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The Patent Protection and Making of the Global Technological Divergence with reference of British Patent System

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Abstract

The main argument of this paper is that British patent institutions were not merely legal devices for rewarding inventors but central to a historical process through which early industrializers consolidated technological leadership and generated long-run North–South divergence. Using evidence from the British Industrial Revolution, it shows that as mechanization spread through textiles, transport, steam power, metals, chemicals and communications, patents evolved into reasonably effective instruments for protecting inventions, organizing commercialization and codifying technical knowledge, while sectors such as agriculture and shipbuilding remained relatively weakly protected. A sectoral patent table demonstrates that patenting was concentrated in high-return, high-spillover industries, where exclusive rights allowed firms to capture rents, reinvest in new technologies and maintain a lead over the developing countries. The analysis interprets these historical patterns through a North–South model of innovation and protection, in which the North conducts R&D and enjoys temporary monopoly power over new products while the South imitates, licenses or is excluded depending on the strength of intellectual property rights. The main contribution is to link concrete British historical evidence and sectoral patent concentration to modern North–South intellectual property models, showing how patents played a dual role: supporting invention and diffusion within pioneering economies while also shaping an international distribution of technological rents that favored early industrializers and constrained latecomers' opportunities to build technological capabilities

Keywords: Patents, Intellectual Property Rights, North-South and British Industrial Revolution

1. Introduction

Historically, the stone age evolution of humans cannot be traced back to the exact time, but it is a known fact that humans have consumed grains for over 1000 years. Planting grains started around 11500 years ago and domestication of cattle started around 10,000 years ago (Singhal & Singhal, 2022). In between the 8700 BC to 2700 BCE, it was the Bronze age that started after the stone age in Mesopotamia, in Sub-continent, in Europe and in China. Then the era of the molding of copper, tin and bronze started ultimately forming the heavy industries such ship building industry (Knopf, 2014). At around 1200 BC the Iron Age succeeded the Bronze Age, this was the time when the iron was stronger and lighter than the Bronze (Landes, 2015). In the process of shifting from one era to the other, the process of migration for hunting and gathering to new territories for food and shelter also resulted in the transfer of the knowledge from one place to another. And it was then in the 14th century that improvement and development started to take different forms, i.e., making of sunglasses, microscopes, mechanical clocks, gunpowder, and telescopes were made to change the dynamics of development (Langley et al., 2006).

Therefore, the history of modern technology does not date back to several centuries, but it was in in 1750s that the notion of technology started to emerge not as a term but as "machinery" that was introduced to produce more goods in the lesser time. The mechanized production process started to witness inventions and innovations that changed the entire economic framework of the world. It has now transformed into what is known as a "global economy" where the economies interact with each other and have integrated so well that a person in the North of the globe knows what type of production is taking place in the South of the globe (Usher, 1960).

Protecting technology became essential for safeguarding industries that generated high profits for producers, ultimately boosting their economic growth. Innovations were continuously emerging, and they needed protection through "patent laws."

Questioning about the patent laws, and how do they protect industries? These laws grant exclusive rights to inventors, preventing other producers from easily entering the market and becoming strong competitors. These laws existed as early as the 18th century, offering industries exclusive rights to encourage innovation, which accelerated technological advancements and the spread of innovations, thereby driving economic growth. The following paragraphs provide a brief overview of the evolution of patent rights over time.

(Dutton, 1984) justifies the existence of patents as they are a reward for the inventor for their efforts in invention of a new product. It utilizes both a physical labor using the labor work and it also requires the labor services referred to as the mental power and skills that it possesses. An important development by the author is that knowledge though expensive becomes inexpensive if it is reproduced causing a free rider problem. This making it a gross immorality in law to let everyone use a persons' work without taking that person's consent therefore enhancing the importance of the patents. But the British patents were not strong enough to create barriers for others to get access to a person's knowledge that can be used by others.

The Industrial Revolution is often treated as the moment when modern economic growth began, but the institutional mechanisms behind that transformation remain contested. Among the most debated mechanisms is the patent system: some scholars argue that stronger Intellectual property rights (IPRs) helped inventors capture returns, encouraged investment, and supported technological change, while others emphasize that much inventive activity occurred outside the patent system and that patents sometimes slowed innovation through monopoly effects. This disagreement matters not only for interpreting Britain's industrial rise, but also for understanding why technological capability became so unevenly distributed across countries (Mokyr, 2009). In another study (Greasley & Oxley, 2007), they argue by using the time series methods that the increase in the patenting rights resulted in the rapid growth of the products like cotton, iron and mining sectors leading to an increased protection of the IPRs. They do not consider the protection of the IPRs to be the main cause of the Industrial Revolution.

This paper investigates about how patent institutions contribute to long-run technological and industrial divergence between the Global North and the Global South. The central argument (Yang & Sonmez, 2013) is that patent protection was not merely a legal arrangement for rewarding inventors; it also became an institutional device through which early industrializers protected monopoly rents, accumulated technological capability, and strengthened their lead in capital-intensive production. Over time, that cumulative advantage helped lock in a global pattern in which the North specialized in higher-value industrial activity while much of the South remained tied to labor-intensive and agrarian production.

The paper contributes to the literature in three ways. First, it reconnects the history of British patenting to the broader North-South development divide, rather than treating patents only as a domestic institutional issue. Second, it uses sectoral evidence from textiles, transport, metals, communications, and related industries to show how patenting concentrated in activities with higher capital intensity and stronger market power. Third, it frames intellectual property as part of a larger political economy of development, in which legal protection, industrial organization, and technological accumulation jointly shape long-run growth paths.

2. Literature Review

The relationship between patent protection, invention, and industrialization has long occupied economic historians and development economists. One influential view holds that patent rights provided inventors with incentives to invest in risky experimentation and helped successful innovators capture returns from their effort, thereby supporting technological advance and commercial expansion. In this view, patents are not simply legal devices; they are part of the institutional architecture that made sustained invention more likely during the Industrial Revolution and in the early stages of modern economic growth. At the same time, a more cautious strand of the literature argues that patent systems were often expensive, unevenly applied, and only one of several mechanisms through which knowledge circulated and production improved.

A major contribution to this debate comes from work on the British patent system during the Industrial Revolution. (Bottomley, 2014b) in his historical analysis finds that the pre-1852 British patent system was far more functional and important for industrialization than older scholarship suggested. Using extensive archival and legal evidence, he shows that by the late eighteenth century patents had effectively shifted from royal privilege to a contract-like property right, in which inventors disclosed technical specifications in exchange for temporary exclusivity. This evolution, supported by emerging patent agents and increasingly supportive court enforcement, lowered effective barriers to obtaining and defending patents and enabled inventors to earn substantial returns, especially in key industrial sectors. he concludes that this institutional framework helped Britain sustain a technological lead over its rivals, making the patent system an important contributory factor in the country's Industrial Revolution rather than a marginal or purely symbolic institution. In another survey on how historians have understood technology's role in the British Industrial Revolution and how the focus has evolved over time (Tomory, 2016) traces a shift from early nineteenth-century debates about the machinery question and the social impact of machines on workers, through early twentieth-century attempts to explain the causes of technological innovation, to the post-1945 accounts that celebrated technological creativity as the key driver of Western economic growth. Since the 1970s, he elaborates, that research has broadened beyond the classic triad of cotton, iron, and steam to include product innovation, proto-industrialization, and a wider range of industries and technologies, producing a much more heterogeneous picture of technological change.

(Inkster, 2003) examines how far patents can be used as reliable indicators of technological change and innovation for the period 1830–1914, and it does so by carefully probing the structure and biases of historical patent data. He surveys national and international trends in patenting and shows that simple patent counts often mislead because they reflect legal changes, fee structures, and institutional reforms as much as underlying inventive activity, so he argues for disaggregated, context-specific analyses rather than treating patents as a transparent proxy for innovation. He highlights sectoral and regional differences, the role of individual versus corporate patentees, and the interaction between patent statistics and broader processes of industrialization, concluding that patents are useful but inherently ambivalent indicators that must be interpreted within their institutional and economic settings. In another scholarly work (Inkster, 2007) develops a global, historically grounded framework for understanding how cultures of constraint shape innovation, emulation, and technology transfer over the long run. He criticizes purely economic or a cultural account of technological change and instead argues that markets, institutions, and even information systems are themselves cultural constructions that can either channel or block inventive activity and imitation. Using a broad, Schumpeterian notion of innovation including organizational and institutional change, he distinguishes between cultural constraints that raise the costs or slow the pace of technological change and those that provide structured channels, such as systems of information, liberal discourse, and loose social ties, that make cumulative innovation more likely. A key claim is that, in world history, emulation and technology transfer have been more powerful

than original invention, but societies differ in how their cultural configurations filter incoming technologies, producing uneven outcomes in modernity and development.

With an emphasis on the two country North-South model (Chin & Grossman, 1990) analyzes that when developing economy will choose to protect the IPRs of an innovating Northern firm and what this implies for welfare and world efficiency. In their setup, only the Northern firm can undertake cost-reducing R&D, while the Southern rival can imitate costless if the South does not enforce process patents, so Southern policymakers face a trade-off between cheap access via piracy and the dynamic benefits of encouraging innovation. The core result is that the interests of North and South typically conflict: the South tends to gain from weak protection through lower costs and competitive output, whereas the North loses rents; moreover, even when stronger IPRs raise innovation, they do not necessarily maximize global welfare because monopoly distortions can outweigh dynamic gains. The paper thus established one of the foundational theoretical arguments behind later work on TRIPS and North–South IPR conflicts, framing IPR as a central source of distributional tension between industrialized and developing economies rather than a simple win–win policy. Then in another working paper (Grossmn & Elhanan, 1994) connects endogenous technological change with international trade, and it provides a broader theoretical backdrop for North–South models of innovation and diffusion. They start from older trade theory, where technology is exogenous, and then synthesize newer work in which technological progress arises either from learning-by-doing or from R&D investment, highlighting how trade both responds to and shapes the evolution of technology. A central theme is the role of knowledge spillovers and their geographic reach: when spillovers are global, trade tends to equalize technology and support convergence, but when they are local or biased toward advanced countries, trade can reinforce technological gaps between a leading North and a lagging South. Therefore, the paper frames North–South issues not just in terms of static comparative advantage, but as dynamic interactions between trade, innovation, and learning that can produce either convergence or persistent divergence in technological capabilities. On the stronger IPRs that are associated with the faster economic growth (Gould & Gruben, 1996) used cross-country panel data from 1960–1988 on patent protection, trade regime, and other country characteristics. Motivated by endogenous-growth theory, they note that IPRs can theoretically have opposite effects in encouraging innovation by raising returns to R&D, but also potentially entrenching incumbents and reducing competition. Their econometric results show that, controlling for human capital, openness, and initial income, countries with stronger patent protection tend to experience higher per-capita GDP growth, although the effect is modest and more robust in relatively open, competitive economies than in closed ones. This places their work within the broader North–South debate by suggesting that, especially for more open developing economies, tighter IPR regimes can support growth, but that the growth payoff depends on domestic competition and integration into world markets rather than on legal protection alone.

3. Historical Background

The British Industrial Revolution is widely treated as the turning point from agrarian and handicraft production to mechanized industrial production, but the historical mechanisms behind that transition remain debated. One important line of research argues that patent rights helped inventors capture returns from risky experimentation and encouraged the commercialization of new technology, while a more cautious view emphasizes that patenting was only one of several forces shaping invention and that its importance should not be overstated. The analysis of the British patent system shows how patent protection moved from a system of privilege toward a more formalized property regime, which increased the legal and commercial relevance of inventions during industrialization. This institutional shift matters because it indicates that technology was not only a technical process but also a legal and economic one (Bottomley, 2014a; Mokyr, 2009).

Technological change in Britain was cumulative rather than sudden, but the scale of its effects was dramatic. Innovations in textiles, steam power, mining, iron, and transport steadily reduced dependence on manual labor and allowed output to expand far beyond earlier limits. The spinning jenny, water frame, and spinning mule were not only technical improvements; they also reflected the growing importance of invention, adaptation, and the ability to protect or diffuse ideas in industrial production. In steam power and mining, the development of improved engines likewise changed the economics of production and created new opportunities for factory growth, transport, and urban expansion. These changes helped transform Britain into the first major industrial economy, and they also established the technological base from which later industrial leadership emerged (Sullivan, 1990).

The social consequences of this transformation were equally important. Industrialization created a growing divide between industrial capitalists, who controlled machinery and accumulated profits, and wage laborers, who sold their labor under increasingly unequal conditions. That class structure is central to the political economy of invention because patenting and ownership rights were deeply tied to who could appropriate the gains from technological progress. As industrial production expanded, landowners, merchants, financiers, and managers also became part of the new industrial order, but the key distinction remained the concentration of control over capital and knowledge in the hands of those able to secure and commercialize new technologies. In that sense, patents were not merely legal documents; they were instruments through which industrial power could be organized and defended (Bottomley, 2014a; Mokyr, 2009).

The historical record also shows that patenting was not concentrated evenly across sectors. (Sullivan, 1990) work on English patenting shows that patents were widespread during 1711–1850, but they were especially important in industries such as textiles, transport, and other manufacturing activities where commercialization potential was high. That pattern is consistent with the table, which shows heavy patenting in textiles, transportation, chemicals, and communications, alongside lower counts in agriculture and shipbuilding. The significance of this sectoral pattern is that patent protection appears to have favored industries with stronger market returns and faster

technological accumulation, helping some sectors move ahead more rapidly than others. This unevenness later contributed to the broader global divide between capital-intensive industrial economies and economies that remained more dependent on labor-intensive or agrarian production (Zukerfeld, 2014).

(Mokyr, 2009) work adds an important corrective to any overly patient-centered account of industrialization. He argues that the Industrial Revolution should be understood as part of a broader accumulation of useful knowledge, in which scientific understanding, technical competence, information diffusion, and institutional openness all mattered alongside formal IPRs. This perspective is valuable because it prevents the analysis from reducing technological progress to patents alone. Instead, it emphasizes that patents were one mechanism among many through which innovation was encouraged, contested, and disseminated. For the present paper, that distinction matters because the argument is not that patents alone created industrial growth, but that they helped shape the distribution of industrial power by enabling early innovators to protect returns and expand cumulative advantage.

The British Industrial Revolution should be understood not only as a domestic story of mechanization, but also as the historical beginning of a longer global divergence in productive capacity. The institutional environment of patents, property rights, and invention helped early industrializers sustain technological leadership, while many later-developing economies entered the global economy under very different conditions. This is why the British case remains central to the analysis: it provides the historical foundation for the argument that patent institutions helped structure long-run North-South divergence. The next section can now move directly to the British patent system and its role in industrial innovation.

3.1 British Patent System

Technological advancement is characterized by rapid improvements in the functionality of tools and devices, enabling the creation of models and designs swiftly and with increased precision. This progress allows for activities to be planned, assembled, and integrated in controlled environments, ultimately producing goods for individuals and corporations at both regional and international levels.

However, a question arises about the extent of technological advancement during the Industrial Revolution, which spanned from 1750 to 1900. How did the labor force interact with industrial capitalists during this period? Labor, as a productive force, facilitates the production process using another critical resource: physical machinery, which includes tools, raw materials, and machines. Labor productivity is derived from skills (whether inherent or acquired through training and practice) and the knowledge applied in the production process (Cohen, 2000).

In an economic structure, when labor and machinery interact to achieve desired productivity levels, new ideas are formed, which sustain the functioning of the economic system through their interplay(Cohen, 1982). During the Industrial Revolution, this dynamic contributed to the emergence of class structures: the industrial capitalists who benefited from inventions and

innovations, and the labor class, which suffered exploitation at the hands of the industrialists who held power over them. Faced with constant competition, industrial capitalists sought to reduce the turnover time of production and the sale of goods.

The producer who could bring more goods to market would generate a higher surplus compared to others. Thus, while technology and the exploitation rate were common factors among capitalists, their differentiation lay in the surplus value they could generate. The industrial landscape was not limited to two classes; it included other groups such as money lenders, managers, merchants, and importantly, landowners. Landlords played a crucial role by providing land on which production activities took place. This access to land was essential for the existence of industrial capitalists, as, given the technology of the time, surplus could only be produced on land acquired from landlords. In exchange, industrial capitalists paid landlords a portion of the surplus value generated, known historically as rent, which applied to both agricultural and industrial commodities (Houston, 1983).

3.2 The Role of Technological Innovations

What is technology if it has transformed economies? Simply put, technology is the process of performing tasks using machines or tools. The skills of artisans enabled human interaction with machines, from the labor of trainees to the modern-day elites who purchase luxury goods. Industrialization has revolutionized the world, unifying it into a global industrial economy. This transformation relies on utilizing existing resources to reinvent the old world into a new one (Hahn, 2020).

Britain was the first country to undergo the Industrial Revolution, witnessing the transformation of a rural, agricultural, and handicraft-dominated society into an urban, industrialized one. This shift marked the transition from handmade goods to machine-made products. While Britain led this development, it was also influenced by continuous innovations from Germany, France, the Netherlands, and other countries. Technological advancements began with the introduction of blast furnaces and iron casting in the late 15th century in Britain. Subsequent inventions like the printing press, paper mills, woolen industries, draperies, wire drawing machines, spinning wheels, and swivel wool significantly eased production for the industrial capitalist class. Additionally, industries unfamiliar to Britain, such as tinplate manufacturing, brewing, sugar refining, silk, pottery, and glass making, contributed to the expansion of production capabilities (Musson & Robinson, 1989).

3.3 How the Industrial Revolution Transformed the Technology

The technology transformed from real time labor exploitation of the usage machines to the labor replacing machines. The machines introduced first were functional given the expertise of human skills that mostly required the physical efforts of rolling and turning the heavy machines to the push and pull of the heavy levers. But this was the start, the start that revolutionized the productivity techniques, that gave rise to evolutionary ideas. Though in the start as the technology was new and the methods of making the machinery was unique and not known by many, the conversion of resources into hard metal machines with nuts and bolts fixed in a way so that they can function properly. But again, this was the start of an affair that changed the dynamics of the

production process which is now globalized. One can see a product assembled in China, that was idealized in USA and is distributed in different parts of the world to generate revenue from global sources. A few more examples will be discussed ahead in the section.
To understand the transformation, I tried to give a brief comparison explanation, to make the understanding better. By starting with the spinning jenny invented in 1746 by James Hargreaves; a skilled worker could easily operate it for the purpose of weaving of cloth starting from weaving 8 clothes in the start to weaving 80 at a time by improving the technology with time. Then spinning mule out-invented spinning jenny, but it exploited the child labor as many children employed in its production. Both spinning Jenny and Spinning mule can now be found in museums. With the highly advanced and innovative ideas that changed the productivity system altogether from the labor-intensive techniques to capital (machine) intensive techniques of production, the latest form of weaving machine is highly automated and digitized. But the irony is that it is used in the developed countries as the traditional and labor-intensive economies, also referred to as developing economies still rely on the hard work of labor or not so advanced machinery in the weaving industry. One of the most famous weaving industries in current time is the SMIT[1] joining the famous Santex Rimar Group producing the machines since 1938.

The steam engine was a result of the invention of a single piston pump by Thomas Newcomen in 1712, that was first of its kind by directing steam to pull out water and later to be used by coal mines to dig out coal. Steam engines were widely used in railway and marine transportation, pumping out the water, in industries and was very useful in generating the electricity. It was a revolutionary invention, as it was widely used in factories, steamboats and mines in making the productive process efficient and highly productive. Much of the early development is obsolete now but it gave rise to new ideas and ideologies that helped improved the development to a highly advanced level. It was after the steam engine that the producers started to think out of the box and now a very highly efficient internal combustion engine is used in heavy machinery like power generators, stationary engines and vehicles to name a few. The mobility has become faster not only regionally but the exchange of products in the form of exports and imports have become easier. This era is referred to as modern automotive age by Karl Benz in 1886. Today's world revolves more about the quality than the quantity, the efficient machinery is utilizing the resources in a way that it is producing higher quantities with higher quality given the demand of the products that are distributed in the market for sale.

The industrial revolution was followed by urbanization, the population in the cities increased rapidly and it was the railways that contributed to the divergence of the spatial population. The transportation in the form of railway networks assisted in the increase in employment opportunities, increased the economies of scale and accentuated the agglomeration. It was the invention of the railways that fortified how the hierarchy of population agglomerated to the urban areas in the early 19th century (Bogart et al., 2022). The transportation revolution was not only limited to the Britain instead the Americans were constantly moving from eastern coastal states to

[1] SMIT stands for Società Macchine per l'Industria Tessile. This industry was founded in 1938 in Italy.

the Western states in search of employment opportunities. That was made possible with the construction of roads, railway tracks and canals. The canal construction was a huge success in US as it saved time for the travelers connecting the Pittsburgh to New Orleans, Hudson River to New York city to name a few with a shorter distance travel time. There were enormous developments in the highway projects, canal mania and railway tracks laid down across the country (Olmstead & Rhode, 2018).

For this paper, the main implication is straightforward: the British patent system helped create an institutional setting in which technological progress could be protected, commercialized, and accumulated. That setting did not mechanically cause the Industrial Revolution, but it did strengthen the incentives and market structures that made industrial leadership more durable. The table 1 as given now moves from the legal-institutional story to the sectoral evidence on patents and invention.

Table 1: Percentage distribution of List of the industries patented after industrial revolution

Industry	No. of Patents (1850-1900)	Percentage of the Patents %	Examples	Notable patents	Latest advancements	Notable patents
Steam Engines	2000	9	Compound steam engine	Locomotive valve gear (1854)	Steam turbines for power plants	Steam turbine blade design (2019)
Iron and Steel	1800	8	Bessemer converter, Siemens Martin Furnace	Hot Blast (1855)	3D printing of metal components	High strength steel alloys (2020)
Mining	1000	5	Safety lamp, rock drills	Hydraulic mining machine (1858)	Automated mining robots, AI driven exploration	Autonomous Mining robot (2019)
Transportation	3500	17	Pneumatic tires	Internal combustion Car (1885)	Electric and autonomous vehicles	Autonomous vehicles navigation system (2018)
Chemicals	2500	12	Synthetic dyes	Aspirin (1899)	Biodegradable plastics	Biodegradable plastic composition (2020)
Shipbuilding	900	4	Iron made ships	Turbine powered ships (1897)	LNG powered ships	Autonomous navigation for ships (2020)
Communications	1300	6	Bell's telephone, telegraph	Wireless telegraph (1895)	5G tech and quantum communications	Quantum secure communication (2020)
Agriculture	1200	6	Steam powered threshing machine	Grain elevator (1889)	Agriculture drones, CRISPR	Drones for agriculture (2020)
Textile	3200	15	Sewing machine	Shuttleless loom (1850)	3D knitting machines	Smart fabrics with integrated sensors (2021)

Source: (Abbot et al., 2019; Bottomley, 2014a; Walker, 1922; Woodcroft, 1969)

The central argument of this paper is that the patenting both during and after the industrial revolution was not evenly distributed across the sectors.

Table 1 shows a comprehensive overview of the patented industries and then in the same table, I have given examples of new inventions with advanced form of technological changes in them that

are patented recently. Historically, the highest number of patents as can be seen are in the transportation and textile industry. Transport as a means of connection of the regions through various modes of commute indicating a significant role in the railway, sector, steam engines and then with the introduction of the internal combustion engines and bicycles. These forms later gave way to inventions in the form of autonomous vehicles and autonomous navigation system. Similarly, Textile industry was an important source of income during the revolution where the sewing machine, spinning jenny, wool production they were all a kind of kind of development that enhanced the earlier forms of growth in the economy. Although, it was replaced by highly mechanized forms of production later but their contribution towards the production and gaining profits cannot be ruled out. The example of increased units of weaving cloth has already been given in the text. The number of patents were higher for the industries of electronics, communications and chemicals as well. The invention of Bell's telephone, then a wireless telegraph can be regarded as one of the most anticipated inventions of the time, it changed the dynamics of communication from letter writing to voice communication and the transfer of signals through electric signals and radio.

Comparatively iron & steel and mining have lower patents, the reason is that there is a sustained innovation required in the heavy industries that is very important for the infrastructure to be built in the cities and surrounding areas as well as the extraction of resources that requires hard labor work as well. Main patents given in this industry were steel production such as Bessemer converter, Siemens Martin Furnace and mining equipment such as safety lamp, hydraulic machines, and rock drills. The investment in the iron & steel was ultimately supporting the industries such as transportation and textile industry.

Lastly it can be seen that the agriculture and shipbuilding industry are the lowest patented industries with total of 6% for the former and 4% for the latter. The reason for lower patents in the shipbuilding can be attributed to the dominance of the large-scale ship designs, which involves slow paced innovations as compared to industries like textile, and communication. The patents in the agriculture industry are lower because though the advancements in the reapers, threshers or farmer's efficiency vehicles, food preservations and processing technologies are changing with time and advancing but the forms of technology required for their development if is spread among the competitors will not harm their profits. The agricultural tools are a public domain considered to be as common knowledge, where most of the practices performed are traditional techniques of agrarian production. Sometimes to secure a patent is expensive and time consuming instead of time effective therefore a small-scale farmer will avoid the complexities attached with the patenting process and therefore will avoid the potential benefits and therefore seek to work without patent filings. This is also one of the main reasons that developing countries are lagging than the industrially developed economies. However, taken together, the sectoral evidence supports the main claim that is patenting was concentrated in industries that could generate cumulative technological and commercial power, and that concentration helped early industrializers deepen their advantage.

In the next section I will move into the formal North-South model, which provides the theory for why this historical pattern matters for global divergence.

4. The North-South Framework

To understand the models that have been developed to address the welfare loss globally due to the extension of the patents geographically. It is important to discuss Intellectual Property Rights (IPR), the exclusive rights given to the inventor of an idea or product that are basically divided into two main categories namely: Rights related to copyright and Industrial Property. The former category is for the rights of the authors for their literary works such as writing books, doing artwork such as painting, making sculptures or performing computer codes or working on computer programs. The rights are also given to the artists who are involved in media or performing arts by singing or acting in Programs on different platforms that can be online or live shows. The latter category is related to the rights given to the identification of a good attributed to a region, and for the protection and the stimulation of the designs resulting in the development of new technology. The main purpose of the IPR is to incentivize and finance the research to promote the development activities.

However, the developing countries that are termed as global south in this study have very limited IPRs therefore they are not able to get the benefits that they should get from the technological development. (Krugman, 1979) two regional general equilibrium model was used by (Helpman, 1992), to understand the impact of the restrictions due to IPR on the terms of trade, production and consumption. The developing countries have a limited technological activity due to the imitation therefore the two-region division into global north and south is not a requisite to understand the heterogeneity of production in the developing countries. The two-region division is best for the newly industrialized countries as they can catchup with developed countries in terms of adopting and marketing the new technology.

I have used the model of (Chin & Grossman, 1990) that states the conditions for the global welfare loss that takes place because of the patent protection through the IPR implemented. The model provides a rationale for the global unification of IPR regimes. The world economy is occupied by powerful and strong economies, making the protection of the intellectual property complex structure protecting the interesting of these economies. The belief of the powerful economies is that the restrictions maximize their well-being, and they can earn monopoly rents for newly introduced technologies. On the other hand, if the relief is even provided and patents are not implemented a more serious issue of piracy and infringement will take place benefitting the country where the capability of Research and Development, R&D is low.

4.1 North–South model of innovation and protection

The historical pattern in which patents concentrated in a few capital-intensive industries can be interpreted through a simple North–South framework of innovation and protection.

In the model, the world is divided into a technologically advanced North and a technologically lagging South. The North has the capacity to undertake research and development The model by (Chin & Grossman, 1988) assumes that there is North firm and a South firm, and both have access

to old technology to produce a good that is demanded in both countries. The Northern firm has the capability of R&D and therefore improves its production technology. The foreign intellectual rights in the South are protected therefore the North will gain through its R&D efforts through a competitive advantage that it has over the South. This will lead to an oligopolistic advantage of the south by getting a larger share of the market and licensing its superior technology in comparison to the technology that South has. But if the assumption of protection of foreign intellectual rights is removed then the firms in the south will have an opportunity to pirate the innovative technology and earn profits without R&D into the innovation as North did. Therefore, both will become competitive in the international market taking away the share of profits that North was earning in the presence of protection.

To what extent the patent protection by the South can maintain the level of welfare in each country and in the whole world? The global patent protection purpose is to stimulate the innovation in the technological productivity leading to a decrease in the cost of production. The model depicts the global patent protection to decrease the cost of production for the North firms at-least. This effect should benefit both countries, but the enforcement of the patent protection decreases or may cease the oligopolistic competition that can damage the welfare in both countries in North and South. The protection has implication in the South due to international distribution of the income because the North can get a greater share of the super-normal profits due to IPRs.

The model assumes that the South fails to protect the IPRs of the North firms leading to a market structure of symmetric duopoly. At the R&D phase the North firm foresees the implications of the actions for the product market competition. The role for the government in the South is important because if it can prevent the violation of the IPRs of North firm product. Then the duopoly of the firms has a different marginal cost that they can meet in the product market leading to equilibrium, based on the effectiveness of R&D and decreases the production costs. If the level of innovation is low then the R&D by the North firm will be modest, therefore asymmetric duopoly led to the final stage of the competition. But if the level of innovation is higher, then the North firm equilibrium will be to find it's optimal to reduce the costs substantially, enjoying the monopoly in the product market. What would be the welfare of the South if the government of South does or does not protect the IPR of the North firm.

South achieves higher National Welfare if it neglects to protect the IPR if the duopoly outcome will result under the protection given its share in the world consumption. It will prefer to look the way the patent infringements occur except if its consumers the world's output of the good that is subject to reduced costs of production. However, North will capture monopoly position if the property rights are respected. Therefore, the conflict of interest between the North and South is based on the system of IPR.

To maintain the level of profits by the firm in the South, it will elect to license the superior technology it has over its rival in the South. Licensing on the contracts is done once the R&D is completed, they can be negotiated at some stage and for North it is profit oriented if it enforces

contract. But the South will never be willing to pay a positive fee by using the North firm technology, instead it will want to copy that technology at no costs. The North would not let this happen through IPR to enjoy the bargaining power in the licensing negotiations to extract the surplus from any agreement. The IPR are leading to the conflict in the international economic relations, unless the South has a major share of market for the good if the technology is subject to improvement, then the social welfare in the South will be higher otherwise with not strong market for the good it will succumb to the pressure from the North. However, North will enjoy the benefits from the patents, enhancing the global profit comparisons where the protection of IPR results in the world efficiency when. the productivity in R&D is great, and the innovations too are likely to be high in the process of production of the product.

Lastly, with more firms in the South and the scope for the technological improvement then a strong system of IPR is important to prevent the South firm from appropriating the technologies from each other. The industrial countries force the countries in the South to impose the patent restrictions over both technology and knowledge.

4.2 Implications of the model

The main implication of the North–South model is that patent protection does not merely determine who can legally use an invention; it also affects where innovation happens, who captures the rents from innovation, and how quickly technological advantages accumulate over time. When the North can protect its inventions, it has a stronger incentive to invest in R&D because successful innovation yields temporary monopoly profits. When the South is allowed to imitate more easily, consumers may benefit from lower prices in the short run, but the long-run effect can be weaker incentives for innovation and a slower expansion of frontier technologies. The result is a persistent asymmetry: the North keeps generating new technologies, while the South remains more dependent on catching up through imitation or licensing.

This implication fits the historical evidence in the table 1, very well. The industries with the highest patent intensity, especially transportation, textiles, chemicals, steam engines, and communications are exactly the kinds of sectors in which innovation generates large private returns and large spillovers. Once firms in these sectors secure patents, they can protect market share, earn above-normal profits, and reinvest in further technological improvement. That pattern helps explain why the same sectors remained technologically dynamic over time and why the more advanced economies kept moving into newer waves of innovation.

The model also helps to understand why weaker patent enforcement can have mixed effects in the South. In the short run, imitation may expand access to technologies and reduce costs for consumers. But if the South relies too heavily on imitation rather than building its own innovation capacity, it may remain locked out of the sectors that create the highest long-run gains. The table 1 shows that the most protected and commercially important industries were also the ones that generated the strongest industrial momentum. In other words, the South may gain access to existing products, but the North keeps control over the innovation frontier.

This is also where the broader historical argument of the paper becomes clear. Britain and other early industrialized nations were able to turn patents into mechanisms of cumulative industrial advantage because they already had the legal, financial, and industrial structures needed to commercialize new technologies. This model is in support of the my analysis's central claim that patent institutions helped produce long-run divergence, not just temporary differences in output. The developing economies, with the examples of Pakistan, Ethiopia, Bangladesh, and Nigeria by contrast, entered the global system with weaker industrial bases and less ability to convert imitation into sustained technological leadership. For instance, in Pakistan a highly valued project like CPEC[2] could not deliver in completing the energy projects through the modern techniques of development and is still relying on the coal-based energy projects (Khan & Khan, 2025). Similarly, Ethiopia being a fragile state and contracting instead of developing it is weak due to undemocratic institutions that are not letting the infrastructure to become technologically advanced (Bayeh, 2022). My next piece of work will be an extension of this study in which I will elaborate on the given set of countries and their lack of development due to patent protection and how it lead them into massive debt traps.

5. Conclusion

I presented an argument that patent institutions were not merely legal mechanisms for rewarding inventors, but key components of a historical process through which early industrializers consolidated technological leadership and deepened long-run North–South divergence. The British Industrial Revolution provides the starting point: as mechanization spread through textiles, transport, steam power, metals, and related sectors, patents increasingly became tools for protecting inventions, organizing commercialization, and codifying technical knowledge. Historical work on the British patent system shows that, despite imperfections, it evolved into a reasonably functional institution that could secure exclusive rights and support the market for inventions.

The sectoral evidence from patented industries reinforces this interpretation. In the table 1, transport, textiles, chemicals, steam engines, and communications stand out as highly patent-intensive sectors, while agriculture and shipbuilding appear less protected. That concentration is consistent with broader historical findings that innovation and patenting were strongest where commercial returns and technological spillovers were greatest. In these sectors, patents helped firms capture rents, reinvest in new technologies, and maintain a lead over potential rivals. Over time, this dynamic contributed to an industrial structure in which advanced economies specialized in high-patent, high-productivity activities, while many other regions remained tied to less dynamic sectors.

The North–South model of innovation and protection provides the analytical link between this historical pattern and global divergence. In such models, the North undertakes R&D and enjoys temporary monopoly power over new products, while the South either imitates, licenses, or

[2] China Pakistan Economic Corridor, in an initiative under the China's Belt and Road initiative Project (BRI) is a massive development project connecting Gwadar Port to the West of China.

remains excluded depending on the strength of intellectual property protection. Stronger protection raises innovation incentives in the North, but it also constrains cheap imitation and learning in the South, creating conflicting welfare interests across regions. Interpreted through this lens, British and later northern patent institutions helped secure a larger share of the global surplus from key technologies, reinforcing cumulative advantage in exactly those sectors that drove structural transformation.

The central implication is that patents have played a dual historical role: they supported invention and diffusion within pioneering economies, while also contributing to an international distribution of technological rents that favored early industrializers. For contemporary debates on intellectual property and development, this suggests that global standards cannot be evaluated solely by their effects on innovation in advanced economies; they must also be assessed in terms of how they shape opportunities for late industrializers to build their own technological capabilities. While this paper has focused on the historical and theoretical dimensions, its argument sets the stage for further work on how current patent regimes interact with debt, agrarian structures, and public finance in the Global South, a question that, I mentioned in the implications section and therefore looking into and working on for my next potential research work.

This paper's main contribution is to show that British patent institutions and the sectoral concentration of patents in key capital-intensive industries provided the historical foundation for the later North–South asymmetries analyzed in modern intellectual property models. Unlike existing work that treats North and South as abstract regions or examines patents only in a domestic context, the paper links concrete historical evidence from the Industrial Revolution to a North–South framework of innovation, imitation, and long-run divergence.

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