The Patent Institutions in Early Industrialization of UK and US

This essay explores the role of the patent institutions in encouraging inventive activities during the period of early industrialization in America and Britain[1]. The focus on patents rather than intellectual property rights in general, which includes copyrights, is due to our interest in considering the role this institution played during the period often associated with technological advancement.

We will investigate how and why patent institutions emerging out of the two economies differed and consider their impacts on patenting activity. We posit that the different structure of the two economies resulted in different patent systems that eventually affected the inventive activities in the United States and United Kingdom during the years 1790-1860. In addition, Britain was the established industrial power of that period while America was clearly a rising industrial power, yet the American innovation demonstrated during the Crystal Palace Exhibition of 1851 in London prompted the move of the UK's patent institution towards that of the US's.

The essay will proceed first by briefly comparing the two institutions before the 1850s; through that we point out how these differences were driven by fundamentally different purposes and thus evolved to deal with very different set of problems. Then, we look into how that impacted the inventive activities of the two countries and speculate on the impacts it might have on the technological progress of the two economies.

Section I - Two Systems, Different Purposes

The US and the UK patent institutions were quite drastically different. Whilst the US system was geared towards promotion of innovation and technological progress, the UK system was largely evolved out of institutions regulating economic activities. Therefore, one could go as

[1] We will be using Britain to refer to UK and America to refer to US; 'British' and 'American' will be used as adjectives counterparts respectively in this essay.

far as to say that the British never quite saw their institution as one that was supposed to incentivize invention - patents merely regulated the commercialization of technologies and served the interests of those well-equipped to exploit useful technologies. The use of the patents as a system of incentives for innovators was perhaps discovered and refined by the Americans.

Institutional Differences

To keep our discussion on the differences brief, we summarize the findings of several different authors in Table 1 as a means to consolidate the comparison between patent institutions in US and UK over the period 1790-1860 that we are interested in. The British system during 1790 to 1851 remained that created through the Statutes of Monopolies in 1624, and gradually refined through case laws while the American system was more strongly based on statutes, with the 1836 change being the most significant after the founding of the institution through the passing of Patent Act of 1790.

In general, the British system was characterized as being costly, less accessible to the common man, with great of uncertainties in terms of patent enforcement and validity for the patentee. A lack of clear documentation and specification of the technologies or designs patented for most of the period examined meant that the case law based approach serves to accentuate enforcement uncertainties. The system served to generate revenue for the government and was more of a gatekeeping activity to the practice of monopoly, thus a form of regulation on economic activity. On the contrary, the American system had the state bearing most of the costs of the institution, with open access for use by the common man who happened to be inventive and was characterized especially with the development of strong legal enforcement of the rights of

patentees, licensees and assignees[2], backed by a reliable examination system that reduced the incidence of issuing invalid patents.

Table 1: Qualitative Summary of differences between the patent institutions across time

	Cost & Administration	**Publicizing specification**	**Examination for novelty**	**Judiciary**
British, 1624	£100-£120 for just England; up to £380 to include Scotland & Ireland	High costs of access and poorly organized	No; pure registration system with little details required[3]	Generally anti-patentee[4]. Judges and juries sometimes decided validity of a patent on basis of utility
British, 1852	Consolidated as one single patent office; with initial fee £24 and later installments of £50 (next 3 years) then £100 (for another 7 years)	Provision was made for printing and publishing of patent records	No; pure registration system but specifications improved	
American, 1790	Centralized Federal system; patent fee of $4-5	De jure; but not practically done	Yes; committee of state secretaries and attorney general	Generally friendly to patentees; enforces the rights of licensees and assignees
American, 1793	Centralized Federal system; patent fee raised to $30	Yes; scrutinized by a panel of scientists	No; pure registration system with standardized specifications required	
American, 1836	Centralized Federal system; patent fee $30 (but raised to $35 from 1861) – though with discriminatory fees for foreign patentees	Yes, indexed and published	Yes	

Notes & Sources: Details on the patent institution of the UK during the period is mainly obtained from Dutton (1984) and MacLeod (1988) with Khan (2005) providing proper dimensions for comparison. Details on the US' patent institutions are gathered from Khan (2005, 2008a, 2008b, 2009).

[2] Assignees referred to those holders of patent rights who did not original come up with the invention that was patented but was 'assigned' the right by the original patentee through a legal contract.

[3] Improvements in specifications is later known to improve the patentees position in court cases and thus raise the validity or at least reduce the invalidation of a patents

[4] Before 1800, rulings common law cases in favor of patentees form less than 39% of the cases and only increased to 76% by 1840s; the changing attitude of judges in court was supplemented by improvements in specifications (Dutton, 1984, p.71-79).

Purposes of the Patent Systems

Earlier in British history, there had been evidence of the use of patents as a means of promoting industry. Chief minister to Queen Elizabeth I, Lord Burghley (William Cecil) had used patenting as means to encourage invention and importation of technology during the mid-1500s (MacLeod, 1988, p.12). MacLeod (1988) provides ample evidence that application for patents were carefully considered on the basis of its merit to the society as well as its novelty (whether the subjects of the crown already knew and had access to those innovations).

The issue of patents were coherent with the overall mercantilist strategy of weaning off dependence of the industries of other powers through reducing imports of industrial produce; that meant knowledge acquired and embedded in patents were to be withheld and guarded from foreign powers. But since it was a grant by the sovereign to advance the interest of the crown, it comes as no surprise that such practice was subsequently refashioned for purposes that suited the crown. By late 1500s, the original use of patents as means of importing technology was abandoned and the instrument became a means of obtaining exclusive rights to certain technology or industries, thus securing a monopoly in the corresponding markets. It was only in the Statute of Monopolies of 1624 that the parliament tried to institute the granting of such exclusive rights as a reward to innovators. Even then, it fell into a long history of abuse as the crown sought to use it as a tool of patronage and crown revenues.

Invention and innovation in Britain was not thought to be fostered through the patent institution; rather, the inventive culture described by Meisenzahl & Mokyr (2011) and the array of premiums or prizes offered to inventors also explained in Khan (2008b). There is a sense that scientists and inventors are motivated by recognition of peers for discovery of solutions to intractable problems; and therefore an award conferring such honor would best incentivize innovation. Of course, the byproduct of such an institution is the arbitrariness of awards and

assessment of the value of an invention - giving rise to potential abuses and corruption since judging the merits of entries often is implicated by prior achievements and accolades of participants (Khan, 2008b). In any case, the society appear to think of patenting as an apparatus for the crown, the elites and wealthy to regulate economic activity by the legal powers of the crown. The courts, which at various points in history had different attitudes towards monopolists and the crown, produced a somewhat haphazard track record of ruling on patents, which made the patent institution extremely uncertain and unreliably enforced.

The Americans at independence were deeply familiar with the patent institutions in Europe, particularly that of the British patent system. Therefore, any deviation from it crafted by American legislators is thus derived through a conscious decision to improve upon it (Khan, 2005). The key refinement that America introduced to the world is a patent institution primarily designed to promote progress and diffusion of technological advancements. The drafters of the US Constitution included the lines in Article 1, Section 8, Clause 8: "The Congress shall have Power... To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries". Consequently, in the Patent Act of 1790, bits of the former British patent institution, which encourages rent-seeking behaviour or cronyism, were eliminated as far as possible.

That laid the foundation for incentivizing broad based engagement with technical improvements. The American founding fathers had in mind an America which would be the frontier of innovation for the world, requiring the patentee to be the 'first and true inventor[5]' anywhere in the world and pioneered the use of broad-based technological progress as a means to promote growth in the economy.

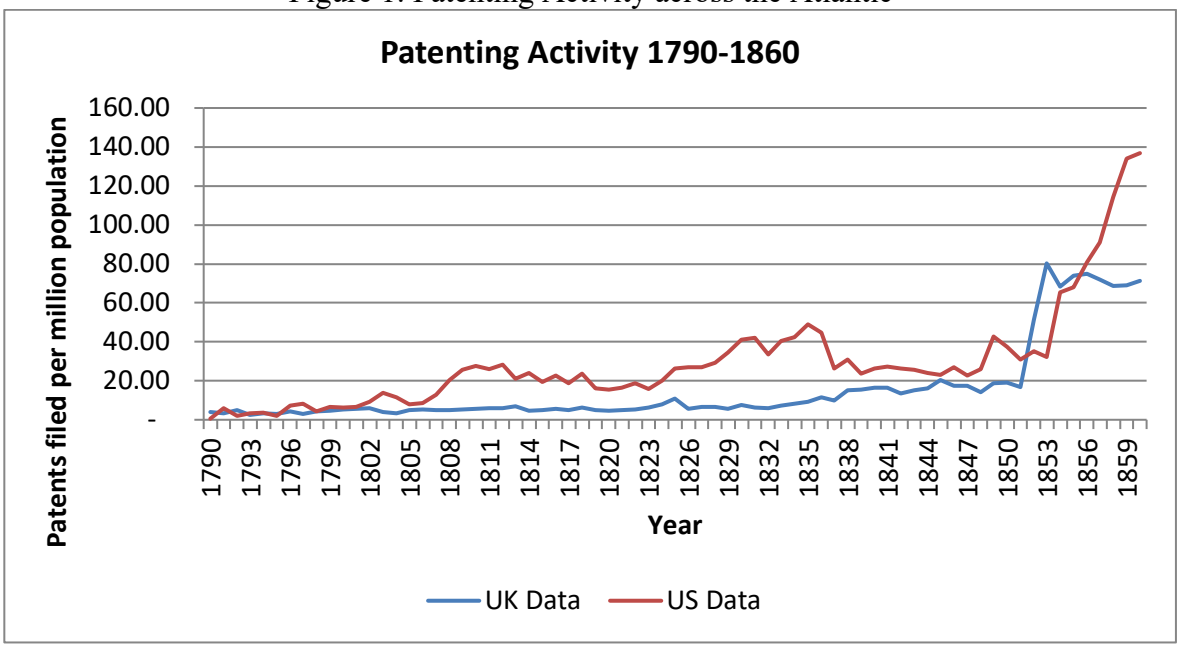
[5] This was a phrase adopted from the original British Statute of Monopolies in 1624; but was applied to any 'inventor' in the realm – referring to Great Britain.

The US essentially improved upon the use of the patent institution as a means to encourage innovation in general and not just to serve the purposes of a local economy or state machinery. In many senses, it was the legislators in US who first recognized the importance of empowering the decentralized invention decisions through the impersonal filtering of value by the market and consistent, effective legal enforcement (Khan, 2008b). The marriage of the incentives for innovation with the diffusion of practical technologies enabled the rapid industrialization and buildup of an inventive culture of skilled technicians and workmen, fostering industrial growth.

Section II - Impacts on Inventive Activities and Patenting

Zorina Khan and Kenneth Sokoloff have independently (Khan, 2005; Khan, 2008a, Khan, 2008b and Sokoloff, 1988) and jointly (Khan & Sokoloff 1990, 2004) produced much work on the characteristics and profiles of inventors on both sides of the Atlantic over this period of early industrial Britain and America. US Patents were issued by the US federal government starting 1790, a year after the ratification of the US Constitution. Nevertheless, the patenting activity in US quickly caught up with that of UK. The relative ease of access to patenting allowed US's patenting activity to surpass UK in a short time (see Figure 1).

Figure 1: Patenting Activity across the Atlantic



Notes & Sources: Patent-filing figures were taken from Khan, B. Zorina (2008a). "An Economic History of Patent Institutions". EH.Net[6]; and population figures were taken from estimates used by Angus Maddison with those between 1790 and 1800 extrapolated on the basis of constant annual growth. For readers familiar with this area of research, the discrepancy with chart with that in Khan (2005, p.35) relates to the counting of Ireland population in the UK population figures

Yet the number of patents relative to the population does not provide reliable statistics on the population's degree of engagement in inventive activities. As it turned out, Moser (2005) reveals that less than half of the inventions from UK and US were patented within each of the patent institutions. While most of Khan's research trumpets the achievements of the patent institution in US in encouraging innovation, Sokoloff (1988) and Bottomley (2014) suggests that some market forces may be at work in terms of generating demand for the new inventions. This implies that the patenting activity may simply be a proxy for the measure of economic activities engaged in exploiting new technologies in emerging geographical markets in those economies.

With America rapidly growing and expanding its territories over that period, it may come as little surprise that demands from new market provided more impetus for innovation and the

[6] Khan (2008a) made a small mistake in the UK patenting figure in 1856 on this article and cross-referring to Federico (1964) provided correction of the total number of English patents from 1094 to 2094

patent institution merely provided a tool to facilitate the commercialization of technologies. Britain, on the contrary had very established markets in London with little growth elsewhere. However, Bottomley (2014) argued, rising growth in Scotland and Ireland beginning of the 19th Century did provide growing markets which patentees clearly took advantage of through extending the jurisdiction of their England patents over Scotland and Ireland (at the expense of additional administrative costs and paperwork). Besides that, the relatively small geographical area perhaps meant that most inventor-entrepreneurs would rather tap on their own connections and prevailing market dominance to achieve first-mover advantage in technology or intimidate competitors rather than try to achieve state-enforced exclusion rights.

This could explain the pattern of a greater proportion of patentees in US taking out only a single patent over their career as compared to the UK shown in Table 2. While the multiple-patentees in both economies are more or less similar in proportion of total patentees, America features a broader base pyramid of patentees with merely one patent – reflecting the prevalence of patenting by the 'common man' inventor. In Britain, however, even if inventing was a common man's activity (as we shall see), patenting remains the enterprise of the elite and wealthy, with dominant commercial interests.

Table 2: Distribution of Patents Across US and UK for 4 periods between 1790-1850

		No. of patents over patentee's career					
Period	Country	1	2	3	4-5	6-9	Above 10
1790-1811	England	52.5%*	23.6%	9.8%	8.3%	4.7%	1.4%
	US	51%	19%	12%	7.6%	7%	3.5%
1812-1829	England	42.9%	18.9%	13.1%	10.9%	8%	6.3%
	US	57.5%	17.4%	7.1%	7.6%	5.5%	4.9%
1830-1842	England	46.1%	20.6%	10%	11.1%	3.9%	8.3%
	US	57.4%	16.5%	8.1%	8%	5.6%	4.4%
1843-1850	England	51.8%	14.5%	10.9%	10.9%	5.2%	6.7%
	US	60.5%	17.7%	8.8%	7.2%	2.4%	3.5%
All Years	England	49.4%	20%	10.9%	9%	5.4%	5.3%
	US	57.1%	17.2%	8.3%	7.7%	5.3%	4.4%

Modified & adapted from Khan (2005, p.112); *each figure should be read '52.5% of all patentees in the 1790-1811 period in England obtained 1 patent over their career'. England patents are used as a measure

for the patenting in UK since it represents the full suite of patenting activity (most Irish and Scottish patents are merely England patents with extended coverage).

Perhaps due to the combination of high costs, bureaucracy and cronyism, some sectors in Britain, especially that of engineering has evolved a culture that is rather hostile to the patent system (Meisenzahl & Mokyr, 2011). Even brilliant scientists and inventors were openly against the patent laws, Charles Babbage who conceptualized the difference engine saw the patent system as 'factitious privileges of little value', where 'the most exalted officers of the State in the position of a legalized banditto' (Dutton, 1984 p.70). Mokyr (2009) brought up several cases of British innovators who refused to take out a patent in their inventions and opened their designs to be used by the public.

In addition, there are countless incremental innovation and micro-adaptations that were not captured by the patent system. MacLeod & Nuvolari (2006) raised the case for 'collective inventions' where groups of industrial mechanics and engineers freely shared techniques to improve production methods in the iron industry of Cleveland, UK as well as steam engine technology for pumps in the cooper and tin mines of Cornwall, UK.

Nevertheless, without widespread use of patents, inventors often would have cashed out on the invention simply by keeping its details a secret. This meant that the commercial failure of the inventor that may be attributable to his entrepreneurial inaptitude would result in the lost of the invention. And at the same time, inefficient investments have to be made to ensure the secrecy of particular designs. Diffusion of the technologies would correspondingly be curtailed. The ingenuity of the American patent systems seems to be its ability to separate invention from commercialization of a technology through the use of an impersonal market process (Khan, 2009). Whether it truly incentivizes innovation at an individual-inventor level, we are uncertain; but we can be sure through the historic experiment that as an economy, the diffusion of knowledge that

was encouraged by the system appeared to have helped increase the rate of technical progress that eventually allowed US to surpass UK.

Section III - Conclusion

We conclude suggesting that the difference between the patent institutions of US and UK during the early period of industrialization was due to the differences in purposes they seek to serve. The British sovereign generally regarded the promotion of industry, crafts and useful arts and therefore innovation as the domain of the various societies and guilds set up for this purpose. As a consequence, the patent institution was a mere state appendage to regulate the subsequent commercial activities relating to these inventive activities. America's founding fathers found the federal government's authority useful in designing an institution that would provide a conscious push to technical progress in the economy. The democratic ideals, principles of individual liberty as well as the lower relative inequality between the common man and the elites at the dawn of American Independence prevented the system from being captured by the interests of a privileged class, making patenting an activity open and accessible to the common man.

Surprisingly, the heap of scholarly work done on this topic neglect to mention that the dominant value of a patent is in offering the innovator the hope of realizing returns on his ideas through full disclosure of the invention to an authority who would enforce rights to exclude. This ensures inventive activities translate into contributions of the useful knowledge to the public domain. Mokyr (2009) comes close to pointing this out in mentioning how patenting is a bit like taking part in a lottery, offering hopes of a huge success. The next step for scholars in this field would be to examine how this public dissemination helps to provide support for the emergence of an inventive economy that can be constantly engaged in productivity-enhancing innovation.

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