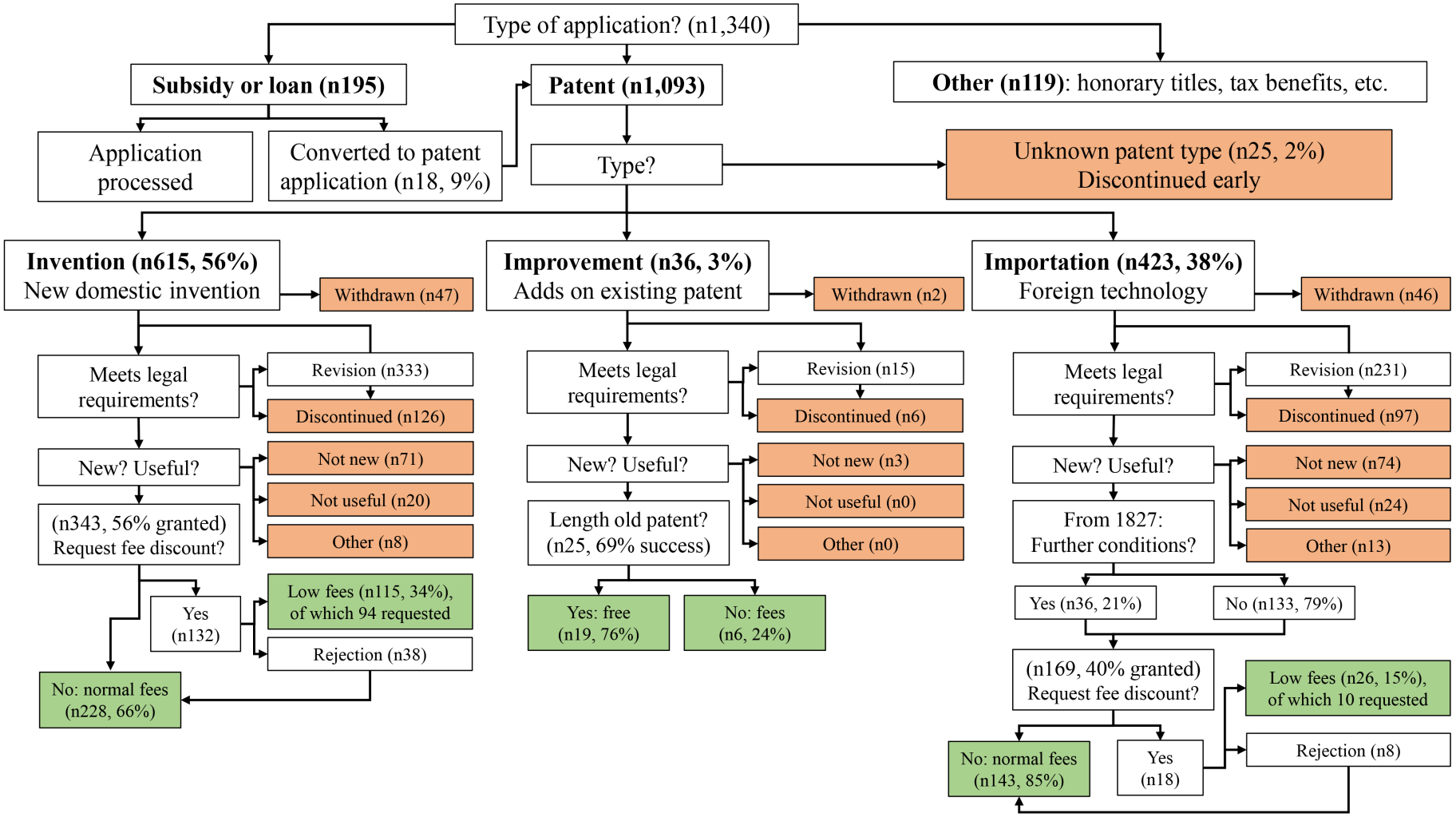
Notes: Summary of authors' empirical findings compared with expectations taken from Table 1.

Figure 1: Patent applications and patent grants, all types, 1817–1830



Source: Authors' calculation using patents database.

Figure 2: Flowchart depicting the UKNL patent system, 1817–1830



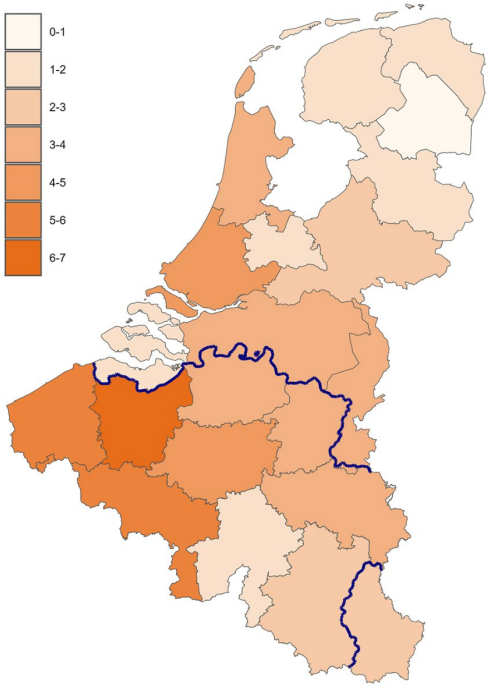
Notes: Orange shading signifies rejected or withdrawn patents; green shading represent all granted patents.

Sources: Authors' depiction of patent system as part of the UKNL's wider national innovation system, as described in Appendix B.

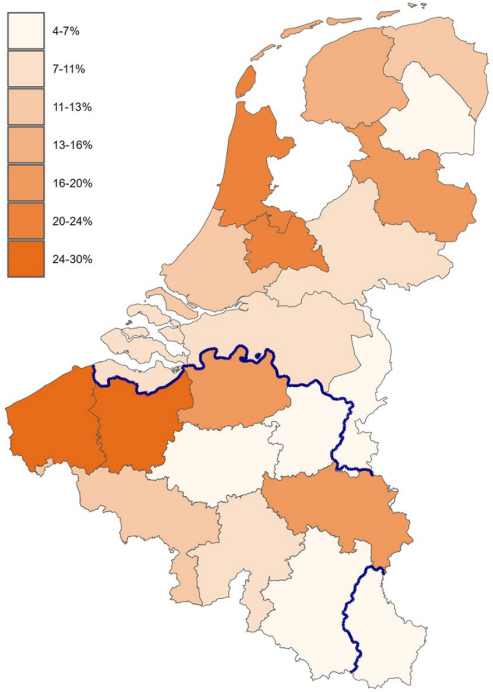
Figure 3: Maps of the 19 provinces of the UKNL, 1819

(a) Border locations and province names

(b) Total population, in 100,000s



(c) Industry and mining employment, in perc.

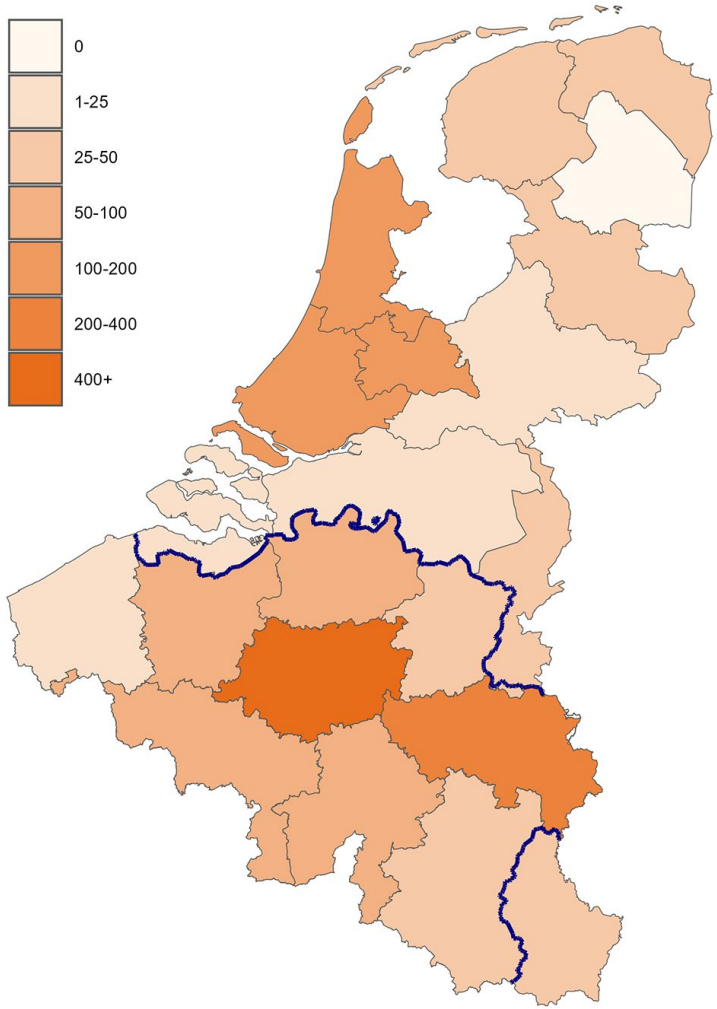


Notes: Map depicts the 19 provinces of the UKNL, superimposing the international borders following the Treaty of London in 1839 (in blue). NHOL, ZHOL, UTRE, ZEEL, FRIE, GRON, DRENT, OVER, GELD and NBRA constitute 10 of the 11 provinces that make up the UKNL's successor state of the Netherlands. WVLA, OVLA, ANTW, ZBRA, HAIN NAMU and LIEG are 7 of the 9 provinces that form the successor state of Belgium. LIMB was partitioned between these two successor states, while LUXE was partitioned between Belgium and Luxembourg. We include both halves of both provinces in our definition of the Southern Netherlands in our analysis.

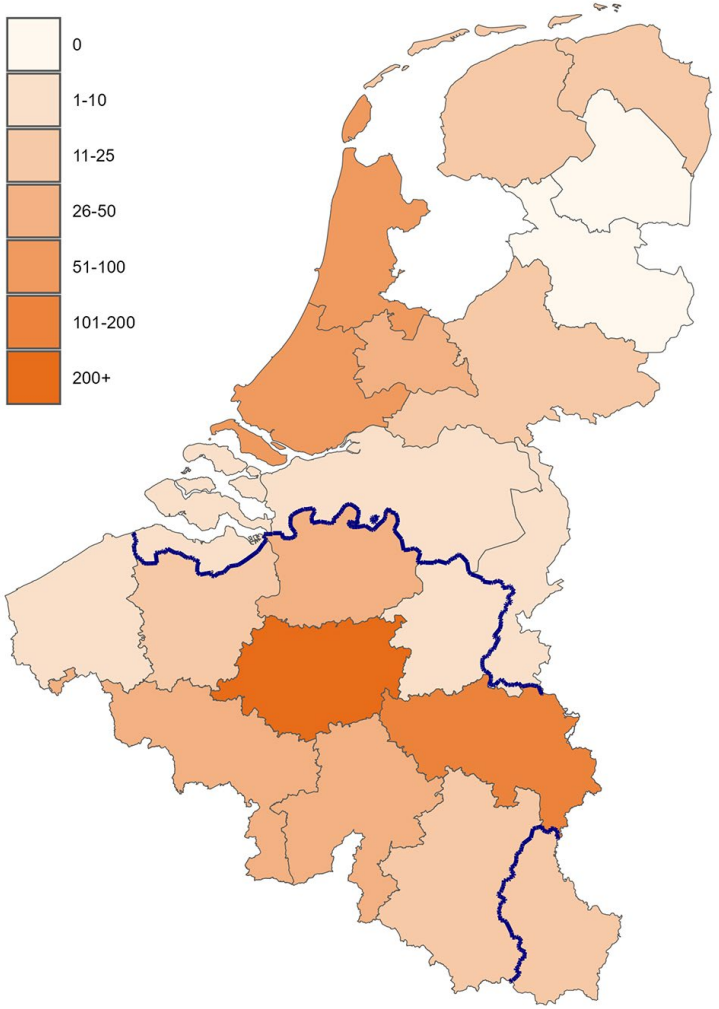
Sources: Population data for 1819 from Commissie voor de Statistiek (1826); employment data from the 1819 industrial census extracted by Philips and Buyst (2020).

Figure 4: Maps of patenting activity across the UKNL, 1817–1830

(a) Patent of invention applications, per capita



(b) Patent of invention grants, per capita



Sources: Authors' calculation using patents database and population data from Commissie voor de Statistiek (1826).

Appendices

Appendix A. HISCO, HISCLASS and Occupations in the UKNL

One set of variables employed in our regression analysis concerns the social class of the patent applicants. To investigate the accessibility of the patent system, we rely on HISCLASS to code our occupation data. HISCLASS was developed by an international team led by van Leeuwen and Maas (2011) using HISCO occupation codes developed by them a decade earlier (van Leeuwen et al. 2002). It combines occupation codes with status indicators that can also be found in historical data (student, owner, boss, apprentice, etc.) and relationship indicators when the occupation mentioned in the historical source is held by a family member rather than the individual in question. HISCLASS distinguishes between 12 class categories that are subdivided into four skill levels (high, medium, low and unskilled), as well as distinctions showing manual/non-manual, supervision/non-supervision and primary sector/non-primary sector.[41]

Table A1 shows the results of this exercise for our dataset. The last two columns report data from Billington (2021) for English patent grantees between 1700 and 1841 for comparison.[42] Very comparable shares are shown for each. Indeed, the rank correlation between the two shows a relatively high correlation: 0.833 (Spearman) or 0.674 (Kendall's Tau-b). The main differences are a much higher share of 'higher managers', or the group of manufacturers, nobles, military officers and property owners in the British data. They are the largest category in England, while in the UKNL, the artisans and medium-skilled workers (6 and 7) form the largest group of unique patentees. In England, the class of higher professionals is larger, reflecting most probably the presence of more engineers, while in the UKNL the group of traders, lower professionals and clerical personnel is larger (3-5).

How to interpret the difference in these data is less obvious. They could signify the greater accessibility of the UKNL patent system for artisans due to the fee customisation to wealth by the UKNL government, or could merely reflect the more advanced stage of industrialisation of the British economy. This more advanced stage would explain the larger shares of managers and higher professionals if these are factory owners and engineers. In both

[41] 1 = Higher managers (high skill level), 2 = Higher professionals (high), 3 = Lower managers (medium skill level), 4 = Lower professionals, and clerical and sales personnel (medium), 5 = Lower clerical and sales personnel (low), 6 = Foremen (medium), 7 = Medium skilled workers (medium), 8 = Farmers and fishermen (medium), 9 = Lower skilled workers (low), 10 = Lower skilled farm workers (low), 11 = Unskilled workers (unskilled), 12 = Unskilled farm workers (unskilled).

[42] We cannot include the French data of Nuvolari et al. (2023) because they did not follow the HISCO/HISCLASS codification system.

systems the number of patents per year was increasing over time, so that a large share of the overall body of patents come from the last years of patent data. Just as in Great Britain, in the UKNL patentees were skilled individuals (H6): the artisans and high professionals together already formed more than two-fifths of the patentees. To this could still be added manufacturers from the 'higher managers' class.

Using the HISCLASS coding, we recategorized certain groups (Table A2) to address weaknesses in the HISCO/HISCLASS system for the early nineteenth century. Categories 1 and 2 remain unchanged, while categories 3, 4, and 5 were merged to group merchants and clerks as non-manual workers. Categories 6, 7, and 8 were combined into an artisan/medium-skilled worker/farmer group to avoid arbitrary distinctions between artisans based on self-identification as masters. Low-skilled and unskilled workers were also merged due to the small number of unskilled workers.

While HISCO has been valuable for historians, it has limitations for this period. Professionalisation was still developing, and occupational titles were less standardised. For example, 'engineer' in the UKNL did not yet apply to mechanics, complicating the categorisation of individuals identifying as *mécanicien*, *werktuigkundige*, *mechanicus*, or 'mechanic.' Some installed machinery, while others designed machines, requiring different skill classifications. In England, 'mechanical engineers' already existed, leading to an upward bias in skill classification for foreign mechanics compared to UKNL counterparts.

Additionally, occupation data often fail to distinguish workers from proprietors. A brewer (employee) and a brewery owner are both classified as medium-skilled (7), with owners assigned one level higher if their status is known—though this does not reflect historical realities. Similarly, a master carpenter is placed under 6 and a regular carpenter under 7—though guilds had already been abolished, making such distinctions less relevant.

Another challenge is the historical role of traders and merchants, which was more significant in the nineteenth century. Wholesalers are classified as 3 (lower managers) and retailers as 4 (lower professionals and sales personnel), though their wealth and social class often matched those of manufacturers. The Dutch term *koopman* covers both wholesalers and retailers, but HISCLASS classifies all as retailers, creating a downward bias. In contrast, French distinguishes between *négociant* (wholesaler) and *marchand* (retailer), leading to potentially inconsistent classifications between Dutch- and French-speaking merchants.

In their use of HISCO/HISCLASS, Billington (2021), Nuvolari et al. (2023) and Berger and Prawitz (2024) have each tried to resolve issues in their own ways. While Billington and Berger and Prawitz have more faithfully followed the HISCLASS codification system,

Nuvolari et al. have tried to solve some of the issues mentioned above by adapting the HISCLASS system. They add two categories to signify ownership: 0-1 and 0-2, where 0-1 contains small proprietors such as traders/merchants, shopkeepers and jewellers, and 0-2 large proprietors such as manufacturers, owners and rentiers, while also not coding the HISCO/HISCLASS categories very faithfully.[43] Since Billington uses HISCLASS to test for the relationship between skill and patenting, he reduces the number of categories in his econometric analysis by using the system's four skill levels, thus mitigating some of the problems of the system. Nuvolari et al. do not actually use the full HISCLASS system in their econometrics, except class 2 for testing for scientists/engineers and class 6 for testing for artisans.

We code occupations as faithfully as possible into HISCO categories, following the HISCO guide for job titles in French and Dutch, the HISCO occupation descriptions, the HISCLASS codifications for status and relation, and sometimes upgrading individuals to manufacturers when other historical source material shows their wealth or the size of their enterprise.[44] As discussed, we have recombined the HISCLASS categories to compensate for the weaknesses in the coding.

[43] For example, in their system, *fabricants* are translated as large manufacturers and allocated category 0-2 (large proprietors). In fact, HISCO explains that a *fabricant* in France is more likely to be a small producer (in their system a large proprietor) while in Belgium/Canada it can indeed be a manufacturer. Nuvolari et al. classify chemists among the lower professionals (category 4) while HISCO/HISCLASS places them among high professionals (2). HISCO puts all military officers into one category, which translates into higher managers (1). Nuvolari et al. choose to define captains as lower managers, so category 3. Nuvolari et al. reinvent category 6 as artisans, placing occupations like clock makers, carpenters and smiths there, while mechanics and locksmiths are in 7. However, HISCLASS defines category 6 as medium-skilled manual workers with a supervisory relationship, such as foremen, housekeeping matrons or master artisans.

[44] For example, music instrument maker Sax (the father of the inventor of the saxophone) was promoted from music instrument maker (7) to manufacturer (1) when it became clear from other source material that he led a workshop of 100 employees.

Table A1: Patents by HISCLASS categories

HISCLASS number and label		UKNL (1817-1830)								England (1700-1841)	
		Patents				Patentees				Patentees	
		Applications		Grants		Applicants		Grantees		Grantees	
1	Higher managers	195	18.40%	114	22.40%	129	15.66%	65	17.91%	1,881	35.75%
2	Higher professionals	81	7.64%	35	6.88%	58	7.04%	26	7.16%	800	15.21%
3	Lower managers	40	3.77%	25	4.91%	19	2.31%	9	2.48%	17	0.32%
4	Lower professionals	89	8.40%	49	9.63%	77	9.34%	42	11.57%	719	13.67%
5	Lower clerical and sales personnel	8	0.75%	5	0.98%	8	0.97%	5	1.38%	51	0.97%
6	Foremen	35	3.30%	14	2.75%	33	4.00%	13	3.58%	25	0.48%
7	Medium-skilled workers	184	17.36%	95	18.66%	140	16.99%	72	19.83%	1213	23.06%
8	Farmers and fishermen	4	0.38%	1	0.20%	4	0.49%	1	0.28%	45	0.86%
9	Low-skilled workers	58	5.47%	26	5.11%	54	6.55%	23	6.34%	486	9.24%
11	Unskilled workers	5	0.47%	2	0.39%	5	0.61%	2	0.55%	24	0.46%
-1	Unknown	361	34.06%	143	28.09%	297	36.04%	105	28.93%	0	0.00%

Notes: The division of British patents across HISCLASS in taken from Billington (2021). For sake of comparability with his data, we report percentage share of each class of the total body of classes known. We calculated rank correlations:

- UKNL applications and applicants: 0.976 (Spearman); 0.911 (Kendall's Tau-b)
- UKNL grants and grantees: 0.976 (Spearman); 0.909 (Kendall's Tau-b)
- UKNL applicants and grantees: 0.997 (Spearman); 0.989 (Kendall's Tau-b)
- UKNL grantees and England grantees: 0.833 (Spearman); 0.674 (Kendall's Tau-b)

Table A2: Recoding of HISCLASS categories

Category label	HISCLASS	Represented professions (English translation)	Patent applications	
Factory owners, nobility and large landholders	1	Manufacturer, director, military officer, owner, baron, esquire	168	(15.85%)
Higher professionals	2	Engineer, medical doctor, chemist, pharmacist, priest, professor, lawyer, government adviser	80	(7.55%)
Merchant, clerks and lower professionals	3, 4, 5	Merchant, broker, shop keeper, book seller, lower engineer, teacher, pharmacy assistant	121	(11.42%)
Medium-skilled workers and business holders	6, 7, 8	Mechanic, watchmaker, smith, carpenter, tailor, lithographer, printer, music instrument maker, instrument maker, baker	212	(20.00%)
Low-skilled workers	9, 10, 11, 12	Barber, pencil maker, glove maker, salt maker, soap maker, worker	57	(5.38%)
Unknown	-1	Unknown, inventor, unemployed, pensioned military officer, student, widow	422	(39.81%)

Notes: Categories adapted from van Leeuwen and Maas (2011).

Appendix B. Institutional Design of the UKNL Patent System

As the flow diagram in Figure 2 shows, the administrative processes for each type of patent were similar. The first stages of a patent request are identical: they must first pass a formal test to see whether the application meets the minimum legal requirements. The most common ground for rejection at this stage was a lack of a sufficiently high-quality description (or drawing) of the invention in the right language,[45] or the lack of information provided on the original patent for a patent of importation. Most often, therefore, patent applicants that failed their legal test were granted the opportunity to improve their application. Only in a few cases were patents rejected out of hand at this stage because they were not considered patentable subject matter.[46]

In the second stage, we see a substantive evaluation of novelty, utility and other considerations.[47] It is usually here, after a complete specification has been submitted, that the patent administrators consult external advisers on the utility and novelty of the invention covered by the application. However, they are often confident enough to examine patents on their own. The success rates vary according to the patent type.

Patent procedures diverge by patent type at the point that patents are ready to be granted. Applicants for a patent of invention or importation could hope to obtain a reduction in their patent fees—more than a third of the applications for a patent of invention requested a patent fee reduction. This request set in motion an additional investigation. The ministry inquired after the personal wealth of the individual, their moral standing, and whether they had a caring responsibility to dependents. In the archives we find reports drafted by the mayors of applicants' towns, having used the police, other business holders or the applicant's employees to obtain answers to these questions.[48]

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[45] The official languages for the UKNL were Dutch and French. From January 1823 the UKNL government introduced a language policy that applicants from the Dutch-speaking provinces were required to address the government and the court in Dutch. This included South-Brabant, which as a province was Dutch-speaking but where the city of Brussels was already largely Francophone. Those in French-speaking provinces like Namur or Liège could keep addressing the government in French. This had consequences for the patent system as well: inhabitants of Dutch-speaking provinces were required to write their specification in Dutch or translate it. See Vosters and Janssens (2015) for a discussion on of this language policy.

[46] Inventions that were not patentable were pharmaceutics (because the state feared it would interfere with its control on medicines that were considered safe for public use), as well as for those chemical inventions or food recipes where the exact composition of ingredients mattered. The UKNL argued it would be impossible to enforce such a patent, so preferred to grant no patents at all for these inventions (knowing it would then probably be used for signalling purposes which it did not approve of). Report to the King on a request for Rumfordsch Soeppoeder, NL-HaNA, entry no. 2.04.01, inv. no. 4106, 21-1-1821, no 39/112.

[47] Other considerations include when an invention threatens the state's tax income, or when the invention is dangerous. An example of the latter is a patent request for an umbrella hiding a rifle.

[48] See, e.g.: Letter to the Governor of Antwerp on a request for a free patent by van Campen, NL-HaNA, entry no. 2.04.01, inv. no. 4145, 19-12-1822, no. 2210.

In addition to this information, patent administrators would take into consideration their estimation of the utility of the invention in question. For example, if the value of the invention was deemed to be high, administrators would communicate to the applicant that they should try to find an investor.[49] If they questioned whether the invention would work at all, administrators preferred to keep patent fees steep to discourage patents for frivolous creations.[50] The procedure was much simpler for patents of improvement: if the patent of improvement took the same length as the original patent, it would generally be granted free of charge.

Fee reductions were rarely given to patents of importation. Rather, the UKNL's patent authorities would wonder whether the patent should be granted at all and under what conditions. Its policy reached full maturity around 1827, after two major scandals involving patents of importation.[51] From this point onwards, it would involve Chambers of Commerce to obtain an assessment of how difficult importation would be, and under what conditions a patent of importation could be acceptable to industry incumbents.[52] The Chambers of Commerce and Industry—if positive—would almost always recommended an open license clause and a reduction of the patent length requested. It led to a four-pronged treatment of patents of importation: rejection of easily accessible inventions; reduction of patent lengths to acceptable levels; open license clauses; and stricter working clauses. What is meant by 'further conditions' in the flowchart are those patents that have either an open license clause or a reduced length of the working clause imposed on them.

[49] Report to the King on the request by van Campen, NL-HaNA, 2.04.01, entry no. 2.04.01, inv. no. 4148, 1-2-1823, 45/218.

[50] 'It is advisable to multiply the grant of patents without payment of duties as little as possible, from the perspective that the payment of duties gives the government a means that is simple and offends no-one to prevent countless patent requests for useless and pipe-dream inventions' [translation by authors]. Report on request L. Embach to obtain a free patent, NL-HaNA, 2.04.01, entry no. 2.04.01, inv. no. 4256, 29-10-1825, 137A.

[51] There had been two related scandals in 1825-1826 and 1827-1828 in the Southern Netherlands involving patents of importation. Both were for patents of importation obtained by proxies in the UKNL on behalf of French entrepreneurs: Magnan acting on behalf of John Collier, and Kockx acting on behalf of Albert (who was in turn acting on behalf of Jones). Both were for machines to finish draperies. Doorman (1953, 103) discusses social unrest in UKNL that associated the labour-saving of the type that Magnan patented. Rather than construct the machines they sold themselves on UKNL soil, Magnan and Kockx merely acted as importing commercial agents of their patrons in France. For both cases, a coalition of complainants in textile manufacturing undid their illegal practice. Magnan lost all his patents up to that point, while Kockx was forced to transfer his patent to a UKNL manufacturer who had to accept a new open license clause that was not originally in the patent. Around the time of these two incidents, the government became more careful with patents of importation. For Magnan, see report to the King on resistance to Magnan's patents, NL-HaNA, entry. no. 2.04.01, inv. no. 4267, 10-1-1826, 114A. For Kockx, see for the letter to the governor of Liège on Kockx, NL-HaNA, entry no. 2.04.01, inv. no. 4414, 29-7-1828, 25F.

[52] This test had a standard formulation: (1) Is this invention yet unknown and unused in this kingdom? (2) Is it to be expected that this invention will be imported without a patent of importation? (3) Is it useful to stimulate this importation with a patent? And: (4) under what conditions? See letter to the governor of East-Flanders in Ghent on Warin's patent request for an invention by J. Nicholson, NL-HaNA, 2.04.01, 4350, 14-8-1827, no 17F.

Across the full body of 153 patents of importation granted, only 8 had additional conditions.[53] Table B1 reports the titles of patents which had conditions imposed on them. All were related to domestic industries. What is also evident from this list is the difference in names between the original patentees and the patent applicant in the UKNL: no patent was requested under the same name as the original patent.[54]

[53] There were also 10 patents of invention that have additional conditions imposed upon them. Because they represent a very marginal faction of this patent type, we did not incorporate this step in the flowchart.
[54] This is probably driven by the idiosyncratic rule in the French system that nullified any patent of a patent holder that would take a patent for the same invention in another country. Since this could be verified only if they used their own name, patent holders were likely to use a proxy or an agent.

Table B1: All foreign patent grantees which had additional conditions imposed on their patents

Name	Country	Original patentee	Patent description	Year	Additional condition
Bent	England	Raddatz	Steam engine	1827	Short working clause
Ternaux	France	Delcourt	Machine for preparing flax	1829	Short working clause
Berg	England	None	Processes to filter and refine sugar	1829	Open license
Camusat	France	Pelletan	Process for making soda	1829	Open license
Chasselon	France	Noverre	Machine for kneading bread	1829	Open license
Chasselon	France	Maisonneuve	Machine for kneading bread	1829	Open license
Duplessis	France	Souchon	Replacing indigo for fabrics	1829	Open license
Davis	England	Gardner and Herbert	Machine to prepare draperies	1830	Short working clause

Notes: Extracted from database. We exclude one patentee from a UKNL national living in France that had a shorter working clause imposed as he was a patent agent representing an English inhabitant whose patent was an imported technology from England on salt-making.