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**Why the Industrial Revolution was a civilizational
path dependent phenomenon**

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Why the Industrial Revolution was a civilizational path dependent phenomenon

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Abstract

The paper argues the Industrial Revolution was a civilizational path-dependent phenomenon. It could not have occurred out of contingent factors, such as imperialism/colonial exploitation, commercial expansion, governance, or geography. It resulted from a peculiar and long evolutionary process. Peculiar in the sense of having to break two difficult obstacles shared by all civilizations: the resistance to innovations that disrupt established social-political orders; and the cultural fatalism which reinforce social-political orders' stability. And long because of the necessary accumulation of knowledge. Long term economic growth is subversive, as it depends upon the continuous introduction of innovations, the *creative destruction*.

Keywords: Industrial Revolution; Path dependence; Creative destruction; Cultural and technological creativity.

Resumo

O trabalho procura mostrar que a Revolução Industrial foi um fenômeno que resultou de uma trajetória civilizacional. Ela não poderia ter ocorrido como resultado de fatores contingentes, tais como imperialismo/exploração colonial, expansão comercial, governança ou geografia. Foi um processo evolucionário longo e peculiar. Peculiar no sentido de ter tido que superar dois obstáculos difíceis compartilhados por todas as civilizações: a resistência a inovações que ameaçam a estabilidade da ordem socio-política estabelecida; e o fatalismo cultural que reforça a estabilidade das ordens socio-políticas. Longo também por causa da necessidade de acumulação do conhecimento. Crescimento econômico de longo prazo é subversivo, na medida em que depende da introdução contínua de inovações, a *destruição criativa*.

Palavras-chave: Revolução Industrial; Dependência de trajetória; Destruição criativa; Criatividade cultural e tecnológica.

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Introduction

The historical phenomenon known as the Industrial Revolution (IR) profoundly changed humanity's material and psychological conditions. Although this is an indisputable fact, its magnitude in terms of material prosperity for all is a less recognizable one. As put by McCloskey (2010, p. 49), modern growth in a world scale was a factor of at least sixteen since then! And even in the poorest regions "the world's growth rate recently has been far above the rates 1913-1950, a little above 1870-1913, and gigantically above anything seen before 1870... People had always produced and consumed about \$3 a day. By now they consume \$ 30 a day if they are average denizens of the world,

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and \$ 137 if Norwegians... modern economic growth has been astounding, unprecedented, unexpected, the greatest surprise in economic history”.

It is not a surprise, however, that explaining a phenomenon of such a “*geological*” magnitude had generated a vast and lasting debate. Nonetheless, the choices menu for explanations would be more limited if the central question to be answered were better specified based on this fact: such a huge, gigantic, increase in human productive capacity could have only occurred because of an explosion of innovations. During many millennia, since the Neolithic Revolution, in all civilizations the introduction of cultural, institutional, and technological innovations fades away after having defined its characteristics in a consolidated socio-political order. That is why in all of them sustained economic growth stalls because in the long run economic growth is **subversive**, as it requires a continuous flow of innovations to be sustained which, in turn, impacts the way people live and earn their lives, in a process of “creative destruction”². Therefore, those in a position of power reacted against innovations that threatened the benefits they enjoyed in the established political order. In the words of the historian Robert Lopez (1976, pos.69) regarding the case of the Roman Empire, but truthful for all civilizations:

Growth, of course, is upsetting and tends to lose its appeal once a satisfactory equilibrium has been attained. This holds in economics as well as in art, in politics, and in war. Each of the great empires which had flourished before Rome sooner or later had grown up to such a point that it found a comfortable level and sought no further. Similarly, in the last two centuries before Christ, republican Rome had matched her breathless military expansion with a measure of entrepreneurship and commercial adventure; but the political convulsions which accompanied that growth scared the landed aristocrats who originally held the power, and who eventually won the day. Augustus restored peace and dedicated the Empire to agricultural tranquility and the pursuit of the golden mean, *aurea mediocritas*. Every citizen was made to feel safe and well-adjusted to the standard of living to which his social position entitled him, but his was not encouraged to strive for more. Stability, not opportunity, was held out as the most desirable goal.

Still, it is important to note that most people perceived the existing order as the right one, a God-given order, where each one has a pre-ordered place in the social hierarchy. Such a perception was culturally conditioned and reinforced. The idea of material improvement did not exist. The higher positions in the hierarchy were always occupied by people from either warrior or priestly background, with the working class, including merchants, occupying the hierarchy’s bottom. Furthermore, besides occupying the bottom positions, the working class was object of contempt. Working had no dignity. Slavery was pervasive.

With this historical context in mind, the correctly specified question would be: why, for the first time in the history of civilizations, the introduction of innovations was not blocked or controlled, but even stimulated? It seems that, logically, the only possible general answer to this question would be: the IR occurred because of the rise of a peculiarly “mutant civilization”, having a kind of “built-in quality of instability”³, where the inventiveness of the people was stimulated and could not be blocked or controlled, thus translating into innovations⁴; in other words, the IR was, and could only

(2) As put by Acemoglu and Robinson (2012), the history of nations’ wealth and poverty is really the history of overcoming the inherent resistance from political orders to the “creative destruction” process by the systematic introduction of innovations.

(3) Expressions employed, respectively, by Braudel (1979) and Needham (1967) to characterize the restlessness of the European civilization as compared the tendency to the “homeostasis” of the others.

(4) Mokyr (1990) distinguish invention from innovation. Innovation occurs when an invention has socio-economic impacts.

be a civilizational path-dependent phenomenon. Nevertheless, the scholars favoring this type of answer were dubbed by their critics as “Eurocentric” in a derogatory meaning of imagining something unreal or even because many of them would be supremacists/racists, defending the superiority of the European culture or people.

A group of scholars, baptized by Goldstone (2009) as the “Californian school”⁵, developed the “Eurasian similarity thesis”, defending that from the beginning of modernity in the 15th century to the end of the 17th century, the level of wealth, development, and growth between the two extremes of Eurasia was similar⁶ and the supposedly unique character of Western society was the product of the “imagination” of Eurocentric historians. For Perdue (2005), it would be wrong even to point out the fact, agreed by all Eurocentrics, that geopolitical fragmentation and competition between the European States could have favored the introduction of innovations. Alternatively, as defended by Rosenthal and Wong (2011), European institutions not only were not more favorable to economic growth than the Chinese ones but even the opposite. As a result, if the IR happened to occur in Europe, it could only be caused by contingent factors such as imperialism/colonial exploitation, commercial expansion, governance, or geography.

Imperialism/colonial exploitation⁷ – looting labor and natural resources from the world – as the explanation for the IR in Europe has been one of the favorites (Frank, 1998, Pomeranz, 2000; Hobson, 2004). Marxist authors found themselves in a peculiar position. In a way they could be considered Eurocentric, as for them IR was the inevitable result of the development of the capitalist productive forces, something specific to Europe. However, to arrive at the IR the development of the capitalist productive forces depended on an exogenous element: a “primitive capital accumulation” by looting the world’s riches⁸. For others, just the commercial expansion, not exploitation, regardless if backed by force or not, was a decisive factor explaining the IR as it provided economies of scale, which were essential to, at least, start it (Deane and Cole, 1962). Hobsbawm (1977) stressed its importance to the British cotton industry, which started the IR. For Inikori (2002), more than an initial condition, the expansion of the international trade was the primary cause of the IR in England, as it stimulated technological innovation; the IR would have been the first “export-led” industrialization in history!

For Vries (2015), Europe’s success lay in the State governance role in promoting industrialization. For him, this was the big difference between Britain and China, capable of explaining the great divergence. It was so decisive a factor that the relevant divide of the controversy should be reframed: in one side those, as the institutionalists like Landes (1998), pointing the lead of the private sector and, on the other side, those like him seeing the State as the leading promoter of the IR. Finally, the geographic argument. For Morris (2010), geography was critical – location, location, location! – to the point of pushing forward Europe in a period when it was a backyard region as compared to Asia.

(5) Because a significant number of them came from California.

(6) For some, if a difference existed, it was favorable to China. See Hobson (2004), Frank (1998), Marks (2002).

(7) The fact that imperialism by other societies did not lead to industrial revolutions is not a concern. Ironically, at the very moment European powers were expanding their colonial dominions, the armies of the Ottoman Empire sieged by the second time and almost took Vienna at the heart of Europe.

(8) Primitive capital accumulation is an essential notion in Marx’s analytical scheme to explain the capitalist development since the transition feudalism/capitalism. See Dobb (1974) and Vilar (1975).

These analyses do not take into account the fact that some of these factors existed in one or another civilization, without resulting in anything like the IR. The very fact that in the case of Europe they would have led to an IR should be considered an indication of the existence of a more complex situation behind them. A phenomenon like the IR could not be the result of one or two isolated factors. Chinese civilization was the one that almost arrived at an IR, in a trajectory entirely dependent on its peculiar civilizational characteristics; however, the common trait of all civilizations, albeit in a peculiar Chinese manner, eventually prevailed and blocked a Chinese Industrial Revolution: the aversion towards innovations that could threaten the stability of a consolidated, *celestial*, socio-political order.

Regarding the Eurocentric analysis, in most of them, the analytically relevant period is shorter than the period of the evolutionary trajectory of Western Civilization. Their focus is on periods when it would have occurred key institutional (Landes, 1998, Acemoglu; Robinson, 2012, North and al., 2009)⁹ or cultural changes (Mokyr, 2010, 2016). The argument in this paper is more akin to that one of Jones (1986) in terms of the period of the analysis, but differently less concerned than in Jones' argument about Europe's natural environmental specificities and more concerned with some of its' cultural and institutional features which are absent in Jones'. It is an effort to track the path dependence of the IR since the Middle Ages, showing the unfolding of an evolutionary process of cultural, institutional, and technological change.

1. The Medieval Matrix of Western Civilization¹⁰

Western Civilization began after the fall of the Roman Empire. Of course, the Greco-Roman Civilization was Western, but not in a sense given to the expression. It is one of its constitutive elements which fused with Germanic tribal traditions under the *aegis* of Christianity, giving rise to the European feudal order. A culturally unified but geopolitically fragmented order. Christianity and its organized church granted cultural unity. A culture unity that was characterized by a worldview open to the ideas of progress, of improvement of living conditions through the manipulation of nature by dignified labor, and to the power of reason; furthermore, a common socio-cultural trait, the prevalence of individualism over familism. The fragmented political order, in turn, was composed of two types of competing polities: the feudal states and the city-states. Additionally, within these polities, the power was fragmented between different corporate organizations independent from the State: aristocratic groups, Guilds – craft and commercial corporations, an organized Church, Universities, and Monasteries. Historically a very peculiar civilizational space that had so many State independent players.

1.1. The Cultural Unity

The prevalence of **individualism** was something new in the history of civilizations. In all of them, institutions based on territory and centralized legal authority had to be superimposed on societies where the familism of tribal origins remained as the primary organizational force of society's members (see Fukuyama, 2011). In the European case, the networks of family relations as the basis of the political relations disappeared with the emergence of Feudalism, because of two forces acting

(9) Authors like Karayalçin (2008) offered narrower Eurocentric perspectives. For him, political competition for a mobile tax base forced rulers to provide relatively more secure property rights and thus encouraging faster capital accumulation.

(10) Based on Romeiro (2020).

simultaneously. The first was the sociocultural influence of the Church, which had been spreading a new pattern of marriage in Western Europe since the end of the Roman Empire. In the new pattern of marriage it promoted, inheritance became bilateral (by man and woman), intermarriage banned, and exogamy stimulated. The Church also banned other familial strategies to maintain the property within the family group, such as widows' marriage within the family, the divorce of women by men, concubinage, and adoption of children in the absence of a male heir. Women came to have greater property rights and participation in public life¹¹. By the end of the 4th century, thanks to its influence, Roman civil law had been modified; the father's right to life and death of his children was abolished. This change was particularly beneficial to daughters who tended to be sacrificed if there was already a female firstborn.

It is worth notice that the empowerment of women in the new type of marriage promoted by the Church was not in disagreement with the status of women in the Germanic tribes that invaded the Roman Empire, judging by the evidence available from specific peculiar characteristics of these tribal societies. Among these characteristics, Jones (1987, pp.14-15) points out the persistent tendency to keep population growth below what would be its maximum to maintain land available for pasture and forests, resulting in different consumption patterns (especially meat) from those prevailing in Asia. Individuals in these tribal societies were willing to exchange children for goods at the margin to maintain a given standard of consumption, which empowered women. Based on Hajnal (1965), Jones notes the prevalence of later marriages and a high percentage of unmarried individuals as a distinctive European element – women had the right of not marry. Individuals were encouraged to accumulate goods before marriage and constituted nuclear families relatively independent from larger kin circles. Moreover, this behavioral pattern could go back to the 2nd millennium BC.

Therefore, European society was individualistic from an early age in the sense that it was the individuals rather than their extended families (clans) who made important decisions about marriage, property, and other personal matters. As a result, State institutions had to be superimposed on societies in which individuals already enjoyed considerable freedom from familistic obligations. For this reason, Fukuyama (2011, p.231) considers it appropriate to claim that “the social development in Europe preceded the political development”.

The second force destroying familistic relationships as the basis of social organization was the European peculiar feudal **vassalage system**. For Bloch (1949), Feudalism was formed “in the fervent crucible” of invasions and immense disorders, being a desperate self-defense response thereof, that demanded new forms of articulation between isolated groups that were not related by familistic ties. In other words, Feudalism emerged as a non-familistic alternative of social organization. Familistic structures no longer provided adequate protection, to the extent that they were already actively undermined by the exogamous marriage rules defined by the Church. Therefore, the essence of Feudalism was the voluntary submission of one individual to another, not based on kin relationships, but on exchanging of protection for loyalty.

(11) Goody (1983) argues that the motivation behind the actions of the Catholic Church in this regard would be less theological than institutional, as it was the primary beneficiary of the inheritance left by women who died without children. Thus, for this author, the higher social status of women in Western Europe was a ‘side effect’ of the Church’s actions in pursuing its interests. However, the theological motivation was fundamental, as the individual was at the center of the Christian theological reasoning founded on free will. The bounded and unfree woman of the Greek and Roman marriage contradicted this theological base.

Thus, as noted by Fukuyama (2011), during the medieval period, before the formation of the centralized National States and centuries before the Reformation, the Enlightenment, and the Industrial Revolution, Western European societies had already become much more individualistic than any other society that ever existed. So, not only individualism was not caused by modernity but, on the contrary, was an essential element explaining its emergence. As a result, the emerging capitalist economy had not to face the resistance of large, corporately organized familistic groups with substantial property to protect, as it happened in China or India. It instead, it advanced in societies where property routinely changed hands between strangers (non-relatives).

As for the worldview, although originating in the Middle East, the Judeo-Christian worldview blossomed in Latin Europe in all its potential as an important cultural factor explaining the unprecedented innovation dynamics observed since the beginnings of what eventually became the Western Civilization. In this worldview, the human being is seen as the center of divine creation and has nature at its service. For White (1962, 1967), this fact led to a desacralization of nature¹², with God and the Saints substituting for nature as the divine/spiritual locus, thus providing much greater freedom to its manipulation, which is the very essence of innovative technical progress, as noted by Mokyr (1990). Another characteristic of this worldview was a linear concept of time, usually progressive towards a better world. This concept is in sharp contrast to the cyclical conceptions prevalent in other civilizations, including the Greco-Roman, where the idea of progress was lacking. A third characteristic was that the respect for labor found in the Old and New Testaments, which in medieval Latin Christianity, at first in the monasteries, translated into a much-respected social value, in sharp contrast to the historically prevailing view of labor as something degrading.

For Le Goff (1990) the social attitudes developed during this period of the Western civilizational process were decisive for its future. Regarding labor, starting from a tradition of contempt of it (including to the work of engineers) inherited from the Greco-Roman world and from a pessimistic idea of working as a curse, punishment, and penance, it evolved by multiple paths to an attitude of appreciation with a proper concept and vocabulary for labor and laborers. The monasteries played a crucial role in this evolving process, which translated into a socio-ideological conflict regarding labor stemming from The Rule of Saint Benedict, “*ora et labora.*”

The conflict between the two great monastic orders of the period, Cluny and Cîteaux, had as one of its motivations precisely the relative weight that should be attributed to each of these Benedictine injunctions. In the end, Cîteaux’s idea of labor prevailed, as something that dignifies the human person, worthy of heavenly blessings as represented by the patron saints of the craft and commercial corporations. As will be seen later, these corporations were decisive organizational innovations for medieval commercial and pre-industrial revolutions. Working could be a penance, yes, but a blessed penance. Oxele (1990) also points out that the consolidation of the mental schema associating three ranking orders with three social functions in the 11th century, which placed the social function of labor alongside the social functions of prayer and military protection (*oratores, bellatores et laboratores*), revealed a remarkable appreciation of work. The “*laboratores*” began to appear far more actively in historical settings through social organizations of peasants, artisans, and merchants,

(12) In a famous article published in the Science Magazine, White (1967) pointed out the desacralization of nature as the root of our current ecological crisis. Reacting, however, to radical ecologists who have hailed his statement as an indictment of the Judeo-Christian anthropocentric approach to nature, he clarified his position by saying that this anthropocentric view of the world was not incompatible to a stewardship responsibility towards nature and proposed Saint Francis as the patron saint of environmentalism.

which grouped themselves into sworn associations in public oaths for mutual assistance and protection.

Finally, a fourth characteristic, an openness to reason, something that had an old Christian theological origin. It evolved through centuries of efforts to conciliate faith and reason. In the 4th century, it reached a peak with St. Augustin. John Scotus in the 9th century argued that reason should be put above the ecclesiastic authority, and even above the sacred scriptures when certain of their passages conflicted with the discoveries of natural philosophy; in these cases the sacred scriptures should be interpreted metaphorically. By the 12th century the adoption of reason had reached a threshold, leading to a conceptual revolution through the Christian rationalism: – God created the universe according to an immutable set of Natural Laws; – God gave men Reason in Its image, thus was up to men to competently use it; – God’s Natural Laws are based on Logic, so Reason can be used to thoroughly understand them; – using Reason to understand God’s Natural Laws, men can perceive the Truth; – reaching the Truth through Reason, men can have a glimpse of the God’s Mind. As a result of this understanding, it laid opened the gates to the strengthening of the conviction that all natural phenomena and regularities could be explained by a coherent and understandable set of natural laws, a necessary condition for scientific progress and its technological applications (see Grant, 1996 and Lindberg, 1992).

In the 13th century at the University of Paris, the Christian theology reached a summit with Saint Thomas Aquinas: theology should be considered a science based on reason. He also defended that through the empirical knowledge of God’s eternal Law as it manifests itself in the world, men could have a glimpse of God Himself. Reason and empirical knowledge: theology became a highly rational discipline, having an inherent inclination to seek knowledge as the efforts to comprehend God were extended to include Its creation, under the name of natural philosophy. So, as a rule, almost all theologians also became natural philosophes. The importance attributed to Reason and Logic naturally led to Mathematics. By the end of the 10th century, the mathematician Gerbert of Aurillac became Pope under the name of Silvester II, and the logic became a central part of the curriculum of the Cathedral Schools, forerunners of the universities. In Oxford, founded in 1214, the Franciscan monk Roger Bacon (1219-1292), regarded by many as the first scientist, saw mathematics as the language of nature and believed optics could offer a path to comprehend God’s mind! Kepler (1571-1630) and Galilee (1564-1642) thought a geometer God mathematically created the universe. Galilee considered that the difference between his mind and God’s mind lay only in the speed of the cognitive process: God knows everything instantly while he must painfully know the world through mathematical logic. In short, as Lent (2017) put, theology sprang from the Christian vision of the world and incubated the scientific cognition during centuries.

1.2. The Fragmented Political Order

Another decisive element explaining the European exceptionalism was the fragmentation of power along geopolitical lines into competing feudal states and city-states having peculiar features themselves.

The Feudal States

The feudal States consolidated at the end of the 10th century after a long struggle against waves of invasions. Their leaders were kings who were also feudal lords, being only “*primus inter pares*.” They were the suzerains of several manors, having vassals who, as a rule, had vassalage

relationships with other lords simultaneously. Eventually, the vassals acquired full control of the land, which was passed on directly to the heirs. Therefore, the power of the feudal aristocracy limited the royal power and differentiated itself into high and small (gentry) nobility, acting through **representative assemblies**.

On the other hand, the legitimacy of the feudal monarchy, another peculiarity, heavily depended on feudal kings' capacity to provide justice. They spent most of their time traveling through their realms, as this was the only way to assert their authority and maintain communication in a fragmented world of isolated villages and fiefdoms. One of the king's primary services was to serve as a court of appeals to individuals who were dissatisfied with the rulings of the local courts. Of course, it was in the kings' interests to expand the jurisdiction of their courts. It increased their authority and prestige, besides being paid services. Itinerant royal courts had the advantage of being more impartial due to having fewer bonds with litigants than the local lords. They also presented procedural advantages, such as the ability to compel citizens to serve as jurors and, over time, they began to enjoy economies of scale and scope. The administration of justice requires specialized work performed by better-trained personnel (see Fukuyama, 2011).

It is important to note that it was not a simple matter of administering justice, something that was the responsibility of the rulers of any civilization but administering it under the "Rule of Law." The Law consists of a body of abstract rules responsible for the cohesion of a given community. In premodern societies, the Law was supposed to originate from an authority superior to any human legislator, whether it was divine authority, an immemorial custom, or nature. The Legislation, in turn, corresponds to what is now called a positive law, being the responsibility of the political power, i.e., the responsibility of the king, warlord, president or legislature to elaborate and enforce new rules based on a combination of power and authority. The "Rule of Law" only exists when a preexisting body of laws (based on a religious text or a constitution as in the Modern States) is sovereign regarding the legislation, thus limiting the rulers' power. Law and Legislation currently correspond to the distinction between constitutional laws and ordinary laws. Therefore, the prevalence of the Rule of Law implies a limitation to the power of the State.

However, the conditions for the proper functioning of the Rule of Law go beyond institutional or procedural aspects. The Law must be perceived as fair, and no exceptions in its application can exist. The kings and the seigneurial barons could not be above the law, which, ultimately had value derived from a religious sanction. Therefore, in its more profound sense, the Rule of Law means that there is a society's consensus that its laws are fair, and that they must preexist and regulate the behavior of whoever is the ruler. The Law is sovereign and not the ruler. The legitimacy of the ruler depends on the Law. In the past, the primary source of fair laws outside the political order sphere was religion. In this sense an autonomous religious authority was important for these laws to be respected by the rulers, as was the case with the Catholic Church.

The Cities-State

Medieval cities came to have an independent and innovative form of governance, the **Commune**. It was a temporary voluntary sworn association, led by consuls elected for a limited period by a parliament composed of all citizens with "full rights". Such organizations were self-governing communities that occupied a gray area between the State and the communities. A Commune was like a community insofar it characterized by intra-community personal familiarity, but also a State as it had a geographically localized monopoly of the legal use of coercive power.

Alternating alliances with monarchies and feudal aristocracies, arming themselves, and being able to defeat even the Emperor¹³, the cities played a decisive role in the medieval political order, which was unique in the history of civilizations. Over time, the accumulation of military capacity allowed them to force local lords to become members of the Communes as the only alternative to total ruin.

They came to form an internal frontier to the landed feudal estates that increased a lot the mobility of labor. Such mobility exerted a permanent evolutionary pressure on the relations between landlords and serfs, being one of the reasons for the eventual feudal order demise. From an economic point of view the cities caused a decisive impact by engaging in international trade very early and creating an ample market space that united Northern Europe (including the Baltic Sea area) to Southern Europe (including the Mediterranean Sea area) and Europe to Asia/North Africa, what decisively contributed to expanding the role of the market in the medieval economic transactions. By the 12th century, the “Italian communes were essentially governments of the merchants, by the merchants, for merchants” (Lopez, 1976, pos.922).

Another medieval city innovation was the **community responsibility system**. It involved the association between municipalities and trade Guilds. This system managed to coordinate the collective action of a group of interests, the merchants, preventing the group’s internal conflicts and, at the same time, allowing the establishment of long-distance commercial activities between economic agents unrelated by kinship and with property rights secured *vis-à-vis* potentially predatory states. In the community responsibility system, the Commune court held all members of another Commune accountable for the damage caused to one of its members. If the deceiver’s Commune refused to compensate the deceived agent, the Commune court of the deceived individual would order the confiscation of the property of all the members of the deceiver’s Commune to compensate the deceived agent. The only way for the deceiver’s Commune to avoid compensation would be to have no business whatsoever with the Commune of the deceived agent. However, this could be very costly. Therefore, the court of a Commune’s most sensible behavior was to dispense impartial justice by punishing its fraudulent member. This system transformed Communes into perpetual life organizations, which internalized the cost of a fraud performed by any of its members against members of another community (see Greif, 2006).

Therefore, the binomial Guild-Commune solved the problem of impersonal exchanges in premodern Europe, which are characterized by the separation of *quid* and *quo* through jurisdictional boundaries, through a self-enforcing institution. A private order based on institutions capable of enforcing the rules they created was the hallmark of the medieval trade expansion. An order that resulted from the coordinated efforts of many individuals unrelated by kinship bonds. The social structures created through these efforts were self-governed and based on the mutual interests of their participants. They were self-governed as their members participated in creating of the rules to govern their activities, which legitimated them. In this sense, Greif (2006) considers that the traditional understanding that the emergence of centralized states was a precondition for the expansion of markets should be reviewed in the light of the community responsibility system’s history.

(13) In 1176, the Lombard League defeated in Legnano the supreme lord of Italy, the Emperor Frederick Barbarossa, thereby conquering complete independence; after the defeat, their vassalage bond with the Emperor became just nominal. Shortly after, the cities of Tuscany reached the same status without having to fight.

1.3. The Fragmentation of Power Within the Polities

Another unique European feature was the fragmentation of power within the polities between different independent organizations. They played different roles, all of them contributing to cultural, institutional, and technological innovations that will have a lasting influence in the trajectory leading to the Industrial Revolution.

The Rule of Law and the Role of an Independent Religious Organization

As an independent religious institution, the Catholic Church was able to define a field of spiritual power prerogatives separated from temporal power, as well as to play a decisive role in defining and legitimizing a superior law under which everyone, including the monarch, was subjected. It was a singular religious corporation, of a type unknown in other civilizations, capable of exerting a decisive civilizer role¹⁴. In China, as pointed out by Fukuyama (2011), religion did not reflect a sociocultural consensus but usually served as a social protest source. The Chinese State has never recognized any religious source of authority as superior to its own and has always easily controlled every religious class that ever existed. Therefore, there has never been a Rule of Law based on religious authority in China. In its legalistic tradition, all the laws were considered positive laws, i.e., the Law was whatever the Emperor decreed.

In India, the situation was completely different. Brahmanism, which developed concurrently to the formation of the Indian states, subordinated the political/warrior class to the priestly class. The Law had strong roots in religion, and there was no separate secular law-making field. However, the priestly class (Brahmin) was not organized within a Church in a hierarchical way as in the West. This class acted in a fragmented way, divided into different subclasses defined by the functions performed (those conducting the rites of the investiture of kings, those conducting funerals, and the likes). They never subordinated themselves to the State, nor became officials, but were incapable of collective action through an institutional hierarchy. In the domain of Islamic Civilization, there was a Rule of Law based on religious authority, but not a religious institution independent of the State. There was a higher law of divine origin clearly expressed in the Qur'an, which gave origin to a codified body of laws – the Shariah. The legitimacy of the temporal power was conditional to the application of Islamic Law. As a result, religious and secular powers fused into theocratic political orders.

In Western Europe, the Rule of Law was institutionalized into a much greater degree, largely due to the influence of the Catholic Church. After the fall of the Roman Empire and the subsequent weakening of political power, the Church was able to assert its independence. However, such independence started to erode as feudal political orders began consolidating; the appointment of bishops and even popes became a common prerogative of local and regional political powers, as well as of the Emperor himself. However, the Church was able to, once again, incisively assert its independence from secular powers by the end of the 11th century.

For Fukuyama (2011), this ability undoubtedly depended on the energy, tenacity, and determination of a man like Hildebrand, a monk who became Pope in 1073 under the name of Gregory VII. He was determined to end the corruption and rent-seeking that this system of appointments promoted, reinforced by the fact that priests could marry and bequeath to their children properties that should belong to the Church. Compulsory celibacy solved this last problem. To solve the first

(14) In a sense is not so much an exaggeration of Thomas Wood (2005) in considering that the Western Civilization was built by the Catholic Church.

one, he directly attacked the right of secular powers to appoint bishops and priests, making it an exclusive prerogative to the Church itself. Moreover, he advocated the Popes' legal supremacy over all Christians, including the Emperor (who could be deposed). Emperor Henry IV's reaction was to attempt deposing the Pope, who retaliated by excommunicating him. The ex-communication made the Emperor undergo a barefoot walk during the winter of 1077, in a historical episode, to humbly ask Gregory VII for his forgiveness who was waiting for him in the fortress of Canossa (north of Italy).

The investiture contest – as this dispute became historically known, in addition to contributing to consolidating the Church as an institution with autonomous political power, as well as an organization of high complexity and capacity for adaptation, had as a consequence a clear-cut separation between the realms of temporal and spiritual powers, so laying the foundations for the emergence and consolidation of the secular State. Finally, this conflict was essential for the development of both the Law and the Rule of Law in Europe. For the development of the Law to the extent that it stimulated the Church's efforts to gain legitimacy through the formulation of a regular legal canon, the Canon Law; for the development of the Rule of Law, as the Church was able to create a separate and well-institutionalized domain of spiritual authority with universal jurisdiction.

In the search for sources of law that would serve to strengthen the position of the Church in claiming universal jurisdiction in some issues, Gregory VII's successors rediscovered the *Codex Justinianus* (Justinian's Code) at the end of the 11th century. From this moment on, this Code became and remained until today, the basis of civil laws practiced throughout continental Europe and in countries that were colonized or influenced by it. Thus, starting from the Gregorian reform, the Church gradually acquired a State structure, having its legislation – the Canon Law – and a professional bureaucracy like that one the Chinese developed centuries before. The Gregorian reform offered a bureaucratic and legal model for the new centralized States that were starting to emerge in Europe and stimulated the emergence of several new legal forms related to different domains – the fiefdom, the city, long-distance trade –, which motivated the competition between jurisdictions. The rise of the independent cities was particularly crucial for the development of commercial law due to their dependence on foreign trade. However, the strength of this revival of Roman law will mostly depend on the establishment of Law studies programs on new institutional bases with the “invention” of the University.

The Universities

Universities were autonomous centers of thought and acted corporately; on the one hand, they had an unparalleled evolutionary impact in the political and philosophical debate; on the other hand, they had an impact on the legal order by training an entire category of legal experts who were at the origin of an independent and professional judiciary, a necessary condition to consolidate the “Rule of Law”. Their origins were in the schools of the Cathedrals, beginning in Bologna in 1088. The fundamental difference between the University and other types of higher education institutions in Europe and in other societies lied in their freedom and autonomy. All levels of power granted such freedom and autonomy. In 1158, Emperor Frederick I (also known as Barbarossa) promulgated an “*Authentica Habita*” (a university's organic law) that transformed the University of Bologna into a “city-state.” The municipalities competed for having the privilege to host a University. The papacy

defended the universities' autonomy over the established powers and respected their research agendas, even when they contradicted the Church's doctrines or guidelines¹⁵.

The new Law curriculum at the University of Bologna attracted students from all over Europe. Soon, the other universities began to compete strongly in this field, notably the University of Paris. Thus, the sophisticated legal system of Justinian's Code became the model for the legal systems in several regions. After an initial period of reconstruction and reproduction of Roman law, generations of "scholars" went further searching for the intellectual foundations of Law, reaching the Greek philosophers. Classical philosophers e Aristotle thought that the legal tradition received had to be submitted to human reason and confronted with more universal standards of truth. In this sense, the rediscovery of the classical philosophical tradition in European universities, especially by the work of Saint Thomas Aquinas at the University of Paris, encouraged successive generations of legal commentators to go further than the mechanical reproduction of an existing body of laws, rationally reflecting on the sources of law and how they could apply it in new situations. A separate class of legal experts emerged from universities; they acted similarly to the members of a Guild in perfecting their "art." Over time, both religious and lay authorities understood that they had to rely on legal experts' knowledge when making decisions, especially in the commercial sphere where contracts and property rights were critical.

The Monastic Orders

Linked to the Church, but having considerable autonomy, the monastic orders, although capable of acting directly in the political game of power, had their most notable role as centers of innovations, agricultural and industrial, acting much like "proto-capitalist" enterprises. They had a pioneering role in the systematic search for innovations of all kinds, especially the monastic order of Citeaux. As seen, this order won the "socio-ideological" battle in favor of the idea of work as dignifying to man. New monastic orders became "farming models." They also transformed many of their monasteries into models for solving non-agricultural technical problems – such as reinforcing and maintaining the dikes in the Netherlands or drilling wells – and for building bridges and various industrial activities¹⁶. The monasteries evolved to become proto-capitalist enterprises, where the work was valued, but not heavy and repetitive ones. Creative work was the most valued, including that of the engineers who invented ways to make it less painful¹⁷.

(15) Discussing the fact that universities openly flouted the Church's restrictions on the dissection of corpses, Schachner (1938, p. 3), apud Stark (2017, pos.2503) noted that:

"The university was the darling, the spoiled child of the Papacy and the Empire, of king and municipality alike. Privileges were showered on the proud Universities in a continuous golden stream; privileges that had no counterpart, then, before, or since. Not even the sacred hierarchies of the Church had quite the exemptions of the poorest begging scholar who could claim protection of a University. Municipalities competed violently for the honor of housing one within their walls; kings wrote siren letters to entice discontented groups of scholars from the domains of their rivals; Popes intervened with menacing language to compel royalty to respect the inviolability of this beloved institution."

(16) A monastery of the Chartreuse monastic order, for example, is credited with the invention of 'artesian' wells (artesian comes from the name of the monastery region, Artois). Another monastic order, the Bridge's Brothers order, was explicitly created to build bridges; their bridges were covered and contained houses and installations like mills. See Gies (1994, p.112 and p.148/149).

(17) In the Classic Antiquity the intellectual's contempt towards labor included non-manual labor. In his *Gorgias*, Plato had already signaled the philosophers' contempt towards the work of the engineers: *«il n'est pas du tout moins vrai que toi, tu es pour lui plein de mépris, ainsi que pour l'art qui est le sien ; que ce serait en manière d'opprobre que tu le traiterais de mécanicien, et que tu ne consentirais ni à donner à son fils la main de ta fille, ni à prendre pour toi la sienne»*. Platon, *Gorgias*, 512c, apud Gimpel, (1975, p. 8).

A document from the 13th century gives a remarkably clear idea on the enthusiasm in the employment of hydraulic energy in the mechanization of the activities in the Cistercian monastery of Clairvaux:

A branch of the river, crossing the numerous workshops of the Abbey, makes itself felt everywhere by the services it provides [...] the river is first launched with impetuosity on the mill, where it becomes very agitated and writhes, both to grind the grain under the weight of grinding stones, as well as to stir the sieve separating the flour from the straw. Then, it goes to the next compartment; it fills the boiler and surrenders itself to the fire that cooks it to prepare monks' beer if the harvest of grapes was not good. The river does not give up. The cloth pressing mills call it in turn. The river that was busy preparing the monks' food, now thinks about their vestments. It does not refuse anything that it is asked for. It raises or lowers these heavy pestles and hammers, or rather, these wooden feet, thus sparing the monks from great fatigues [...] how many horses would be exhausted, how many men would fatigue their arms in this work made for us by this graceful river, to which we owe our garments and our food. When it spins so many fast wheels, it comes out foaming as it were ground. When it leaves, it enters the tannery, where it prepares the leather necessary for the monks' shoes; it shows both activity and care, for it divides himself into numerous small arms to visit different services, diligently searching everywhere for those in need of its services, whether it was to cook, tan, break, wet, wash or grind, never refusing to offer its services. Finally, to complete its work, it takes the filth away, leaving everything clean"¹⁸.

The Guilds

Finally, there were the Guilds – craftsmen and merchant corporations. These professionals' associations also performed a significant role in the political game, especially in the governance of the cities in alliance with the Communes. As seen above, the binomial Guilds-Communes played a decisive role in the European commercial expansion. They represented an important institutional innovation, giving dignity to the labor activities and perfecting the craftsmanship. Their origin lied in the mutual aid confraternities with their respective patron saints, which characterized the evolving social life in the cities. The work in Craft Corporations was hierarchically structured, from the apprentices to the master, but mobility existed through talent and dedication. The corporation established the product quality levels and the fair price to ensure the adequate remuneration of the entire hierarchy of artisans. Under this form of organization, the craftsmanship techniques – and the quality of the products, reached extremely high levels, as can be witnessed in the Dijon's Musée de l'Outil, with its vast collection of specialized tools of all kinds for the most perfected finishes.

However, they were among the first medieval institutions to suffer the impacts of the innovation dynamics in the wake of the market economy expansion. The superior productivity made possible by the division of the artisanal work into specialized operations of the working process began to impose itself in more dynamic sectors like the textile: the production of one piece of cloth went through 26 different operations, each performed by a skilled worker (Gimpel, 1975). As noted by (Lopez, 1976), in the textile sector, the production process was initially divided into specialized operations run by different Guilds but eventually integrated into a single management unit. Each operation could be accelerated by relatively simple innovations – the pedal weaver replacing manual weavers and spinning wheels replacing hand spindles. As could be expected, the Guilds reacted against this trend which would destroy their very legitimizing essence: a protective institution of the professions and their workers.

(18) Descriptio Monasterii Claraevallensis, Migne, Patr. Lat., t.185, 570 A-571 B. Apud Gimpel, (1975, p.11, 12).

1.4. “Destructive Creation” undermined Feudalism

The actions of these different medieval players coalesced to create an exceptionally transformative space. Agricultural, industrial, and commercial activities went through a period of innovative expansion backed by a huge increase in energy production, a water and windmills revolution (see Bloch, 1963). They were old human inventions that were perfected and massively diffused in a historically unprecedented scale. Every suitable site was used to produce eolian and hydraulic energy. Already by the end of the 11th, thanks to the *Domesday Book*, there is an inventory of the water mills in England¹⁹; in the Wiltshire county, for instance, crossed by the Wylye river, there was 16 mills in 30 kilometers! As noted by Gimpel (1975, p. 17), “this madness to build had financial reasons. After an important investment, the mills were very profitable and could be rented for high prices”.

By the middle of the 13th century, less than three centuries after its consolidation, the feudal order was already in a clear process of transformative disintegration. Transformative in a sense it was giving birth to a new system, to a new “mode of production”. As seen, in the cities, one of the most conspicuous medieval institutions, the Guilds, were being shattered by the introduction of destructive innovations in the working process. Their reaction against it, however, was deemed to fail in the long run as the merchant innovators went outside their jurisdiction in the countryside, in a movement that became historically known as the “**putting-out system**”. This movement was only possible in a fragmented polity. A movement bent to destroy one of the key institutional components of the polity itself. The economic stimulus behind this movement was the expansion of a unified pan European market made possible by the merchants of the cities-state. The craft and manufacturing production went through a vigorous growth, to the point of being considered by some authors as a “pre-industrial revolution” or even a first industrial revolution in the Middle Ages (see Gimpel, 1975). According to Lopez (1976), the wool-based textile industry led that revolution. The reason for that was twofold, technical, and commercial. The technical reason regards the enhanced division of the labor process possible in this type of industry.

The commercial reason, in turn, had to do with the pan European character of the market, which allowed the entrepreneurs to take advantage and promote regional specializations; and, secondly, because of the characteristics of both raw materials and finished products regarding the transportation costs, which allowed for a concentration of production in the most desirable places in terms of the availability of labor and entrepreneurial capacity, as was the case of the Netherlands in particular. The silk industry in Italy was not far behind the wool industry in the Netherlands. Furthermore, the production of linen fabrics had equal importance, especially for lingerie, with Switzerland and German Rhine valley becoming the main producing centers. Fustian (piquet), a new and cheaper textile product, was developed from a mixture of cotton and wool. Around 1200, a piece of piquet cost a twentieth of a piece of good quality wool. In short, for Lopez, the Medieval textile output based on the putting-out system came close to the English textile industry on the eve of the IR. As noted by Jones (1987, p. XIV), what happened to distinguish the expansion of the markets in Medieval Europe was the “swollen emergency of bulk trade over quite long distances, multilaterally, in everyday commodities, and not simply in the luxuries that had always dominated long-distance trade”.

(19) In fact, it is not necessary any more to rely on historical sources to know about the diffusion of mills. Radar-satellites have showed all the old mills sites all over Europe.

The dynamic of innovations in the agricultural sector, coupled with the expansion of the markets, in turn, would undermine the core of the feudal political order, the **serfdom**. As mentioned, the cities formed a kind of internal frontier to the surrounding feudal manors, which running away serfs could cross. This very fact created a permanent evolutionary pressure to feudal order. As Kula (1977) put, the “coefficient of practicable oppression” reduced for the benefit of the serfs²⁰. In a static society, the feudal lords could perhaps have managed to control the damage caused by the losses of workers; however, this was not the case at all, on the contrary. The cities themselves were growing, literally, in attractiveness, but the agricultural activities were also going through a process of technological transformation which, in the more advanced regions, clearly responded to the cities’ demands.

After the 11th century, with the end of invasions, it followed a period of populational and agricultural expansion. The agricultural expansion was based on important innovations which increased the total productivity of production factors, land and labor. The 8th/9th centuries’ inventions of the heavy plow and the harnessing of horses for heavy fieldwork (horse collar) began to be more largely diffused, leading to the substitution of a new triennial rotation system for the old biennial one. In the old biennial rotations system, the land plot was divided into two parts: while one half – in *fallow* – was cultivated the other one was plowed to control weeds²¹. In the new triennial rotations system, the land plot was divided into three parts: one was cultivated with a winter culture like wheat, the ‘noble’ cereal, the other with a lesser important cereal in the spring, and the last one was plowed to control weeds. So, its adoption immediately increases by a third the productivity of labor. The adoption of horses also induced innovations to improve soil fertility such as the invention and the use of composted manure²², substantially increasing soil productivity. The combined effect of soil improvement and a larger cultivated area eventually led to the doubling of labor productivity in the agricultural fields, thus liberating labor to other activities, such as manufacturing in the putting-out system or increasing the labor surplus.

It is important to note that if it was not possible to adopt the triennial rotation system without horses as heavy-duty animals, the reverse was also true, i.e., the significant expansion of the equine herd was only possible because of it. The reason for that lies in the fact that horses are not ruminants; their food must be supplemented with cereals. The spring crop in the triennial system, especially oats, will be used almost exclusively to feed horses. Moreover, the expansion of the equine herd played a decisive role in Europe’s development as these animals were much more efficient not only in the agricultural field work, but also in transportation (and war). In short, from the invention of the plow, a whole chain of innovations and improvements can be traced, which developed the infrastructure and the transport capacity of the collectivity, increasing its potential for capital accumulation and giving rise to what Mazoyer (1977) called a “*culture attellée*” (harnessed culture). As Braudel (1979, T1) notes, the generalized use of horses for human and cargo transportation was one of the outstanding features of the European civilization, in stark contrast to the superhuman effort required

(20) The serfdom institution had evolved as a response to the scarcity of labor in a largely depopulated Europe. The rights to the land and protection, the serfs enjoyed came with a bondage tag: they had no right to leave the manor.

(21) As shown by Sigaut (1977), the French word for fallow, *jachere*, means plow the soil. Fallowing was a technical procedure to prepare the soil, for controlling weeds. See also Sigaut (1975) for a comprehensive analysis of the evolution of agricultural systems in Medieval Europe.

(22) According to Mazoyer (1977, p. 31), “without the transport of many tones of forage, hay, and manure per animal unit per year it would not have been possible to feed the livestock stabled in the winter, and so increase animal production and spread composted manure in the fields”.

by the transport on the backs of men used massively in other great civilizations like the Chinese and the Hindu. Therefore, the increase of the equine herd represents a better form of, literally, accumulation of capital²³ that is qualitatively distinct from the accumulation based on other types of herd.

The innovation dynamics and capital accumulation in the agricultural sector could not, of course, fail to impact any heavily agrarian society and a *fortiori* in the Medieval European context. It will undermine serfdom because the serfs will be able to capture a growing part of the agricultural surplus, which translated into a process of social differentiation amid the peasantry giving birth to the agrarian capitalism. A first step was done when the markets' expansion brought about by the cities induced the feudal lords, lured by the growing varied of products offered in the markets, to change the way the "*corvée*", i.e., the serfs' obligations, was paid: from days of working in the lords' plots towards, initially, the payments in products, and then in cash. The substituting of payments in products for payments in work represented a guaranteed surplus to the landlords against crop fluctuations. Nevertheless, in the long run, it favored the peasants as productivity increased in a period of better climate²⁴ for agriculture, while the amount of production to be paid could not be altered once fixed.

The next step, swapping from payments in products to payments in cash, was still more favorable to the peasants. As noted by Takahashi (1972), once settled the amount of money it could not be changed either; so, the peasants besides benefiting from the increasing productivity will benefit from money devaluation; secular inflation of course, not perceivable in the short term – which by the way had the advantage of not drawing the attention of the landlords -, but significant in the end. Hence, inflation will compose with growing productivity in inducing the process of social differentiation amid the peasantry with the rise of agrarian capitalism and the expansion of the free peasantry. Capitalist farmers came to dominate the space in more dynamic regions, as the North of Italy and the Low Countries. There the agricultural frontier had long gone, and the farmers could not anymore count on forests and natural grasslands to feed the cattle and improve soil fertility. A new crop rotation system associated with intensive husbandry was developed in response to that situation. However, this new system required a sizable investment, viable only in these regions where the urban markets for husbandry products were expanding. Thus, everything was set to an institutional innovation called capitalist working arrangements and management²⁵. As Jones (1986, p. XIV) put it, "what Europe achieved in addition to bulk commodity markets was the formation of quite efficient production factors markets able to transact in land and labour. This required a more profound dissolution of cultural and political rigidities, and thus deeper and more dangerous shifts in society, than the mere acceptance of extensive trading in goods".

The Medieval economic and populational expansion came to a halt with the great ecological-economic crisis of the 14th century. It was ecological-economic because the expansion hit a natural ceiling given by the end of the available arable land, in a context of unfavorable climate change²⁶.

(23) The origin of the word capital is '*cheptel*', which means 'cattle' in French.

(24) By the end of the 9th century, the climate the glacial retraction improved the climate.

(25) In general, for Marxist authors, Takahashi (1972) is one of the exceptions, the dogma of "primitive/original accumulation of capital" blinds them for capital accumulation processes other than capital accumulation through "violence, crisis, disequilibria, expropriations, and usury which marked the end of the feudal regime" Vilar, (1975, p. 39).

(26) As showed by Duby (1973), around mid-13th century the glacial movement suddenly reverted opening a cold and rainy period very unfavorable to agriculture.

Consequently, the once exceptionally good food production conditions prevailing between the 11th and 13th centuries gave place to a chronic situation of malnourishment of the population, which rendered the population more vulnerable to infectious diseases. The population growth in urban agglomerations aggravated the situation. On the other hand, it seems the bubonic bacillus went through a mutation process resulting in much more deadly bacillus strains. As seen, agricultural technology which could have saved the population from chronic famine had already been introduced in the more dynamic regions – Northern Italy and Low Countries. However, its more demanding conditions in terms of investments and markets prevented its diffusion all over Europe.

The great crisis of the mid-14th century, which lasting effects till the mid-15th century, ended the Medieval phase in the European evolutionary process, but not its legacy. After the restarting of growth in the 15th century, the rise of centralized territorial states will be substituted for feudal states competition. However, the merchant dominated cities-state will continue to lead the competition dynamics until a territorial state, England, assumed the leadership in the 18th century. On the other hand, the innovations dynamic did not stop, and some disrupting inventions will decisively contribute to taking down the Medieval era and usher in the modern one: the gunpowder, the clock, the printing, the high sea navigation. The gunpowder came from China, that invented also the clock, although it was an independent invention in Europe; the printing was originally a Korean invention which spread to the Chinese Empire long before Guttenberg independent invention, who apparently was unaware of it; finally, the high sea navigation was very well known in China and in the Arab World, and the Portuguese for sure started their navigational experiments in the 15th century based on that knowledge. All these four inventions did not have any significant impacts in China, nor in anywhere else, except for the Arab navigation in the Indian Ocean. In Europe they transmuted into revolutionary innovations.

The gunpowder was used in canons by the Imperial army in China, although with limited effectiveness. To be effective, the powder should be granulated, a European invention, to grant the correct mixture of the air with the explosive. Also, it helped a lot the development of cannon drilling techniques. More importantly, in Europe, the cannons gunned down the fortress of an already shattered Feudal order. Abroad, together with navigational innovations, they granted its dominance of the seas. In turn, the clock, independently invented in a monastery to regulate prayer hours, became revolutionary with the development of the its mechanical version (see Landes, 1983). In China, the mechanical clock remained a toy for the Emperor's joy. In Europe it went to the churches' and cities' towers, with the passing hours being marked by the ringing bells, so everyone in the cities and the countryside could have the lives regulated by the clock. It also became the matrix to the development of the precision mechanics industry. Finally, the printing which in Europe had huge impacts, decisively contributing to epochal cultural/institutional changes such as the Protestant Reformation and Scientific Revolution. In China and the Ottoman Empire, the printing industry was strictly controlled by the State, having no impacts whatsoever on the social fabric of their respective social orders.

2. The Ascent of Industrial Revolution

After a long preparatory trajectory of cultural, institutional, and technological innovations, the IR proper ascent began in the 18th England, when the economic growth accelerated to a new level. A good acceleration but still far from its 'hockey blade shape'²⁷ acceleration in the 19th century. In

(27) McCloskey (2010)'s analogy to characterize the leap in the growth rates.

fact, although more vigorous, the industrial growth in England during the 18th century occurred in a period of general acceleration of industrial growth all over Europe, from England to the Urals! In fact, the big novelty that surprised not only the English people but also all England's visitors, was not the industrialization but the prosperity of the countryside, thanks to an agricultural revolution, in sharp contrast to the poverty, the misery, prevailing all over Europe's countryside.

2.1. A Glimpse of the Intra-European Economic Competition Dynamics

As showed by Braudel (1979, T3), the competition in Europe was characterized by the antagonism and complementary of two sub-regions, two poles "electrically distinct" and complementary: one, in the North, led by Amsterdam and Antwerp; the other, in the South, led by Venice, Genes, Florence, and Milan. The Champagne Fairs in France represented the place of junction of these two worlds. The original characteristic of these fairs rested upon the fact that their leading trade was not in commodities but money and credit. A trade dominated by the Italians and, among them, the Florentines. The triumphal Italy of the 13th century had invented or reinvented many financial instruments and business models and had innovated in the credit dealings. The Florentines companies were able to dominate the English kingdom through the funding of Edward II wars against Scotland and controlling the English wool market. The default of Edward II had a devastating impact, ending the Florentines ventures (see Braudel, 1979, T2, p. 346).

By the end of the 13th century, the Champagne fairs declined, mainly because the Italians merchants began to take their goods directly to the North (Bruges) by sea and the activation of the terrestrial route (Alpes path) linking Italy to Germany. Among the Northern Italian cities, Venice will assume the leadership (after two wars against Genes, the last in 1381). In 1382 it took the strategic island of Corfu in the Adriatic Sea; between 1405 and 1427, it took the surrounding cities of Padua, Verona, Brescia, and Bergamo. The "Venice Empire" spread to the Levant's commercial routes, where it established commercial bases for controlling the goods coming from the East, and to Germany through the Alpes path. By the beginning of the 15th century, its budget was bigger than not only the budgets of all the other competing cities but including those of all territorial states. Venice became the world's commercial depot.

In the 16th century, Antwerp will replace Venice as the leading city-state. Besides internal problems, Venice will have to face the Ottoman Empire growing projection to the sea after the fall of Constantinople. On the other hand, Antwerp will benefit from the opening of the Atlantic routes. The Portuguese will take the Asian spices to its port (the North consumed 90% of them). Additionally, the Portuguese found in Antwerp market the copper and the silver they needed to buy the spices in Asia. Antwerp was also the capital of the financial merchants of Emperor Charles V, who became king of Spain, the Low Countries, and good part of Italy. Finally, it became the marketplace for Spain and Portugal colonial enterprises in the Americas. Its decline was linked to Spain's breakdown in 1557 and the competition of Hamburg in Germany, where the English traders began to take the textiles to be dyed and redistributed. However, the economy was not the only reason for its decline. More importantly, it was the social unrest and wars: in 1566 exploded an iconoclast riot that took by surprise the population that was violently put down by the Duc of Alba, a special envoy of the king. In 1572 the war cut the links between Spain and the Low Countries. Genes will assume leadership.

Genes had to offer much-needed financial expertise of its bankers coming from the commercial culture of the city and their extended branches in Italy and Spain. Their insertion in Spain turned Genes in the primary silver market of Europe. Its bankers will replace the German ones, who

had gone broken after the Spanish default, in the Spanish kings' funding. The Genoese bankers had developed an ingenious credit system based on bills of exchange, which allowed them to control the gold market (the bills of exchange were paid off in gold). The king charged them to make the payments (in gold) in Antwerp for the troops and bills of exchange. So, they funded the king with gold and were repaid when the silver from America arrived, which they used to buy bills of exchange, closing a profitable exchange circuit between two currencies and bills of exchange. The Genoa dominion over of the Spanish and European financial markets lasted about 60 years when Amsterdam surpassed it. However, it continued as an important commercial and financial city and actively participated in the generalized growth of the European industrial production in the 17th and 18th centuries (see Braudel, T3, p. 137-140).

Amsterdam was the last city-state to lead the commercial and industrial expansion in Europe. It was at the center of a tide that raised the North in detriment of the South. Furthermore, with the Low Countries it controlled, it became the capital of kind of informal small territorial State. As in Northern Italy, the agricultural practices there evolved in response to the city's markets. The introduction of commercial cultures, such as flax and hemp, and a new rotation system without fallowing spread rapidly. The vigor of the agricultural transformation led some authors to consider that the correlation between urban dynamism and agricultural progress had a defined direction, with the technical advances in agriculture stimulating city activities²⁸. The increase of its naval fleet was remarkable, too, both quantitatively and qualitatively. It reached 600 thousand tons and a new boat was developed, the *Vlieboot*, a robust and relatively big boat which could be handled with a 20% smaller crew – a considerable cost advantage in the long trips²⁹. Yet, the most important feature explaining the Dutch supremacy was having become the leading credit merchants of Europe thanks to their superiority as the Europe's (and the world) warehouse. In the 17th century, France was literally subjugated by the Dutch merchants and their commissioners³⁰. In England, they did the same, although the English stronger reaction translated into four wars (1652-1654, 1665-1667, 1672-1674, 1782-1783) and a more effective protectionist policy. At the beginning of the 18th century the city-state leadership will end, surpassed by that of a territorial state, England.

2.2. The Rise of the Territorial States and the Bourgeoisie Inside Them

During the period dominated by the cities-state the political structures of the territorial states did not coincide with the economic structures as for to constitute a national market. The economic space went way beyond the political spaces of the emerging territorial states and was dominated by the leading cities-state. In this sense, the territorial states were largely forged in the struggle against the hegemony of the cities-state. Furthermore, they had to deal with a situation of a space fragmented in regional economies that could not be unified just by the effect of economic expansion but simultaneously required, as pointed out by Braudel (1979, T3), a centralizing political effort. Hence, the states' effort to stimulate and control the economic activities inside their territorial spaces was part of the more important political effort to consolidate monarchies' power, which tended to be absolutist/despotic. The provincial states had to be subdued, but also the free cities (i.e., the bourgeoisie), the aristocracy, and even the Church.

(28) As put by De Vries (1976) "the capitalism grows in Hollande from its soil".

(29) The Dutch also innovated in the naval building industry itself, exporting boats to all Europe.

(30) Their actions were denounced in France as a "foreign oppression". See Braudel (1979, T2, p. 367).

However, the prevalence of the Rule of Law helped the reaching of a compromise between the monarchies and the landed nobilities, and the bourgeoisies³¹. One big problem for the new territorial states was to fund their growing financial needs, especially the more and more expensive wars. The incomes coming directly from rural dominions were not enough anymore to support the modern State. The alternative of borrowing growing amounts of money was reaching its limits. Therefore, it became imperative to create a new tributary structure, taxing the circulating monetary riches. However, even a quite authoritarian state as France faced great difficulties in doing so. Its despotism encountered resistance from the dominant class surround it, nobility and bourgeoisie alike, which were protected by the Rule of Law.

The nobility and the bourgeoisie strived to find new ways to accommodate the new monarchic power. The nobility from a weakening economic position, but a still strong tradition. The bourgeoisie from a growing economic power despite the reducing autonomy of the free cities. The growing financial needs of the nobility tended to translate into indebtedness to bourgeois lenders. For Braudel (1979, T2, p. 530) “there is parasitism, exploitation, phagocytizing. The noble class, a fruit that had been ripening slowly from the soil richness and traditional power, revealed itself as a preferred food, that could be absorbed with some risks, but in fact with many advantages”. Yet, for a class to be consumed by another, a necessary condition was that both could accumulate and transmit the richness through generations and, of course, the possibility of social mobility had to be opened, despite of the contempt of the landed nobility towards the bourgeoisie. As noted by Jones (1987, p. XXXIII), in Asia, the merchants “never succeeded in hollowing out the Asian empires into bourgeois states”. As will be seen, this process of “hollowing out” the Monarchy into bourgeois states took different paths in the various European territorial states. The case of England distinguished from the others in the Continent and the case of France was representative of them.

The English state was the first to consolidate a national market, i.e., where the political structure coincides with the economic one. Between mid-15th century and mid-16th century, the English state became an autonomous space, detaching itself (or was detached) from the Continent where it had part of its territory. The conflict with the Catholic Church between 1529 and 1533, which ended up with the creation of the Anglican Church, reinforced the separation. Since then, a firm ‘nationalist’ policy ensued. The Italian merchants were expelled. In 1558 the London Stock Market was created to compete against Antwerp’s one as well as the Royal Exchanges, founded in 1566. The merchants of the Hanseatic Ligue had their privileges cut. Against the Portuguese and Spanish, the Stock Companies. The confront with Amsterdam began with the Navigation Act of 1651, followed by others and by wars. In short, the English Monarchy pursued an aggressive protectionist policy to protect and stimulate its industrial growth. Of course, the fact of being an island helped. Besides being an island, its geographical format facilitated the cabotage navigation, which linked to an extensive channels network much contributed to the market integration.

All these features certainly explain a lot why in one century England passed from being the least industrialized to the most industrialized country in Western Europe. Still, they could have been necessary conditions, but not sufficient ones. Its cultural/institutional features need to be factored in. To begin with, the less despotic nature of the English State as compared to its continental counterparts. In England much more than in the Continent the landed aristocracy – high nobility and gentry – as the bourgeoisie were able to resist the advances of the absolute Monarchy and very soon were able to

(31) Even before the population in general, the legitimacy of the Monarchy was conditioned by a perception of its relative impartiality in the administration of justice.

impose the principle of *no taxation without representation*. The three managed to be represented in the national parliament. At the origins of this process were the peculiarities of the English Common Law and that of the transformation of the royal courts into local representative assemblies. As showed by Fukuyama (2011), it was an ambiguous process and uniquely English. The royal courts tended to be more impartial than the local courts controlled by the landlords and systematically sided with the peasants in disputes like the right to bequest land – copyholder’s rights. So, soon the private property of the land emerged (see North, Wallis; Weingast, 2009).

On the other hand, slowly, the judicial functions of the royal courts in the counties were superseded by political representative functions, eventually transmuting into local representative assemblies. The king’s representative, the Sheriff, came to be accountable to them. Finally, the notable fact that the feudal lords who were losing with the royal courts’ growing preeminence will ally themselves with the gentry and the bourgeoisie in the representative assemblies the royal courts transformed themselves. For Fukuyama (2011), the participative nature of the English justice system, which responded to the local demands in the process of elaborating new rules and norms under the Common Law, created a popular sentiment, much stronger than in the Continent, that the law was for everybody to respect. In national terms, the “*Magna Carta*” in 1215 was the first notable result of this process of affirming counter-powers to Monarchy. The “*Glorious Revolution*” in 1688-1689 its final accomplishment. As summed up by Macfarlane (1987, p.189), England had a decisive political/institutional advantage in the making of an IR: a more efficient political system to control feudal wars, lighter taxes, and a judiciary uniform and well-administered granting freedom to entrepreneurship and reducing the risk of expropriation.

The French case was more representative of the Continental ones. It was notably distinct from the English case for its state governance marked by patrimonialism. For North, Wallis, and Weingast (2009), in the case of France, because it was big e composed by different and independent geographic units, the unit was granted through the creation by the Crown of corporative privileges of limited access. Then, they were sold to elite groups, which, in turn, could sell them or bequest them to heirs by a complicated set of rules. So, the bourgeoisie saw it as an opportunity of ennoblement and sharing in the political power. As a result, the French State’s centralization was built through an entirely patrimonial bureaucracy staffed with ennobled bourgeois. Almost all governmental positions, from military commands to tax collectors, were auctioned to the highest bidder what, of course, resulted in legitimating and institutionalizing rentier behavior and corruption. It also represented a deviation of the bourgeoisie’s resources from productive investments. In the end, the bulk of the taxes fell over an exhausted peasantry, giving birth to a string of peasant revolts which were ruthlessly put down.

However, the system tended to lose efficiency as an overexploited (“*saignée à blanc*”) peasantry could not be any more spoiled, and all other social groups had bought or bribed out tax exemptions. In the first half of the 17th century the fiscal crisis induced the introduction of a new institution, the *intendance*, directly linked to the Crown. In general, the *intendants* were recently ennobled individuals who could be fired at will by the king. They began as representatives *ad hoc* of the king in many issues, but eventually became tax collectors. Local representatives resented this move as a usurpation. The tensions exploded after the Westphalia Treaty in 1648 (which ended the terrible 30 years war) when the Crown tried to keep the war taxation level. Still, the local assemblies refused to approve it. The prison of their leaders sparked a general revolt of the nobility and the local elites (la ‘*Revolte de la Fronde*’). The monarchy won. Jean-Baptiste Colbert, the prime minister of Louis XIV, turned the intendants into instruments of the central government all over the Provinces. However, the Rule of Law protected the nobility, which lost its local power, but became dependent

on the absolutist Monarchy. The aristocracy will recover some its feudal rents which had been lost with the disintegration of feudalism.

In short, England and France had distinct trajectories regarding nobility's the reaction to the losses it suffered from the disintegration of the feudal system. In the case of England, the aristocracy recuperated old rights through an alliance with the gentry and bourgeoisie. More importantly, the English nobility was able to preserve in part its legitimacy by assuming entrepreneurial activities and representation services in the local communities. It worth noting that it also will play a significant role in the introduction and diffusion of better agricultural practices, in sharp contrast to the French case, where an entrepreneur ("bourgeois") landlord was a rather rare figure. This is why the deposition and beheading of the king by the "Glorious Revolution" did not represented the end of the monarchy. But the establishment of a parliamentary monarchy where the nobility came to have a similar role in the national level it had carved out in the regional/local level during the period of the feudal system disintegration (see Fukuyama, 2011).

In France's case, the nobility recuperated its privileges through an alliance with the absolutist monarchy. The absolutist state's authority was then based upon the empowerment of a broad coalition of elites legally seeking privileges. In this sense, as noted by Fukuyama (2011), paradoxically, the Rule of Law contributed to restrain the despotism of the centralizing absolutist state, but also restrained the building of true modern State as it protected a nobility bent on keeping ancient customs and privileges. This is why the deposition and beheading of the king by the French Revolution represented the end of not only the monarchy but also of a nobility correctly perceived by the population as a privileged class without legitimacy as it did not provide any kind of services.

2.3. The Starting of the Industrial Revolution in England

One of the essential differences between cities-state and territorial states was the role played by agriculture. The cities-state, of course, imported the bulk of agricultural products they consumed, and in their surrounding countryside, they invested in the production of more valued products. Commerce funded most of their budgets. In the case of the territorial states just the opposite was true. Their increasing budgets (wars, administrative apparatus, and conspicuous consumption) were funded basically by the agricultural surplus extracted from an exhausting peasantry. When king Louis XV died in 1715, France was broken, and its peasantry exhausted. A situation in stark contrast to that of England, where existed a particularly novel situation: a prosperous countryside, comparable to that of the Low Countries, but on a much larger scale, big enough for decisively contribute to creating a national market for its industrial sector.

The prosperity of the English countryside in the 17th and 18th centuries resulted from what some analysts called the first agricultural revolution as it allowed the English peasantry escape the Malthusian trap, and at the same time, provided the English urban-industrial expansion with the food and raw materials it needed. On the other hand, it enriched a mass of agricultural entrepreneurs big enough to constitute a significant market for industrial products. It was caused by the diffusion of new farming practices coming from the Low Countries. As seen, these practices were first introduced in the 13th century in the European more dynamic regions like Northern Italy and Low Countries. But they did not diffuse to all areas because of their higher entry-level investment, and lack of qualified demand. These were demand induced new agricultural practices. For the first time, these requirements will be met in the territorial state scale in England.

On the demand side, the higher income market on a national scale was the result of the distinctive pattern of the successful industrialization of England between mid-16th and mid-17th centuries. Among the factors explaining its success was its especial situation regarding the use of mineral coal. As in the Continent, deforestation had increased firewood prices. In the Continent, however, its replacement by coal, known and used since the Middle Ages, faced difficult obstacles. The first one regarded the exploration of more deep coal mines. It was reasonably solved by German miners, who developed drainage systems moved by horses allowing for the exploration of coal mines up to one hundred meters deep. The second one regarded the costs of transportation, which had led to a concentration of forgeries nearby the mining regions. In England, to solve the first obstacle, the German miners were hired. As a result, the artisanal coal mining in the coal basin of Newcastle was replaced by capitalist ones, which increased six-fold the coal production within the fifth years – from 35 thousand tons in 1560 to 200 thousand tons in 1610, reaching 500 thousand tons in 1658/59.

As for the second obstacle, a railroad innovation before the steam engines, wagons pulled by horses, brought the coal from the mines to river ports, which was then shipped to almost the whole island, even to the Continent. So, mineral coal, a natural resource of limited use till then, became a national rich: “England’s a perfect world, hath Indies too, / correct your maps, Newcastle is Peru”³². The availability of cheap coal almost all over the places in the English territory induced the increasing of the scale, and diffusion to all over the country, of many kinds of energy-intensive industries, such as salt production, sugar refineries, glass and brick industries, alum, and beer. It was also used in the city’s bakeries and domestic heating. Thus, the conditions were created for a qualified demand of husbandry products of the new farming practices coming from the Low Countries.

On the supply side, the level of entrepreneurship of English agricultural agents was higher as compared to that one prevalent in the Continent. As all over Western Europe, the population growth and the economic recuperation after the great ecological-economic crisis of the 14th-15th centuries had pushed the cultivated area over the land laid idle by the crisis with, basically, the same medieval agricultural techniques, although in England with a relatively higher specialization in more profitable commercial cultures. However, differently from the Continent, capitalist entrepreneurs from peasant (yeomen and tenants) or landlord origins, already had a much more critical role than in the Continent. Yeomen and tenants had access to more dynamic land markets. Firstly, because of the primogeniture tradition – i.e., the common law right for the first-born son in a family to inherit the entire state, which prevented land fragmentation. Secondly, because of a more solid legal tradition granting long term tenancy contracts. Both of which favoring the land concentration and investments³³. As a result, in England, the rural agents were in a much better position to take advantage of the new technology and market opportunities. Most landlords who were unwilling to become capitalist farmers tended to rent their states to capitalist tenants as they saw the gains to be obtained. The rise of the capitalist tenants was a very conspicuous English phenomenon, while in the Continent, the landlords who did not lose their states kept them exploited in the old ways.

From mid-17th on, the new agricultural practices began to spread. They will be named after the Norfolk county, where they were first introduced in England – the Norfolk Rotation System. The reason for that was that its light (and poor) sandy soils were easier to plow and the new rotation system required intensive soil labors. On the other hand, within a few years, the low fertility of the

(32) John Cleveland, Poems (1650, p. 10) apud Braudel, (1979, T3, p. 478).

(33) In France, when the revolution occurred in 1789, the capitalist concentration of the land was still in its beginnings, with most of the land fragmented in millions of parcels unsuitable for more productive technology.

soil was surmounted by the very way the system operated associated with intensive husbandry, which provided manure. As a result, the poor soil regions of England became its best agricultural areas. Eventually, the new system will spread to the heavy (and good) soil regions as better (steel) plows were developed. Meanwhile, the production of cereals in these regions will be abandoned, and the land enclosed for cattle rearing. The labor displaced will join the small farmers, who failed to increase their plots to modernize, and become artisanal laborers in the expanding putting-out system³⁴. The Norfolk rotation system will be at the heart of what was called “English High Farming”. In France, they will be called “culture progressive ou améliorante”, because it improved the soil conditions. Mazoyer (1977) reckoned the soil productivity doubles thanks to the judicious crop rotations associated with intensive husbandry, which provided the composted manure.

A virtuous circle then started: new opportunities for agricultural investments opened by the expansion of urban-industrial markets, more productive technologies increasing rural incomes, and so expanding the markets for industrial products. The result was an unprecedented period of rural prosperity in stark contrast with the generalized poverty in most of the rural areas of the Continent. A period that was called the *Great Rebuilding*. The rural houses “were rebuilt, augmented, improved: the windows were glassed, the fireplaces adapted to coal; post-mortem inventories showed an abundance of furniture, bed and table linen, painted textiles, tin crockery” (Braudel, 1979, T3, p. 479). Additionally, there was a demand for equipment and tools, from horseshoes to plows, representing a good stimulus to the metallurgical industries.

It seems clear, thus, that the urban-industrial growth in England in the 16th and 17th centuries had a distinctive nature with regards to what was going on in the Continent in the same period, which played a decisive role in the starting of the IR. It was diffused all of the country, and coupled with an agricultural revolution, in a relationship of mutual reinforcement: it provided the demand stimulus to agricultural improvements which, in turn, swiftly took place thanks to previous cultural and institutional changes in the countryside. In turn, it was a countryside bustling with activity by entrepreneurial-bent rural agents from peasant and landlord origins alike. Interestingly, the starting of the diffusion of the “English High Farming” in the second half of the 17th century coincided with a period of demographic stagnation, which had led to a stabilization or reduction of the cereal prices. But the higher-income urban markets increased the demand for husbandry products, which stimulated the diffusion of the new agricultural practices that had the focus precisely on these kind of products (see Jones, 1986).

3. The Industrial Revolution Sustained

In the 19th century, there will be the ‘hockey-blade’ leap of the growth rates due to an ‘explosion’ of innovations. The growth rates not only will reach unprecedented high levels but also the high rates will be sustained in the long run; otherwise it would not be an IR at all, constituting a ‘tide that will eventually lift all the world’s boats. McCloskey (2006, 2010, 2016) argues, in her massive trilogy, that this “explosion” of innovations and its continuity in the long, run was not, and could not be, the result of just material, economic forces. Instead, it was the result of a **Revaluation** process around 1700. By Revaluation, she means a sudden and big change in the common opinion about the bourgeoisie and its dealings with markets and innovation. The bourgeois liberty, dignity,

(34) Contrary to Marx’s primitive accumulation model, it will be in the pool of workers in the putting-out system that the IR will find the workers it needed. For a discussion about the enclosures see McCloskey (1975).

and equality became dominant in public discourse, conversation, and rhetoric. Liberty for all to engage with dignity in all kinds of entrepreneurial activities.

In turn, the Revaluation would be the result of the coincidence in the early modernity of four **Rs**: successful **R**eading, **R**eformation, **R**evolt, and **R**evolution. “The dice were rolled by Gutenberg, Luther, Willem van Orange, and Oliver Cromwell. By a lucky chance for England, their payoffs were deposited in that formerly strife-suffering nation in a pile late in the seventeenth century. None of the four Rs had deep English or European causes. All could have rolled the other way. They were bizarre and unpredictable” (McCloskey, 2016, p. XXXV). The Eurocentric economists and economic historians would then get it wrong when they argued that Europe was preparing for the blade of the hockey stick for centuries. This argument would be akin to that one of the “old history attributing Europe’s excellence to its ancient civilization, Christian and humanist, from Israel and Greece, and the Germanic tribes in the forests”. A troubling argument, as even these scholars would admit, because “India and the Arab lands and Iran and China and especially Japan were equally excellent and ready” (McCloskey, 2010, p. 7, 8). Well, no. They could be excellent, but they were not ready.

It was not a matter of excellence, but just about the conditions preventing the blocking or the controlling of innovations by the vested interests of the social-political order. The Revaluation of the bourgeois behavior, of the bourgeoisie virtues, could only have occurred in Europe. It was a path-dependent phenomenon. As seen, it was only in Europe the merchants were able to “hollow out” the monarchies into bourgeois states”. England was the first territorial state where the bourgeoisie reached a position of economic and social power; where, *au contraire* of France, the bourgeois ennoblement was less important a phenomenon than the noble embourgeoisement. Till then, the bourgeoisie was in a dominant position only in the cities-state and in the quasi-territorial state of Amsterdam and its surrounding Low Countries.

Hence, the role of the bourgeois Revaluation in explaining the IR can be discussed, and for sure, it was *necessaire*, even decisive, but it was not, as well as three of the four Rs, something having no roots in the European civilizational peculiarities. As seen, the Gutenberg invention had no significant impacts on other civilizations. Oliver Cromwell’s revolution was a quintessentially English phenomenon in its precocity, and European in its profound constitutional motivation. In turn, the success of Luther’s revolt was highly dependent on Gutenberg’s invention. Furthermore, as will be seen below, it reflected not only his personality but also the downside of the ambivalent cultural scenario of European Renaissance, marked both by the optimism of the economic recovery, discoveries and rediscoveries as well as by the pessimism regarding human nature, the fear of the Demon, the witch hunt and the religious wars.

3.1. The Cultural and Institutional Evolution towards the Scientific Revolution

As mentioned, the acceleration of industrial growth in England in the 18th century was not perceived by the contemporaries as distinctive because industry was expanding all over Europe after the crisis of the second half of the 17th century. Commercial and Industrial expansion already centuries old caused by cultural, institutional, and technological innovations stimulated by the fierce competition between the cities-state and the emerging territorial states. The revolutionary growth acceleration will have to wait for the 19th century to occur. For Landes (1998, p. 200, 201), European cultural and institutional peculiarities explain the place and the timing of the IR. The place because of the European openness to innovations. The timing because of *buildup* (accumulation of knowledge and knowhow) and *breakthrough* (reaching and passing thresholds). In turn, the accumulation of

knowledge and know-how was historically, only possible in the European cultural, institutional, and geopolitical restless context. A sharp contrast with China and the Islamic World where occurred not only “the cessation of improvement but the institutionalization of the stoppage”.

Nothing would better exemplify this process of buildup and breakthrough than the development of power technology. As Landes (1998, p. 206) put it, “no technique drew so closely on experiment – a long inquiry into vacuums and air pressure that began in the sixteenth century and reached fruition in the late seventeenth in the work of Otto von Guericke (1602-1686), Evangelista Torricelli (1608-1647), Robert Boyle (1627-1691), and Denis Papin (?1647-1712), German, Italian, English, French. To be sure, the scientists of the eighteenth century could not have explained why and how a steam engine worked. That had to wait for Said Carnot (1796-1832) and the laws of thermodynamics. But to say that the engine anticipated knowledge it is not to say that the engine builder did not draw on earlier scientific acquisitions, both substantive and methodological”. It took a long evolutionary process of cultural and institutional innovations to push the increasing of the “useful knowledge” up to the systematic merging of science and technology from mid-19th century on.

A process brilliantly analyzed by Joel Mokyr (2016). For him to focus only on the role of institutions in the economic development does not explain the acceleration of technological creativity and innovations in Europe, especially from mid-18th on. The scientific revolution in particular could not be just the result of an obvious institutional stimulus. Or, as it would be put by McCloskey (2006), the result of just *prudence-only* economic decisions. Her cultural/rhetoric argument about bourgeois Revaluation for sure must be factored in the explanation. But it is not enough. There was indeed a centuries-long *buildup* process of accumulation of knowledge and know-how where the economic gains from knowledge advances were small if existed at all. One must keep in mind that the “propositional” (scientific) knowledge is instead a public good, so not having the partial protection of patents as is the case of the prescriptive (technological) knowledge.

In turn, the increase of the prescriptive knowledge by itself, without constant interaction with some form of formal or informal science, could not have been able to generate such high rates of innovations and economic growth. Thus, the critical point is to explain the ascent of the scientific revolution. For Mokyr (op. cit.) , advances of propositional knowledge depended on the attitude, disposition, and energy with which the people try to understand the world around them. It is a rather cultural phenomenon that generates self-reinforcing institutions. From the beginning of the 16th century on, it would have occurred a decisive change in terms of beliefs, values, and preferences of the people. In particular with regards to the beliefs about the relationship between humans and nature, as well as about what was called “useful knowledge” (roughly science and technology) capable of improving the material well-being. The fundamental belief that the human lot could be continuously improved by the increasing understanding of the natural phenomena and regularities would have been the decisive cultural innovation, which made it possible the modern economy.

He recognizes that the belief in the virtuous character of technology comes from Medieval times, referring to the work of Lynn White (1962, 1967). For White, the virtuous character of technology resulted from the belief in a creator God, Who designed the universe for men and Whose wisdom and power would be revealed to men when exploring it. It also must be considered the Medieval positive attitude regarding labor and production. Finally, the individualism that stimulates heterodox intellectuals with non-conventional ideas. In the high Middle Ages, it would have occurred a key event in the modern economic history: a pragmatic change of the Catholic Church in favor of a

transformative attitude with regards to nature, which informed a society that believed that technological activity was meant “to afford help to many for the glory of God and for the exaltation of His name”³⁵.

Nonetheless, in the 16th century it would have emerged a belief that complemented the belief in technology’s virtuous character: the belief in progress, more specifically the belief in the economic progress. In fact, Mokyr (op.cit) recognizes this belief was also present in the Middle Ages, but it was not diffused enough to constitute into a formidable force accelerating economic growth. It can be argued, though, that the greater diffusion of this belief was linked, as cause and consequence, to the strong economic and populational recovery beginning around the mid-15th century. The ascension of the territorial states and, inside them, of the bourgeoisie for sure explain the industrialization policies implemented by all of them in a setting of intense competition. Furthermore, the belief in progress tended understandably to get more robust thanks to disruptive innovations like the printing and high sea navigation. The role of printing need not be emphasized.

Regarding the navigation discoveries and conquests, they impacted in different ways the attitudes of the Europeans: they increased their confidence in controlling the environment, as well their curiosity about the world; the discoveries were seen as evidence of progress and their superiority regarding their Grecque and Roman ancestors. The openness to foreign ideas and technologies was total, as indicated by their naming foreign products and technologies after their supposed origins. So, between 1500 and 1700, Europe experienced critical cultural changes, such as the Protestant Reform, the biblical exegeses, and the Enlightenment, and the cultural impacts of scientific discoveries such as the solar system structure, the gravitational laws, the blood circulation, the atmosphere, and the calculus.

However, three factors would have been more decisive to explain the cultural turning at the beginning of the 16th century: 1-) the emergence of a new technology of the discourse and communication capable of reaching a wider audience and the establishing of rhetoric rules to convince it³⁶; 2-) the weakening of the resistance towards intellectual changes by well entrenched conservative elements; 3-) the significative increase of the skepticism regarding the traditional wisdom, which came to be viewed as inconsistent with new facts emerging. The first factor was expressed in the emergence of great cultural innovators having big impacts thanks to their ideas and rhetoric. Regarding the second factor, Mokyr did not make it very clear. Still, it seems evident that this weakening was caused to a large extent by the emergence itself of these great cultural innovators and, of course, the amplifying of their ideas by the printing, better transports, and postal services. The last factor is also linked to the previous ones. But it must be kept in mind that the questioning of the traditional wisdom, the liberty to philosophizing, was the hallmark of the Medieval universities.

The emergence of the territorial states will indeed weaken the universities, which will transform themselves in orthodoxy centers. However, in some universities and in the new and numerous universities that were being founded, the coming of respected scholars tended to generate new heterodoxic elements. That is why the Medieval liberty of philosophizing could be ‘revived’ in the Renaissance by the priest and humanist scholar Marcilio Ficino (1433-1499). Furthermore, the universities will have to compete with new scientific organizations, as the academies and scientific associations, spreading all over Europe in the 17th century. It appeared new competing methodologies

(35) Klemm (p. 65) cited by Mokyr (2016, p. 143).

(36) He follows McCloskey (1985), considering that cultural change is, in a large extent, a matter of persuasion.

to study the world: Aristotelians *versus* anti-Aristotelians, Corpuscularianism (atomism) *versus* vitalism, and both *versus* Aristotelians.

On the other hand, the intensifying of the competition caused by the ascent of territorial states benefited a lot the cultural innovators as the countries competed for the best minds. The cultural innovators always found shelter and protection among rival cities and states, and, within them, among a variety of corporative institutions (see Slack, 2015). Thus, it became a lot more difficult to suppress subversive/heretical movements generated by the cultural innovators. Eventually, most rulers perceived how futile it could be the effort to persecute the troublemakers. In Europe, as observed by a contemporary like Gibbon, “a modern tyrant would discover that the object of his displeasure would easily obtain in a happier climate, a secure refuge, a new fortune adequate to his merit [and]...the freedom of complaint”³⁷. Around mid-18th century even in the more absolutist countries the suppression of dissent had become a rather ritualized formality than a real threat. The more conservative rulers were obliged to search for a compromise with the dissent and co-opted many of the Enlightenment ideas, thus becoming “Enlightened despots” (see Scott, 1990).

As in the case of the economic entrepreneurs, most of the cultural entrepreneurs changed only marginally the cultural menu. It will be up to the major cultural innovators to make the significant differences. They are not just pawns of profound “historical forces”, but they make the difference changing beliefs, values, and preferences of the society’s significative subsets in certain critical junctures and thus changing the society’s trajectory. That was the case of Martin Luther and Francis Bacon. They coordinated processes of diffusion of ideas in two bifurcation points reflecting the ambivalent cultural scenario of the European Renaissance, optimistic and pessimistic. Optimistic because it was a period of economic and population recovery after the great crisis of the 14th / 15th centuries, of discoveries and rediscoveries. As seen, it was pessimistic because it was also a period marked by the pessimism regarding human nature, by the fear of the Demon, the witch hunt, and the terrible religious wars.

For Delumeau (1983) one could not understand Luther’s violent attacks against reason except in this cultural and political context. A good part of the period’s cultural elite shared a sad view of the world and the man. In this sense, Luther affirmed that without God’s grace, man is bad, irredeemable, it reflected the prevailing light of the time. The doctrine of justification by faith resulted from the desperation regarding human nature. He accused the Church’s rationalism and monopoly of interpreting the Bible as barriers to people accessing the sacred scriptures. On the other hand, the abuse of power by the Church, symbolized by the selling of indulgences, was something which also confronted many rulers of the new territorial states. In his “calling to the Christian Nobility of the German nation”, Luther emphasized were the three “walls of Roman catholicity”: 1-) the pretense superiority of pontifical power over the civil power; 2-) the right arrogated by Pope as the only authority in interpreting the sacred scriptures; 3-) the Pope’s superiority over the episcopal councils (Delumeau, 1983, p. 18). These are, thus, the cultural and political elements explaining the Reformation success, plus the printing revolution without which it would not be possible the wide diffusion of Luther’s pamphlets and the reading of the Bible.

Francis Bacon (1561-1626), in turn, responded to the optimistic side of the cultural European Renaissance setting, due to the economic recovery, discoveries, and rediscoveries. For Mokyr, the work of Bacon would have prepared the western world for the “Baconian program” in the 18th

(37) Gibbon (1789, v. 1, p. 100) cited by Mokyr (p. 176).

century: the reaching of material progress through the interacting of propositional knowledge (science) and prescriptive knowledge (technology). Thanks to Bacon, the acceptance of experimentation to increase the useful knowledge, that had begun at the medieval universities, will significantly expand. By the 17th century, experimentation as a tool to decide scientific disputes became the norm in an international scientific community organized in a new and revolutionary way, in what will be called “Republic of the Letters”³⁸.

Bacon’s writings contributed decisively to push ahead of the trajectory, which since the Middle Ages had led to the emergence of the scientific thought³⁹. In the 16th and 17th, that trajectory matured in a high conscious level about the natural mechanisms and a high expectation to comprehend them. For Cohen (2012), the “Baconian ideology” contained a double faith in the power of science: confidence in what the natural philosophers could do to enhance the human fate and a belief that they would just comply with God’s call. That was precisely the motivation of the theologians/natural philosophers of the medieval universities. In 1925, the English mathematician and philosopher Alfred Whitehead (1861-1947), shocked the audience in a conference at Harvard University (Lowell Lectures), saying that science happened to emerge in Christian Europe only because the Medieval theology. Thanks to it, Medieval Europeans believed that science was not only possible but desirable. As seen, theology was a product of the Christian cosmology and, during centuries, incubated the scientific cognition as the efforts to understand God were extended to include Its creation⁴⁰.

In short, for Mokyr (op.cit), Baconianism represented the belief in the institutionalization of science and the means to collect and to analyze information through planned and cooperative research and that the improvement of the useful knowledge was critical to economic growth. With Isaac Newton, the hopes of Bacon became certitudes. Newton’s insights more than ever confirmed the belief in an understandable mechanical universe, which could and should be manipulated to benefit humanity. He combined the deductive powers of the mathematical modeling with the Bacon’s emphasis on observation and experimental data, showing that the two methods were complementary. Newton’s work was persuasive because it met the rhetorical criteria of those who were able to understand him, i.e., those with enough mathematical knowledge and who could verify the experimental data. In short, the scientific revolution in the 17th century, having Newton as its principal symbol, paved the way to the Industrial Enlightenment and the Enlightenment movement in general. Newton conferred legitimacy to those who controlled the useful knowledge making them a kind of “fourth State” of experts, authorities regarding the secrets of nature. However, to be considered an expert, the necessary condition was to have produced an original and relevant contribution which, in turn, would be judged by the scientific peers congregated in the informal academy of the Republic of the Letters.

(38) Wootton (2015) observes that experimentation was not new, but a community of scientists recognizing it as a powerful method of persuasion. Not a community as it already existed in the Middle Ages, but in the way it was organized and in the new means of diffusion available.

39 Moore, (1983), talks about a ‘baconian compromise’, meaning an implicit and informal *modus vivendi* between religion and natural philosophy: the natural philosophers (scientists) offered illustrations of God’s omnipotence in exchange scientific research liberty. Well, that is not what good historical work shows. As seen, praising God resulted from a sincere belief of almost the totality of scientists.

(40) It could not be such a different, opposite, evolution when compared to that of science in the Islamic world where, after Al-Ghazali (1058-1111), natural philosophy will be regarded as a heresy.

3.1.1. The Republic of the Letters

As already seen above (1.1), the cultural unity of Europe stood in contrast to its geopolitical fragmentation, forming a sort of an integrated market of ideas since the Middle Ages. For Mokyr that was an essential characteristic explaining European success as, without it, no cultural innovator would have reached a pan European audience. In the Middle Ages, especially after the founding of the universities in the 12th century, an intense flux of students and scholars circulated all over Europe. Latin was the *lingua franca*. From the 16th century on⁴¹, this market of ideas will vigorously expand through a new informal institution, the “Republic of the Letters” (RL), which became independent of the Church despite having a significant number of priests and monks among its members⁴². Two typical Renaissance polymaths, the priest Marin Mercenne (1588-1648) – theologian, philosopher, mathematician, physic and music theorist, and the monk Pierre Bayle (1647-1706) – theologian, philosopher, historian, literary critic, lexicographic, writer, journalist and professor, were among its most famous organizers.

For Mokyr, the RL was an institutional innovation that had a decisive role in the diffusion of useful knowledge and so in the scientific and technological revolution. A unique phenomenon in the history of civilizations. It formed an international community of scholars and literati united through intense letter exchanges. It was ruled by the right of free entry, the right to challenge any form of knowledge (contestability), transnationality, and commitment to put new knowledge in the public arena. It provided a set of institutional incentives encouraging artists and scientists; it constituted a competitive market not only for ideas but also for the people having them in their struggle to gain public reconnaissance and patronizing. There was an intense competition between monarchs, princes, and wealthy individuals to have the privilege to host the best and brightest Europeans, whatever their nationality (see Wuthnow, 1989). Besides prestige, there was the belief that highly intelligent and well-read individuals, could be useful advisors in policymaking.

The RL made it possible for an informal market of ideas to work based upon a set of rules enforced by shared beliefs. The non-material incentives provided by this market depended upon reputation, which was established according to a set of rules. On the other hand, reputation drew patronizing. Reputation and networking were complementary: the intellectuals measured themselves by their capacity to communicate with the superstars of the scholars’ world. Reputation, in turn, more and more depended less on erudition (knowledge of the classics) than on making original scientific/technological contributions susceptible of being peer-reviewed in the community⁴³. This dynamic in the context of European competition led to the ascent of the ‘open science’. Mokyr (op.cit.) saw it as ‘emergent property’, an unexpected consequence of scholars vying to build their reputations among their peers and qualify to receive financial support.

Nonetheless, it was necessary to find more efficient solutions to how to incentivize and recompensate the innovators, giving them more security in their endeavors. According to Mokyr (op. cit., p. 184), the answers were complex. In the case of the proposal (scientific) knowledge, property rights meant just authorship acknowledge. In turn, in the case of prescriptive (technological)

(41) It began in the time of Erasmus of Rotterdam (1466-1536), but it will reach its apogee in the first decades of the Enlightenment – 1680/1720.

(42) As noted by Stark (2017, pos. 2682), 13 (25%) of the 50 most prominent scientists of the period were priests and monks.

(43) The ‘peer review’ system was essential to access the quality of the works. For Hahn (1990) the merit as a measure of the intellectual work would have been a radical innovation.

knowledge patents were possible, but not everywhere; in this case, the alternative would be to keep it secret when reverse engineering was not possible. Finally, there were the cases when the inventors themselves publicized their inventions, hoping their so increased reputations would bring jobs, advisory positions, and other kinds of financial support besides public acknowledgement, and academic status. The RL market of ideas was a case of communitarian management of an open-access resource as theorized by Elinor Ostrom. It could do so because it was formed by an invisible collegial of scholars and intellectuals, internationally connected, having an implicit understanding that knowledge was a non-rival good that should be shared by the community. In practical terms, it was an institution responsible for the operation of a market and an identity. A market where persuasion was equivalent to selling, and the payment an increased reputation. In short, for Mokyr (op. cit., p. 217) the RL “turned out to be an institution unique in human history and a key to the understanding where the long road that led to modern economic growth began”.

4. Final Remarks

The Industrial Revolution wherever it could have happened to occur for the first time in history, it would have been the result of a civilizational and long trajectory. Civilizational because it depended on a peculiar process of cultural and institutional evolution, and long because of the necessary knowledge accumulation this evolution made it possible. It had to be a peculiar process in the sense of having to break difficult obstacles: the resistance to innovations that disrupt established socio-political orders, and the cultural fatalism that reinforce their stability. It took time too because the acceleration and sustainability of high rates of growth depended on the accumulation of scientific knowledge to the point of systematically inform the technological development. It happened to occur in Europe. Once it occurred in one place, it will not be necessary anymore for other countries to repeat a similar trajectory. The successful example will break the inherent resistance of political orders to the “creative destruction” process by the systematic introduction of innovations, at least in more organized and well-ruled societies. In fact, they will see it as a survival imperative⁴⁴, just like after the first territorial Estate’s appearance when, then, it became a survival imperative for all tribes to follow suit or perish. Furthermore, eventually, it will happen even in societies dominated by irresponsible and greedy elites, as economic development becomes a political imperative.

If it were not in Europe, for sure, the path towards the IR would have been different. But the necessary conditions would be the same as in Europe: the elites with their vested interests in an established socio-political order had to be prevented from controlling or blocking innovations. And, except for an unlikely succession of enlightened despots, the only way would be the elites becoming powerless to do so. Between the two poles of Eurasia, China could have arrived first at an IR if it were not because the Chinese states coalesced into a gigantic and despotic Imperial State. In Europe, the Holy Roman Empire stayed as a would-be Roman Empire successor. In addition to being a patchwork of competing polities – states and cities-states, within each European polity the power was fragmented into different independent entities. These were the necessary conditions to stymie the rulers’ efforts to control innovations. But not enough to explain a trajectory towards the IR. Cultural and institutional conditions must be added into the formula to explain why in Europe, instead of fate conformism, there existed a willingness to transform nature for the betterment of human material

(44) As it were the cases of Japan and Russia. See Ishikawa (1981) for a brilliant account of the Japanese reaction to the threat of Western industrial powers. In Russia, education and rail roads were seen at the beginning by the nobility as threats to the established order. Education of the masses in especial was viewed as potentially subversive [and it was]; Wilson (1972) tells why in the end, despite the risks, education was taken seriously out of the fear of Germany.

well-being through dignified labor activities. A condition which eventually led to the emergence of the idea of economic progress and science. Its origins lied in the Judeo-Christian cosmic vision of a linear time progression instead of cyclical, implying an ‘eternal return’, and in the belief of a universe created by God that could be understood by humans created in Its image. But it was only in Latin Christianity these beliefs translated into scientific and technological creativity.

Such a cultural unit, amid a fragmented geopolitical order, included social structures organized along non-familistic (individualistic) lines and, for centuries, a *lingua franca*, Latin, and a pan-European independent and an influent religious organization. The fragmentation of power inside European polities combined with the independent religious organization to produce the emergence of the Rule of Law and the secular state. The feudal aristocracy organized in local assemblies and the independent cities-states controlled by merchants constituted effective counter powers to monarchy. In turn, the Catholic Church was able to create a separate and well-institutionalized domain of spiritual authority with universal jurisdiction, which was crucial to the emergence and affirmation of both the Rule of Law and the secular state⁴⁵. The prevalence of the Rule of Law after the feudal demise granted the existence of less despotic absolutist monarchies and a more entrepreneurially favorable institutional framework. The bourgeoisie will be able to hollow out the monarchies into bourgeois states.

In short, for the first time in human history, emerged a *mutant* civilization, with a *built-in quality of instability*, where cultural, institutional and technological creativity was rather stimulated than controlled; where the process of *creative destruction* was given a free pass, leading to the modern world.

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(45) “Render to Caesar the things that are Caesar’s; and to God the things that are God’s” (Matthew, 22:21). These Jesus’s words lent a strong theological justification to the actions of the Church.

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